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USE OF INNOVATIVE PEDAGOGICAL TECHNOLOGIES IN DEVELOPING CREATIVE THINKING SKILLS OF FUTURE PRIMARY SCHOOL TEACHERS

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Abstract: This article examines the pedagogical potential of using innovative pedagogical technologies to develop the creative thinking skills of future primary school teachers. Particular attention is paid to developing future teachers’ ability to think independently, propose unconventional solutions to problematic situations, generate new ideas, and apply them in practical activities within the context of modern education. The role of innovative pedagogical technologies in developing creative thinking is analyzed, with particular consideration given to the pedagogical potential of problem-based learning, project-based learning, Design Thinking, collaborative learning, and the STEAM approach. The study explores the integration of tasks and activities aimed at developing creative thinking into the educational process. The article substantiates that the purposeful and systematic use of innovative pedagogical technologies is an important factor in developing the creative thinking skills of future primary school teachers and strengthening their readiness for professional and pedagogical activities. The findings of the study may serve as a methodological basis for the effective use of innovative approaches in improving the process of preparing pedagogical personnel for primary education.

Keywords: creative thinking, future primary school teacher, innovative pedagogical technologies, problem-based learning, project-based learning, Design Thinking, STEAM, pedagogical training, creativity, professional competence.

INTRODUCTION. Today, transformational processes taking place in the education system require teachers not only to acquire existing knowledge and convey it to students, but also to possess competencies such as analyzing complex pedagogical situations, developing alternative solutions, generating new ideas, and organizing the educational process creatively. Particularly at the primary education level, the development of students’ cognitive activity, independent thinking, and creativity is directly related to the professional preparation and pedagogical skills of teachers. Therefore, developing creative thinking skills among future primary school teachers is emerging as one of the important directions of modern teacher education.

Creative thinking refers to an individual’s ability to generate new ideas based on existing knowledge and experience, approach problems from different perspectives, seek alternative solutions, and develop unconventional decisions. From the perspective of pedagogical activity, creative thinking enables teachers to take into account students’ individual needs, find pedagogical solutions beyond standard situations, adapt lesson content and methods, and organize the educational process in a more engaging and effective manner. In this regard, developing creative thinking as an important component of the professional preparation of future teachers represents a pressing pedagogical task.

The introduction of innovative pedagogical technologies into the educational process creates broad pedagogical opportunities for developing creative thinking. In particular, problem-based learning, project-based learning, collaborative learning, Design Thinking, and the STEAM approach contribute to developing students not as subjects who merely receive ready-made knowledge, but as

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active participants in identifying problems, generating ideas, testing solutions, and evaluating outcomes