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## THE ROLE OF PROJECT ACTIVITIES IN SUPPORTING COGNITIVE ACTIVITY OF SCHOOLCHILDREN

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This article addresses the challenges and potential of using project-based activities to enhance the cognitive engagement of schoolchildren. The research was conducted to determine the role of project-based activities in supporting cognitive activity and to create recommendations for their continued use in this regard. The primary focus of the study is the introduction of comprehensive forms of project activities into the educational process to increase the cognitive engagement of students. The scientific and practical value of this study lies in the expansion of theoretical knowledge and the development of evidence-based recommendations. The study's findings confirm that the proportion of students with high cognitive engagement in the experimental group (EG) increased compared to the control group (CG); interdisciplinary connections and an integrative approach to learning were developed, enhancing students' overall preparation and readiness for further education; teamwork, responsibility, and self-control skills were strengthened; and opportunities for individualized learning, based on each student's interests and abilities, were provided. Based on the results, recommendations for teachers have been developed, such as incorporating innovative technologies, emphasizing independent work, and fostering student collaboration. These suggestions are designed to improve the effectiveness of the educational process and further enhance the quality of education. In conclusion, the use of various strategies to support the cognitive activity of schoolchildren, along with the introduction of different forms of project-based activities, proved to be effective in stimulating students' cognitive engagement in practice.

**Key words:** project activity, cognitive activity, support, schoolchildren, educational technologies, project methodology.

## ОҚУШЫЛАРДЫҢ ТАНЫМДЫҚ БЕЛСЕНДІЛІГІН ҚОЛДАУДАҒЫ ЖОБАЛЫҚ ҚЫЗМЕТТІҢ РӨЛІ

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Бұл мақала мектеп оқушыларының когнитивті белсенділігін арттыру мақсатында жобалық қызметті қолданудың мәселелері мен мүмкіндіктерін қарастырады. Зерттеу жобалық қызметтің когнитивті белсенділікті қолдау рөлін анықтау және оны әрі қарай қолдану үшін ұсыныстар әзірлеу мақсатында жүргізілді. Зерттеудің негізгі бағыттары – оқушылардың когнитивті белсенділігін арттыру мақсатында білім беру процесіне жобалық қызметтің кешенді түрлерін енгізу. Бұл зерттеудің ғылыми және практикалық маңызы теориялық білімді кеңейту және дәлелденген ұсыныстар әзірлеуде жатыр. Зерттеу нәтижелері мыналарды растайды: эксперименттік топтағы (ЭТ) жоғары когнитивті белсенділік деңгейіндегі оқушылардың үлесі бақылау тобымен (БТ) салыстырғанда артты; білім беру барысында пәндер аралық байланыстар мен интегративті тәсілдер дамыды, бұл оқушылардың жалпы дайындығы мен келешектегі оқуға дайындықтарын жақсартты; топтық жұмыс, жауапкершілік және өзін-өзі бақылау дағдылары нығайтылды; әрбір оқушының қызығушылықтары мен қабілеттерін ескере отырып, жеке оқу мүмкіндіктері ұсынылды. Алынған нәтижелер негізінде мұғалімдер үшін инновациялық технологияларды енгізу, оқушылардың өз бетінше жұмыс істеуін күшейту және оқушылар арасындағы ынтымақтастықты дамыту бойынша ұсыныстар әзірленді. Бұл ұсыныстар білім беру процесінің тиімділігін арттыруға және білім сапасын одан әрі жақсартуға бағытталған. Қорытындылай келе, мектеп оқушыларының когнитивті белсенділігін қолдау үшін әртүрлі стратегияларды қолдану және жобалық қызметтің әртүрлі түрлерін білім беру процесіне енгізу оқушылардың когнитивті белсенділігін практикада ынталандыруда тиімді екенін көрсетті.

**Түйінді сөздер:** жобалау қызметі, танымдық белсенділік, қолдау, оқушылар, білім беру технологиялары, жобалау әдістемесі.

#### РОЛЬ ПРОЕКТНОЙ ДЕЯТЕЛЬНОСТИ В ПОДДЕРЖКЕ ПОЗНАВАТЕЛЬНОЙ АКТИВНОСТИ ШКОЛЬНИКОВ

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Эта статья рассматривает проблемы и потенциал использования проектной деятельности для повышения когнитивной активности школьников. Исследование было проведено с целью определения роли проектной деятельности в поддержке когнитивной активности и разработки рекомендаций для ее дальнейшего применения. Основное внимание в исследовании уделено внедрению комплексных форм проектной деятельности в образовательный процесс для увеличения уровня когнитивной активности учащихся. Научная и практическая значимость исследования заключается в расширении теоретических знаний и разработке научно обоснованных рекомендаций. Результаты исследования подтверждают, что доля учащихся с высоким уровнем когнитивной активности в экспериментальной группе (ЭГ) увеличилась по сравнению с контрольной группой (КГ); были развиты междисциплинарные связи и интегративный подход к обучению, что способствовало улучшению общей подготовки учащихся и их готовности к дальнейшему обучению; укрепилась навыки командной работы, ответственности и самоконтроля; были созданы возможности для индивидуализации образовательного процесса с учетом интересов и способностей каждого ученика. На основе полученных данных были разработаны рекомендации для учителей, включая использование инновационных технологий, усиление роли самостоятельной работы и развитие сотрудничества между учениками. Эти предложения направлены на повышение эффективности образовательного процесса и дальнейшее улучшение качества образования. В заключение, использование различных стратегий для поддержки когнитивной активности школьников, а также внедрение различных форм проектной деятельности в образовательный процесс, показали свою эффективность в стимулировании когнитивной активности учащихся на практике.

*Ключевые слова:* проектная деятельность, познавательная активность, поддержка, школьники, образовательные технологии, проектная методика.

**Introduction.** The research into the role and significance of project-based activities in supporting students' cognitive engagement holds particular relevance within the context of contemporary educational trends in Kazakhstan. As educational methods rapidly evolve, the importance of an interdisciplinary approach centered on project-based learning continues to grow, as it effectively stimulates students' cognitive activity. Project-based learning acts as a key educational tool, facilitating the achievement of specific academic goals. This approach not only promotes the integration of knowledge and skills across multiple disciplines but also sparks students' curiosity, motivating them to explore subjects more deeply. As a result, students become more engaged in the learning process while simultaneously developing critical skills necessary to succeed in a constantly changing world.

Previous research in both foreign and Kazakhstani pedagogy and psychology suggests that the project approach in education holds significant potential for enhancing students' motivation to acquire a broad base of knowledge, as well as fostering their creative and innovative abilities, teamwork skills, and more. However, many important aspects related to the mechanisms by which project activities influence students' cognitive engagement remain insufficiently explored. Furthermore, there is a need to identify strategies to optimize and improve these processes.

The relevance of the chosen research topic is underscored by the modern demand for more effective teaching methods, particularly those that align with the evolving conditions of society and the economy. It is essential to recognize that cognitive activity plays a vital role in helping students master the educational material defined by national standards, as well as supporting their personal and professional development. Meanwhile, project-based activities are becoming increasingly recognized as one of the most promising and impactful forms of organizing student learning, as they actively contribute to the development of students' cognitive engagement.

Additionally, the significance of this research is driven by the practical needs of school education, particularly within secondary institutions seeking to incorporate various innovative approaches into their teaching. The current lack of sufficient methodological support regarding the role of project activities in the development of students' cognitive processes calls for further investigation. Specifically, research is needed to explore the interaction mechanisms between project activities and cognitive processes in students, which are crucial indicators of the effectiveness of the learning process.

The focus of this research is on schoolchildren involved in project-based activities.

The primary subject of the research is the impact of project-based activities on the development of students' cognitive engagement.

The objective of this study is to examine the role of project-based activities in fostering students' cognitive engagement and to propose recommendations for the further integration of such activities to support cognitive development.

Research objectives:

1. To explore the fundamental concepts, theories, and practices related to project-based activities and cognitive engagement within the educational context.
2. To determine the perspectives of key educational stakeholders on project-based activities and their influence on cognitive processes.
3. To evaluate the level of cognitive engagement in students.
4. To develop strategies for integrating project-based activities into the learning process to boost students' cognitive involvement.
5. To analyze the effect of project-based activities on students' cognitive engagement and assess their effectiveness.
6. To provide recommendations for the ongoing use of project-based activities to further enhance students' cognitive engagement.

The hypothesis of the study is that the inclusion of advanced project-based activities within the school curriculum will improve students' cognitive engagement.

**Materials and methods.** Research methods used to achieve the goals and test the hypothesis include: literature review, survey, pedagogical experiment, and statistical and analytical analysis.

The literature review involved examining existing official publications and other academic works related to project-based activities and cognitive processes in education, particularly within school education.

Survey methods were based on a questionnaire administered to teachers and students to gauge their attitudes toward project-based activities and their effect on cognitive processes.

Survey design: the respondents were selected from a diverse group of teachers teaching various subjects and students from different age groups (grades 5-11). This diverse selection allows for considering different perspectives and experiences from the participants. All respondents were informed about the survey's goals and their significance. The survey was anonymous. The questionnaire included both closed-ended questions with fixed responses (e.g., "yes/no," "often/rarely") and open-ended questions to obtain

more detailed responses. The teacher questionnaire aimed to: assess teachers' awareness of project-based learning methods and their readiness to incorporate them into their practices; determine how integrated project activities are in the educational process, which is essential for understanding how well this teaching method is incorporated into daily lessons; and identify the types of projects being used, which reveals the level of teachers' professionalism and their ability to adapt the project method to different academic subjects and age groups. Additionally, it evaluated the teachers' level of professionalism and their ability to apply the project method across various disciplines and age levels.

The pupil questionnaire sought to: measure the extent of students' engagement in project work, which is an important indicator of their readiness and willingness to participate in such forms of learning activities; assess the frequency with which students engage in project work and their experience with this approach in the school curriculum; understand students' preferences regarding different types of projects, helping identify ways to stimulate their cognitive activity; and gauge the students' readiness and enthusiasm to participate in project-based learning activities.

The survey was distributed using GOOGLE FORMS, ensuring accessibility and ease for all participants. The distribution of the questionnaire link via the WhatsApp digital messenger further facilitated convenience, minimizing time spent and simplifying the process of data collection and analysis. In total, 64 teachers and 120 students participated in the survey.

The experimental study was conducted through a pedagogical experiment. The experiment involved an experimental group participating in project activities and a control group, where students were taught through traditional methods. Results from both groups were then compared. The experimental group (EG) consisted of 25 participants, while the control group (CG) had 26 participants.

In the first stage, we assessed students' cognitive activity using B.K. Pashnev's questionnaire, designed to determine the level of cognitive activity. The questionnaire consisted of two sections: 42 main questions that reflect indicators of cognitive activity, and 10 questions that measure the sincerity of the answers or the level of social expectations. Each answer matching the "key" received 1 point. The total points were summed, and the results were compared to the norms corresponding to the age of 9th-grade students.

The evaluation criteria in points are as follows: 35-42 points indicate a high level of cognitive engagement; 20-34 points represent an average level of cognitive engagement; and 0-19 points correspond to a low level of cognitive engagement. A low level of cognitive activity is attributed to a student who is passive, tends to react more to the teacher's instructions, and typically does not demonstrate a desire for independent learning. These students rarely ask questions like "Why?" and show little interest in deepening their knowledge. The average level of cognitive engagement describes a student who seeks to understand the meaning of the material being studied. Such students aim to explore and understand the relationships between different processes and phenomena, striving to apply their knowledge in appropriate contexts. A key indicator of this level is the student's commitment to completing tasks, seeking teacher support, or exploring alternative solutions when they encounter difficulties. A high level of cognitive activity is marked by students' curiosity to understand the nature of phenomena and their interrelations, along with a strong desire to learn the methods and techniques necessary to apply acquired knowledge in new situations. They are also capable of finding new ways to achieve these objectives. The distinctive feature of a high level of cognitive activity is the demonstration of broad and consistent cognitive interests, fueled by strong willpower, persistence, and determination.

The survey was conducted online using the Online Test Rad platform. Prior to the survey, students received instructions on the testing rules and were asked to answer all questions truthfully and sincerely. Afterward, the results were processed, resulting in a total score for each participant, categorized into two groups (experimental and control) in percentage terms. Following the completion of the experiment, a final test on students' cognitive engagement was conducted using the same B.K. Pashnev questionnaire.

The data analysis was grounded in quantitative statistical procedures to ensure the reliability and methodological soundness of the results. The selection of statistical techniques was guided by the structure of the research design and the empirical characteristics of the sample. Given the limited group sizes (experimental group  $n = 25$ ; control group  $n = 26$ ) and the ordinal nature of the measured cognitive activity levels (low, medium, high), priority was given to non-parametric methods. At the same time, parametric indicators were additionally examined to maintain comparability with related pedagogical studies.

The core inferential method applied was the Mann-Whitney U test, which is appropriate for comparing independent samples when normality assumptions cannot be guaranteed. This test allowed for the identification of statistically meaningful differences in cognitive activity distributions between the experimental and control groups without relying on parametric assumptions. Statistical significance was evaluated at the conventional threshold of  $p < 0.05$ . To complement significance testing, effect sizes were calculated using Cohen's  $d$  in order to assess the practical relevance of the observed differences. In line with accepted conventions, values above 0.5 were interpreted as moderate effects, while values exceeding 0.8 indicated strong effects.

Descriptive analysis focused on the proportional distribution of cognitive activity levels within each group, expressed as percentages to enhance interpretability. For questionnaire-based categorical variables, chi-square tests were employed to explore associations, including relationships between teaching experience and the frequency of project-based activity implementation. For continuous indicators derived from Pashnev's cognitive activity questionnaire, central tendency and variability were assessed using means, standard deviations, and medians to account for potential skewness and outliers.

The analytical strategy integrated static and dynamic perspectives. Changes in cognitive activity indicators were calculated separately for each group across measurement stages, after which a difference in differences approach was used to distinguish the intervention effect from background developmental trends. This combination of within-group temporal analysis and between-group comparison strengthened the interpretive validity of the findings and supported more robust causal conclusions regarding the effectiveness of project-based learning.

All statistical procedures were conducted using IBM SPSS Statistics (version 23.0). Data interpretation adhered to established standards in educational research and remained deliberately cautious, acknowledging the exploratory character of the study and the constraints imposed by the sample size.

The research methodology addresses key research questions, such as the impact of project-based activities on the development of students' cognitive engagement, the main factors influencing the effectiveness of project-based activities in cognitive development, and the ideal conditions for incorporating project-based learning into the educational process. All these questions are based on the hypothesis that project-based activities enhance cognitive engagement in students, as long as specific pedagogical principles and effective methods are applied within educational institutions.

**Results.** This section describes the materials in which the problems posed, relative to the topic, were addressed in some way.

John Dewey, an American educator and philosopher, who introduced the project-based teaching method, emphasized that project work enables students to address real-world problems, which gives them a chance to cultivate an interest in learning by enhancing critical thinking and other practical abilities [1, p. 1110; 2, p. 7]. Scholars from Kazakhstan share this perspective [3, p. 257; 4, p. 8; 5, p. 84; 6, p. 98].

International sources have identified five distinct characteristics of project-based learning in schools: challenge-based learning, which focuses on contemporary social issues [7, p. 1015]; problem-based learning, a project-oriented approach to problem-solving [8, p. 42]; place-based learning, which centers on local context in project work; activity-based learning, emphasizing practical hands-on experiences in projects [9, p. 7]; and design-based learning, which involves project-based activities through design work [10, p. 6]. It is important to note that Kazakhstan is increasingly adopting all of these teaching methods in its schools. Initially, consulting the methodological guidelines on implementing the project approach in Kazakhstani secondary schools, developed in 2023 by the I. Altynsarin National Academy of Education, is crucial [11, p. 16]. New project-based learning techniques are being applied more frequently, including those that emphasize practical experience and skill development, as they significantly enhance the quality of education in Kazakhstani schools [12, p. 56].

As outlined by various international researchers, the fundamental principles of supporting project-based activities in education include: setting clear goals and objectives for the activities; recognizing the teacher's role as not just a knowledge provider, but also as a consultant, coordinator, and mentor; structuring the project effectively; and fostering cognitive engagement. The latter is achieved by involving students voluntarily in the learning process, sparking their interest in specific subjects and in the learning experience as a whole [13, p. 50; 14, p. 94]. Additionally, Kazakhstani scholars often highlight the role of the teacher in project activities at school, viewing this pedagogical method as a factor in the professional growth of educators and stressing that project-based learning should be used as an essential educational tool, as it aids both teachers and students in acquiring vital skills [15, p. 7; 16, p. 89].

The role of project activities in enhancing the cognitive engagement of students is most often examined through various theoretical frameworks. One such theory is constructivism, which asserts that students should begin learning to construct their knowledge through experience and interaction with real-world situations or their environment from an early stage in their education [17, p. 149]. Furthermore, the primary learning mechanisms according to constructivist theory, as outlined in the training materials of the online platform Kazakhstan Ashyk University, involve ensuring balance, active student participation, and timely feedback from the teacher, who points out incorrect responses to prevent imbalances and a decrease in student engagement [18, p. 14; 19, p. 56].

A closer examination of dominant theoretical approaches demonstrates the absence of a unified view on how project-based activity stimulates cognitive engagement. Constructivist interpretations, actively reflected in contemporary educational practices in Kazakhstan [20, p. 45], conceptualize cognition as a process of experiential knowledge construction grounded in interaction with the learning environment. Within this paradigm, project work functions primarily as a medium for exploration, collaboration, and meaning-making. In contrast, cognitive development theories focus on the purposeful enhancement of mental

processes, emphasizing mechanisms of information processing, comprehension, and intellectual regulation rather than situational discovery [21, p. 177; 22, p. 32].

These theoretical differences fundamentally shape the understanding of the learner's role. Constructivist models position students as autonomous agents who actively construct knowledge, whereas cognitively oriented approaches aim to optimize existing cognitive structures through targeted pedagogical interventions. Developmental learning theory introduces an additional perspective by highlighting the transformative capacity of systematically designed project activities [23, p. 17]. Unlike constructivism, which prioritizes independent discovery, developmental frameworks argue that guided instruction and deliberate scaffolding can accelerate cognitive maturation beyond the level achievable through self-directed activity alone. This divergence is reflected in ongoing debates regarding the teacher's function in project work whether educators should primarily act as facilitators or assume the role of intentional designers of cognitive challenges.

International research further illustrates the contextual variability of these approaches. Western European educational traditions frequently emphasize problem-based and design-oriented project methodologies [24, p. 685; 25, p. 95], relying on assumptions of high learner autonomy, sufficient institutional support, and stable technological infrastructure. Kazakhstani educational practice, while incorporating these models [11, p. 83; 12, p. 78], simultaneously confronts challenges typical of transitioning education systems, including limited methodological support, uneven access to digital resources, and differences in teacher preparedness. These conditions necessitate the adaptation and synthesis of theoretical frameworks rather than their direct transfer.

The comparative analysis also reveals several unresolved research gaps. First, existing studies rarely examine the interaction between specific types of project activities and distinct cognitive domains. Second, the correspondence between project complexity and students' developmental readiness remains insufficiently conceptualized. Third, both international and domestic scholarship lack longitudinal investigations that assess sustained cognitive outcomes beyond immediate post-intervention effects. Addressing these gaps provides the methodological and theoretical justification for the present study, which focuses on experimentally measurable indicators of cognitive engagement. Cognitive theory primarily focuses on enhancing mental processes in children at school, such as stimulating thought and improving their understanding of the information being studied [26, p. 126]. At the same time, it is crucial to note that in contemporary international pedagogy, the project-based learning approach aims to achieve several key goals: "innovative education," "progressive education," and "cognitive engagement." Additionally, the theory of developmental learning is significant because it highlights the role of project-based activities in promoting cognitive development.

It is also important to acknowledge that recent research by Kazakhstani scholars frequently draws on these theories, as they are actively applied in practice. This is supported by evidence showing the effectiveness of organizing project activities for schoolchildren, such as creating STEM startups for students. A. Gellel in his investigation of students' cognitive activity, suggests that project-based work should be considered a method of developmental learning because it fosters students' interest in subjects like chemistry [27, p. 480]. Moreover, it integrates knowledge learned during coursework and helps students develop independent research skills, creativity, logical thinking, and an understanding of real-world issues [28, p. 30].

Studies by international researchers also underline the necessity of addressing certain challenges, without which the benefits of project-based learning in schools cannot be fully realized. In this context, K. Takahiro emphasizes the importance of considering two project-based methods-those of William Herd Kilpatrick and John Dewey's problem-solving approach-when applying them to school teaching [29, p. 7]. Other researchers argue for the early adoption of problem-based learning in middle school to foster deeper understanding before students graduate from high school [30, p. 101]. Authors present an additional approach focused on enhancing memory and vocabulary retention through project-based learning. Furthermore, a group of authors highlights the IQWST model, which uses coherence as a design principle for middle school science curricula.

The most effective project-based practices that promote cognitive activation are identified as: the project method, which enables the fulfillment of educational objectives through the creation of specific projects; research activities that involve experimentation, data analysis, and drawing general conclusions; and collaborative learning, which includes group work, among others [31, p. 90; 32, p. 7]. These theories and practices provide valuable insight into how integrating project activities into the learning process can positively impact cognitive activity and lead to improved educational outcomes [33, p. 28].

The importance of this study lies in its potential to expand theoretical knowledge and offer scientifically grounded recommendations for implementing project-based activities in schools, ultimately enhancing cognitive learning outcomes and improving the overall quality of the educational process.

The review of literature identified the key principles, established theories, and current practices regarding the use of project-based activities and cognitive engagement in the educational process. This analysis enabled the execution of the planned research and the formulation of recommendations for the continued application of project activities to enhance cognitive engagement in schools.

The results of the questionnaire survey of teachers (64 people) are reflected in Table 1.

Table 1 – Results of teachers' survey on their attitudes towards project activities and their impact on cognitive processes.

Question	Answer options	Results, in percentages
Teaching experience	Up to five years	19
	Five to ten years	28
	For more than a decade.	53
Teaching subject	Language, literature	22
	Math	22
	Physics	14
	Chemistry	14
	Biology	14
	Informatics	8
	Others	6
Experience in the use of project activities	Yes	75
	No	10
	Sometimes.	15
Frequency of use of project activities	Frequently (more than once a month)	30
	Rarely (less than once a month)	36
	Very rarely (once a year or less)	34
Types of projects	Individual projects	25
	Group projects	45
	Mixed (individual-group)	30
Project Objectives	Creating interest in learning through solving real-life problems	60
	Development of independent work skills	55
	Increasing the level of responsibility for the results of their work	36
	Development of communication skills through teamwork	34
	Training in searching, selecting and analyzing information	45
Impact on cognitive interest	Positive	78
	Neutral	11
	Negative	11
Student motivation	Opportunity to prove yourself	55
	Interesting project topic	70
	Teamwork	66
	Other	11
Difficulties in implementation	Limited amount of time	73
	Lack of resources	66
	Low level of motivation of pupils	36
	Difficulty in coordinating the work of the team	50
	Other	8

Survey findings show that students are broadly familiar with project-based learning, though the depth of their experience varies considerably. About three out of four respondents (75%) indicated they had previously taken part in project activities. Most of these students reported completing two to three projects (42%), pointing to a moderate level of exposure rather than sustained, systematic use. At the same time, the spread of experience is uneven: nearly one quarter (23%) completed four to five projects, and 15% reported participation in more than five, while one in five students (20%) had engaged in only a single project. This imbalance suggests that project-based learning is implemented inconsistently across classrooms or grade levels.

Student preferences clearly favor collaborative formats. More than half of respondents (52%) expressed a preference for group-based projects, while an additional 20% supported a combined individual group approach. In contrast, fewer than one-third (28%) favored working exclusively on their own. These preferences are reinforced by students stated motivational factors. Interaction with classmates emerged as the strongest driver of engagement (72%), followed closely by opportunities for creative expression (68%). In comparison, more traditional elements such as presenting final results (32%) or searching for information (38%) were rated as less motivating, highlighting the central role of social interaction in sustaining student interest.

Students' evaluations of the educational value of project activities were overwhelmingly positive. A combined 86% described project work as either very interesting (48%) or interesting (38%), while negative

evaluations were minimal (14% in total). Importantly, 88% of respondents believed that participation in projects improved their understanding of the learning material, lending strong support to the assumption that project-based learning enhances cognitive involvement. Only a small minority disagreed (6%), with an equal proportion remaining unsure, indicating near-consensus regarding perceived effectiveness.

When discussing difficulties, students identified challenges that both overlap with and differ from those reported by teachers. Time management was the most frequently cited issue (72%), closely matching teachers' concerns about limited instructional time (73%) and underscoring time pressure as a systemic problem rather than an isolated perspective. However, students also emphasized difficulties in locating relevant information (68%) and coordinating group work (54%), issues that were less prominent in teacher feedback. These challenges may reflect students' developmental stage or a lack of structured methodological support. Additionally, nearly half of respondents (46%) reported anxiety related to presenting project outcomes, suggesting that assessment and presentation formats may need adjustment to reduce performance-related stress.

A comparison of student and teacher viewpoints reveals both convergence and divergence. Both groups recognize time constraints as a major barrier and agree on the overall educational benefits of project-based learning. However, their motivational priorities differ. Teachers tend to emphasize engagement with real-life problems (60%) as the primary goal, whereas students place greater value on peer interaction (72%) and creativity (68%). This mismatch between teachers' focus on applied cognitive outcomes and students' emphasis on social and creative processes points to an opportunity for refinement. Project designs that combine authentic problem-solving with well-structured collaborative elements may better align instructional objectives with student motivations, enhancing both learning outcomes and engagement.

The results of the questionnaire survey of students (120 students) are shown in Table 2.

Table 2 – Results of pupils' survey on their attitudes towards project activities and their influence on cognitive processes.

Question	Answer options	Results, in percentages
Classes	Grades 5-9	60%
	Grades 10-11	40%
Participation in project activities	Yes	75%
	No	25%
Number of completed projects	One	20%
	Two or three	42%
	Four-five	23%
	More than five	15%
Preferred project types	Individual	28%
	Group	52%
	Both types	20%
Level of interest in project activities	Very interesting	48%
	Interesting	38%
	Not very interesting	12%
	It's not interesting at all	2%
Advantages of project activities	Independent search for information	38%
	Creative work	68%
	Communication with classmates	72%
	Presentation of your achievements	32%
	Other	8%
Difficulties in completing projects	Finding the right information	68%
	Time planning	72%
	Group coordination	54%
	Presentation of the result	46%
	Other	14%
Help in understanding the material	Yes	88%
	No	6%
	I can't answer that	6%

Student survey results both confirm and complicate the teacher narrative. On the surface, participation aligns: three out of four students (75%) report having done project work, backing teachers' claims that projects are widely used. But dig deeper and the rollout looks uneven. While most students are actively involved 42% completing two to three projects and another 38% doing four or more one in five reports only a

single project experience. That gap points to inconsistent integration across grades or subjects rather than a uniformly embedded practice.

When it comes to format, students are crystal clear. Collaboration wins. A majority (52%) prefer group projects, and another 20% favor mixed formats, meaning nearly three quarters lean toward some form of teamwork. Only 28% opt for individual projects. In plain terms, independence alone doesn't drive engagement; social interaction does. This directly challenges pedagogical assumptions that prioritize individualized learning as inherently motivating.

Perceived benefits reinforce this preference. The top gain students report is communication with peers (72%), followed by opportunities for creative work (68%). Traditional academic components trail far behind information searching (38%) and presenting results (32%). Students, it seems, value projects less as skill drills and more as social-learning spaces. For project design, this signals a need to move beyond "group work in name only" toward genuinely interactive collaboration.

Overall attitudes toward project learning are strongly positive. An overwhelming 86% describe projects as interesting or very interesting, with negative responses confined to a small minority (14%). Even more compelling, 88% believe project work helps them understand the material better. While these are self-reported perceptions and should be triangulated with objective outcomes, the consistency of responses suggests high perceived instructional value.

Students' accounts of difficulties both echo and expand teachers' concerns. Time management stands out as the shared pain point: 72% of students cite planning problems, almost identical to teachers' reports of time constraints (73%). Beyond that, students highlight challenges teachers rarely foreground finding relevant information (68%) and anxiety around presenting results (46%). This contrast implies that teachers tend to focus on organizational barriers, while students struggle more with specific competencies like research literacy and public speaking areas that can be directly taught and scaffolded.

Taken together, the comparison reveals a key pedagogical mismatch. Teachers emphasize real-world problem solving as the main goal of projects (60%), whereas students are driven by communication (72%) and creativity (68%). This isn't a contradiction so much as a missed opportunity. Projects that embed authentic problems within rich collaborative and creative structures could bridge this gap serving instructional objectives while tapping into what actually motivates students.

The results of the pedagogical experiment at the initial stage are reflected in Table 3.

*Table 3* – Results of initial diagnostics of cognitive activity among 9th grade pupils (EG and CG), in percentages

<b>Group</b>	<b>High level</b>	<b>Medium level</b>	<b>Low level</b>
Experimental group	32	56	12
Control group	31	57	12

The results obtained lead to the following conclusions. The proportion of students with a high level of cognitive engagement is nearly identical in both groups: 32% in the experimental group and 31% in the control group. These students exhibit a strong interest in studying subjects, a desire to understand the essence of phenomena and their interconnections, and possess strong willpower, which enables them to successfully handle tasks even in altered conditions.

In both groups, the majority of students display an average level of cognitive activity, with 56% in the experimental group and 57% in the control group. This indicates that most students aim to comprehend the material's meaning and apply their knowledge in typical situations, demonstrating moderate interest and consistency in their learning efforts.

Only 12% of students in both groups show a low level of cognitive engagement, indicating low motivation, minimal participation in learning activities, and little interest in deeply exploring the material.

The near-identical baseline profiles of the experimental and control groups confirm the internal validity of the comparative design. Minimal discrepancies no more than 1% across high- and medium-level indicators indicate effective random assignment and substantially reduce the likelihood of selection bias influencing the results. This equivalence is not merely procedural; it establishes a necessary methodological condition under which any subsequent group differences can be credibly interpreted as intervention-driven rather than artifacts of initial heterogeneity.

At the same time, the baseline distribution itself reveals structural limitations of the prevailing instructional model. The concentration of students at the medium level of cognitive activity (56-57%) suggests that traditional teaching practices are sufficient for maintaining functional participation but insufficient for stimulating sustained or deep engagement. Of greater concern is the persistent low-level segment (approximately 12%), which signals a stable group of learners vulnerable to disengagement and academic stagnation. These figures define the intervention's strategic objectives: reducing the low-engagement cohort while promoting upward movement from moderate to high cognitive involvement.

The modest proportion of highly engaged students (31-32%) further underscores the unrealized capacity within the learning environment. If conventional pedagogical approaches consistently produce such

ceilings, their developmental potential must be questioned. In this context, project-based learning emerges as a theoretically grounded alternative, as it foregrounds learner autonomy, contextual relevance, and active knowledge construction factors largely absent from transmissive instructional formats and essential for activating higher-order cognitive engagement.

Finally, these baseline parameters provide a critical interpretive frame for evaluating post-intervention outcomes. Increases surpassing the expected range of natural fluctuation (approximately 5-10%) may be reasonably attributed to the pedagogical intervention. Conversely, the absence of meaningful distributional shifts would prompt a reassessment of either the intervention's instructional mechanisms or the sensitivity of the diagnostic tools employed to capture changes in cognitive engagement.

In our experiment, modern project-based activities are incorporated into the experimental group, while the control group continues with traditional learning methods.

A teaching methodology was developed for the experimental 9th-grade group to enhance students' cognitive engagement through various forms of project-based activities.

The aim of this methodology is to create conditions for the holistic development of students by increasing their cognitive engagement, fostering independent work skills and critical thinking, and developing communication and social abilities through the organization of effective group (team) work.

Within this methodology, both individual and group project assignments in different subjects have been created, and opportunities have been provided for interdisciplinary projects that integrate multiple subjects (for example, mathematics and physics, history and art). The work is conducted under the supervision of a teacher.

The key areas for supporting the cognitive activity of schoolchildren through project-based activities are outlined as follows:

1. **Motivating and Engaging Students:** This involves creating interest by explaining the project and providing favorable conditions that encourage personal engagement with the project topic. Maintaining intrinsic motivation is achieved by highlighting the relevance and importance of the project's goals.

2. **Developing Research Skills:** Students are taught how to gather, analyze, and interpret information. They are also guided on how to formulate hypotheses, conduct investigations and experiments, and draw conclusions from their findings.

3. **Facilitating Independent Work:** In this aspect, students are given the opportunity to independently plan and carry out the stages of their project work. Throughout this process, the teacher offers guidance but does not directly intervene in the project execution.

4. **Promoting Collaboration and Teamwork:** Group projects require organizing teamwork and emphasizing the value of sharing knowledge and experiences. It is crucial to consistently cultivate teamwork skills in students, fostering an environment of mutual respect.

5. **Assessment and Reflection:** This involves introducing self-assessment and peer assessment, where students assess their own and each other's work. Regular discussions and reviews are held both during different project stages and upon completion to reflect on progress and outcomes.

6. **Utilizing Modern Technologies:** The integration of information technology and digital tools plays a vital role in helping students search for information, create presentations, and communicate with their project partners or teacher. It is important to combine modern technology with traditional teaching methods to enhance the effectiveness of educational projects.

7. **Encouraging Creativity and Innovation:** Students are encouraged to use non-traditional approaches and think creatively. Emphasis is placed on inspiring students to develop new ideas and solutions.

8. **Integrating Interdisciplinary Connections:** This involves incorporating knowledge from various academic disciplines into the project work. By doing so, students can better understand how theoretical knowledge is applied in real-world scenarios.

The program also includes key project activities:

1. **Research Project:** This project, implemented within the natural science subjects, focuses on developing skills related to scientific inquiry, data analysis, and presenting findings. It takes the form of laboratory experiments in biology, chemistry, and physics, followed by the creation of scientific articles.

2. **Information Retrieval Project:** This project, carried out within social studies and history, aims to develop the skills of searching, processing, and organizing information. Students create multimedia encyclopedias about historical events and major social issues, selecting topics of interest to them.

3. **Technical Project:** Implemented in the fields of technology and informatics, this project focuses on developing technical abilities, engineering thinking, and innovation. It takes place in laboratory sessions, where students design models, build simple robots, develop basic mobile applications, and design various objects.

4. **Business Project:** This project, part of economics and social studies, aims to develop entrepreneurial skills, economic literacy, and management abilities. Students work on creating business plans for starting a mini-business and conducting market research in various sectors.

5. **Subject Projects:** In mathematics, projects such as "Creating a Mathematical Guidebook," "Solving Real-Life Problems Using Mathematics," and "Modeling Financial Operations" are suggested. In physics,

projects like "Investigating Physical Phenomena in Nature," "Creating a Physical Device," and "Conducting Physical Experiments in Virtual Reality" are proposed.

6. Interdisciplinary Integrated Projects: These projects aim to foster holistic problem-solving skills by addressing topics that span multiple disciplines. They combine subjects like history and literature, physics and art, biology and geography, and more. Example projects include: "Ecological Challenges in Our Region" (biology, geography), "The History of Our City" (history, literature), "Building a Model of the Solar System" (physics, astronomy), among others.

The following resources were provided for project work: access to necessary materials (libraries, internet, laboratories) and designated spaces for group and individual work (classrooms, offices, laboratories).

Project activity outcomes were assessed by the teacher using specific evaluation criteria, as well as by students themselves through self-assessment and peer evaluations. To encourage and support students, a competition for the best projects was organized, and an exhibition of the projects was set up to showcase students' cognitive achievements.

The results of the pedagogical experiment at the control stage, in comparison with the indicators of the initial stage, are reflected in Figure 1.

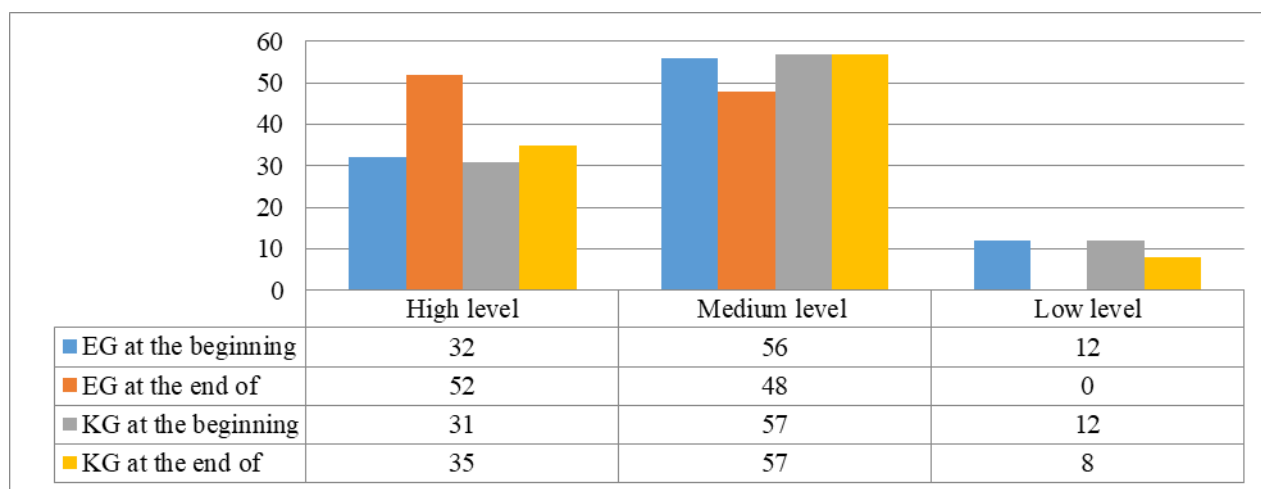


Figure 1 – Results of comparative analysis of initial and control diagnostics of cognitive activity among 9th grade pupils (EG and CG), in percentages

Based on the results of the comparative analysis of the initial and final assessments of cognitive activity in 9th-grade students (experimental and control groups), the following conclusions were drawn.

In the experimental group, after the introduction of active project-based activities, the percentage of students with a high level of cognitive engagement increased to 52%, while the average level decreased to 48%, and there were no students with a low level of activity (0%). The notable increase in the number of students with high cognitive activity reflects the positive impact of active project-based learning. The complete absence of students with low cognitive activity indicates that all students were able to enhance their engagement through the new project-based methods.

In contrast, the control group showed minimal changes according to the final assessment. The percentage of students with a high level of cognitive activity increased by just 3% (from 32% to 35%), the average level remained unchanged (57%), and the low level slightly decreased by 3% (from 12% to 8%). The slight improvement in the high-level indicators and the reduction in low-level students suggest a natural progression in cognitive activity, largely attributed to the traditional teaching methods used, but these changes were much less significant compared to those seen in the experimental group.

**Discussion.** The comparative results reveal far more than a routine confirmation of instructional effectiveness. Most notably, the experimental group demonstrated a marked increase in high-level cognitive engagement approximately a 20-percentage-point gain which clearly exceeds both expected measurement error and typical age-related cognitive growth. This strongly supports a causal interpretation of the intervention's impact. What makes this finding especially compelling is the limited duration of implementation; it is reasonable to assume that sustained use over a full academic cycle could amplify these outcomes even further.

Equally important is the structure of change across engagement levels. The experimental group did not simply show incremental improvement but completely eliminated low-level cognitive activity, dropping from 12% to zero. This pattern suggests that project-based learning exerts a particularly strong influence on students who initially struggle with engagement. From an equity perspective, this is critical: an instructional approach that disproportionately benefits lower-performing learners has the potential to narrow achievement gaps while still advancing overall academic quality.

In contrast, the control group exhibited only marginal shifts approximately 3-4% which serve as an essential interpretive baseline. Such minor variations are more plausibly explained by testing effects, random fluctuation, or natural maturation rather than instructional influence. The divergence between groups 20% growth versus roughly 3% makes it difficult to attribute the experimental outcomes to placebo effects, increased attention, or general classroom dynamics. Instead, project-based activities emerge as a substantive pedagogical driver.

While the exact mechanisms cannot be empirically isolated within the current design, they align well with established learning theory. Project-based formats likely intensify cognitive engagement by increasing perceived relevance, allowing students to connect abstract concepts with real-world contexts. They also promote autonomy through inquiry-based decision-making, reinforce motivation via collaborative interaction, and provide flexible entry points for learners with differing cognitive styles. Traditional instruction, lacking this multidimensional engagement architecture, offers a plausible explanation for the stagnation observed in the control group.

That said, these conclusions must be interpreted with caution. The relatively small sample size ( $n \approx 25$  per group) constrains statistical power and limits broader generalization. Implementation within a single institutional context further restricts external validity, as outcomes may vary across schools with different instructional cultures, resource levels, or student demographics. Moreover, the absence of longitudinal tracking leaves unresolved whether observed cognitive gains are durable or diminish once project-based elements are withdrawn.

Finally, the study design does not allow for differentiation among the components of project-based learning itself. It remains unclear whether gains were primarily driven by interdisciplinary content integration, peer collaboration, authentic problem-solving, instructional scaffolding, or the interaction of these factors. Future studies employing factorial or mixed-method designs would be well positioned to disentangle these influences and generate more targeted, evidence-based pedagogical guidance.

The analysis of these results should also be compared with previous studies and their conclusions. For instance, N. Dagbaeva, who views project-based activities as a tool for fostering cognitive engagement in students, found that projects are highly effective in enhancing cognitive activity, especially when they present a problem scenario and establish a clear action plan to achieve the goal. Additionally, she noted that pedagogical support is essential for maximizing the potential of project activities in promoting active cognitive engagement. Atika Rahma Putri's practical study on the role of project-based learning in developing cognitive activity, using history lessons as an example, emphasizes the importance of using various types of projects for fostering student cognition, including in extracurricular activities. This approach helps address many educational challenges within the subject. It is crucial to consider both the curriculum requirements and the students' interests when developing projects.

In addition to the theoretical framework, a set of practical recommendations has been developed to stimulate students' cognitive engagement through project-based learning, with careful consideration of age-related characteristics and subject specificity.

For Grades 5-6, when students are only beginning to develop self-organization and sustained attention, projects should be short-term, usually lasting two to four weeks. At this stage, the main goal is to spark curiosity without creating cognitive overload. In mathematics, projects may focus on visualizing geometric concepts for example, constructing models of transformations using simple materials and documenting the process through photographs and short explanatory texts. In natural sciences, pupils can explore their immediate environment by observing seasonal temperature changes and linking them to plant development in nearby green areas, thereby combining elements of biology, geography, and elementary data analysis. Language and literature projects are most effective when they incorporate multiple forms of expression: students might collect local legends, interview older community members, and transform these stories into illustrated digital books, simultaneously developing narrative skills and basic media literacy.

Students in Grades 7-8 demonstrate greater independence and an increased ability to work with abstract concepts, which allows projects to extend to six to eight weeks. In physics, this may take the form of applied design tasks, such as building simple mechanical systems to address real-world needs designing a ramp for school accessibility, calculating mechanical advantage, and justifying design choices through basic economic reasoning. History projects can shift toward analytical work, for instance, examining the transformation of local architecture using archival photographs, timelines, and interviews with specialists, followed by student-led proposals for preserving cultural heritage. In mathematics, learners can conduct applied statistical studies, such as analyzing food waste in the school cafeteria, interpreting collected data, and proposing evidence-based solutions that they subsequently test in practice.

For Grades 9-11, long-term projects spanning an entire academic term become pedagogically justified. At this level, students are capable of deep inquiry and interdisciplinary synthesis. Chemistry projects may involve assessing the quality of local water sources using standardized methods, comparing results with regulatory norms, and communicating findings to relevant municipal bodies. Integrated literature and social studies projects can focus on migration experiences, combining oral history interviews, literary analysis of texts on displacement, and documentary film production that connects personal narratives with broader historical processes. Advanced mathematics courses can engage students in financial modeling tasks,

where they design investment portfolios, analyze market trends using spreadsheets, simulate different economic scenarios, and defend their decisions in presentations modeled on professional consulting practices.

Effective project implementation requires sensitivity to disciplinary logic. Scientific subjects emphasize hypothesis formulation, controlled experimentation, and data-driven conclusions. Humanities rely on interpretation, comparison of perspectives, and argumentation grounded in textual or historical evidence. Mathematics prioritizes logical coherence, pattern recognition, and justified procedures. Projects should reflect these epistemological differences rather than forcing all subjects into identical formats.

Individualization plays a critical role in project-based learning. Differentiation should operate across several dimensions. Content differentiation allows some students to engage with advanced aspects of a topic while others focus on core concepts for example, within an ecology project, certain learners may study complex trophic interactions, while others describe basic food chains. Process differentiation accommodates learning styles: visual learners may produce infographics, kinesthetic learners may build physical models, and verbally oriented students may concentrate on analytical writing. Product differentiation enables students to demonstrate mastery through various outputs presentations, research papers, videos, websites, or exhibitions while being assessed using common conceptual criteria.

Technology should be integrated strategically rather than superficially. Digital tools are most effective when they enable learning experiences that are otherwise inaccessible: GIS platforms for spatial analysis, sensors for real-time environmental data collection, CAD software for prototype development, or online collaboration spaces connecting students from different schools or countries. Teachers must explicitly teach digital competencies such as source evaluation, data management, and visual communication, instead of assuming students already possess these skills.

Assessment within project-based learning requires a multidimensional approach. Rubrics should distinguish between levels of cognitive achievement, including factual knowledge, conceptual understanding, analytical depth, creative integration, and critical judgment. Evaluating the learning process collaboration, persistence, time management, and adaptive problem-solving is as important as evaluating the final product. Peer and self-assessment foster metacognitive growth by encouraging students to reflect on quality criteria and learning strategies. Portfolios containing drafts, research notes, and reflective entries provide a more accurate picture of learning trajectories than single-point evaluations.

Potential implementation challenges must be addressed in advance. Limited instructional time can be managed through curriculum alignment, ensuring projects simultaneously meet multiple learning objectives rather than functioning as add-ons. Resource shortages may be offset through partnerships with local businesses, universities, and libraries. Cross-departmental collaboration among teachers reduces individual workload while enhancing interdisciplinary coherence. Administrative support is essential and should include flexible scheduling, targeted professional development, and institutional recognition of innovative teaching practices.

Overall, these recommendations are grounded in the realities of Kazakhstani secondary education while incorporating internationally recognized approaches adapted to local cultural, institutional, and material contexts.

Suggestions for further use of project activity to support cognitive activity of schoolchildren were also developed, the main ones are reflected in Figure 2.

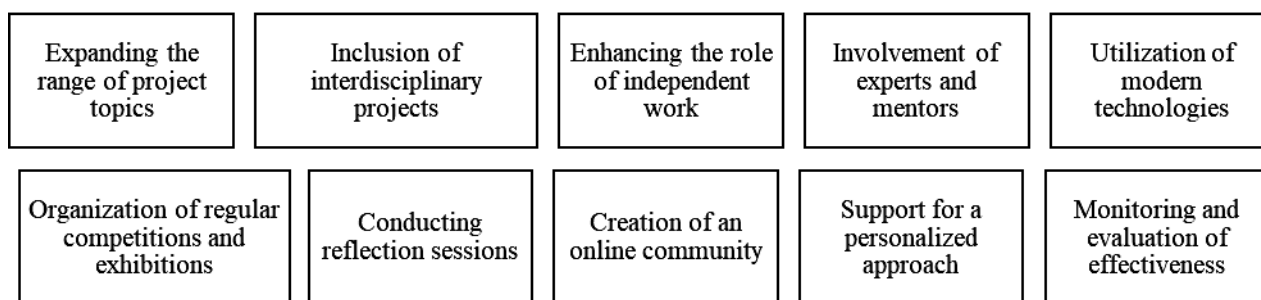


Figure 2 – Suggestions for further use of project activities to support cognitive activity of schoolchildren

Drawing directly on empirical results, the recommendations below target the real implementation gaps moving away from vague slogans toward practices that actually work in classrooms.

**Intentional topic selection, not open-ended chaos.** Instead of simply “offering projects on modern issues,” schools should build structured topic banks that align with curriculum requirements and are informed by student interest data. A practical model is quarterly student voting on a short list of pre-approved themes. Each theme integrates compulsory academic content (for example, climate science) with flexible, student-chosen applications such as local environmental monitoring, comparative energy policies, or sustainable design solutions. This approach preserves curricular rigor while leveraging the motivational value of choice identified in student surveys.

**Deliberate interdisciplinary scaffolding.** Calls for “integrated knowledge” must be translated into concrete design tools. Effective interdisciplinary projects require explicit mapping of how each subject contributes. For instance, mathematics-physics projects can clearly link algebraic modeling (a curricular requirement) to motion analysis through sports biomechanics an application students find meaningful. Structured templates should define the role of each discipline, preventing shallow overlap and ensuring genuine conceptual integration.

**Planned progression of learner autonomy.** Rather than broadly encouraging “more independent work,” autonomy should be introduced in stages. In grades 5-7, projects remain teacher-directed with fixed research questions and assessment criteria. Grades 8-9 shift toward shared control, allowing students to choose from structured options and co-create evaluation standards. By grades 10-11, students should independently define topics and methods. This gradual model directly responds to the high proportion of students reporting difficulties with information searching, while steadily building research competence.

**Skill development embedded in the project cycle.** Student difficulties are not abstract they are measurable. Time management, information retrieval, and presentation anxiety must be addressed before projects begin. Short, targeted modules should be built into the launch phase, covering efficient search strategies, basic project planning tools, and practical presentation skills. Without these supports, even highly engaging topics fail to produce meaningful learning outcomes.

**Assessment grounded in real-world impact, not only competitions.** Exhibitions and contests remain valuable, but they should be complemented by authentic evaluation criteria. Projects gain legitimacy when outcomes matter beyond the classroom. Environmental studies can be assessed partly by whether recommendations inform local decision-making, business projects by feedback from practicing entrepreneurs, and historical research by its contribution to community archives. This model bridges the gap between teacher priorities for real-world relevance and students’ emphasis on social collaboration.

**Purpose-driven technology use.** Technology should solve documented problems not serve as decoration. Planning tools can support students struggling with time management, collaborative platforms can reduce coordination issues, and rehearsal environments with peer feedback can ease presentation anxiety. Digital tools must be selected for specific pedagogical functions, not adopted as ends in themselves.

**Structured inter-school collaboration.** Cross-institutional projects succeed only when governed by clear protocols. Formal agreements should specify shared timelines, common assessment criteria, and regular communication schedules. For example, partner schools can investigate the same phenomenon such as water quality or regional economic patterns then combine findings through joint presentations. With structure, logistical complexity becomes an asset rather than a barrier.

**Systematic formative feedback, not occasional check-ins.** Monitoring must be routine and structured. Bi-weekly progress conferences should follow standard protocols focused on milestones, obstacles, and strategy adjustment. Monthly peer reviews can provide cross-group feedback using shared criteria. Final reflective analyses should compare original plans with actual outcomes, emphasizing learning through revision and adaptation. This consistency reduces coordination problems and replaces ad hoc intervention with predictable support.

Overall, these recommendations are firmly anchored in empirical evidence about both teacher constraints and student difficulties. They move project-based learning away from generic advocacy and toward practical, scalable implementation that respects classroom realities.

**Conclusion.** Throughout the research, all the set objectives were successfully accomplished, with the primary goal being to determine the role of project-based activities in fostering and sustaining the cognitive activity of schoolchildren, and to develop recommendations for enhancing cognitive engagement through the optimized use of the project method. To achieve this, we employed literature review, questionnaire surveys, pedagogical experiments, and statistical and analytical analysis.

The literature review revealed that project-based activities play a crucial role in activating the cognitive engagement of schoolchildren in the educational process. The theories and practices examined highlight the effectiveness of the project approach in enhancing students' creative and innovative skills, as well as in developing teamwork abilities. Both international and Kazakhstani pedagogical studies have underscored the importance of project activities in boosting student motivation, deepening their understanding, and fostering critical thinking. Special emphasis was placed on the development of interdisciplinary connections and an integrative approach, which enhances students' overall preparedness and their readiness for further learning. Improvements in teamwork skills, responsibility, and self-control were also noted as significant aspects. These outcomes are validated by both theoretical research and the practical findings from the pedagogical experiment.

The questionnaire survey results demonstrate a high recognition of project-based activities by teachers as an effective tool for stimulating students' cognitive engagement. Despite some challenges related to resources and organization, the vast majority of teachers regard it as beneficial and positively impacting the learning process.

The survey results also show that students generally have a favorable view of project-based activities and recognize many benefits. They value the opportunity to be creative, collaborate with peers, and engage in independent research. Although some organizational challenges remain, project activities are perceived to positively influence their understanding of the learning material.

The results from the pedagogical experiment confirm that incorporating project-based activities into the 9th-grade curriculum fosters students' cognitive engagement. The implementation of these activities creates a more dynamic and engaging learning environment, which significantly contributes to the overall development and cognitive activity of the students. A comparative analysis of the integration of active project-based activities, using the experimental group as a case study, showed a notable increase in the number of students demonstrating a high level of cognitive engagement and a complete absence of students with low cognitive activity. In contrast, the control group, which continued with traditional teaching methods, showed less pronounced positive changes, thereby affirming the effectiveness of active project-based activities in stimulating cognitive activity.

The recommendations put forward aim to further develop and improve project-based activities in schools, which will enhance students' cognitive engagement and contribute to their holistic development. These recommendations include expanding the variety of project topics, incorporating interdisciplinary projects, increasing the role of independent work, organizing more competitions and exhibitions, involving experts and mentors, utilizing modern technologies, establishing a network community, conducting reflection sessions, supporting personalized learning approaches, and regularly monitoring and evaluating the effectiveness of these activities.

The research demonstrated the importance of project-based activities as an effective tool for supporting and enhancing the cognitive activity of schoolchildren. The findings show that the introduction of various forms of project activity into the educational process leads to greater cognitive engagement, as evidenced by the increase in the percentage of students with high cognitive activity in the experimental group compared to the control group. It also fosters the development of interdisciplinary links and an integrative approach to learning.

Moreover, the results contribute to the academic understanding of the role of project-based activities in education and highlight the need for further research and the broader implementation of this method in teaching practices. This will further improve school curricula and enhance the overall quality of education.

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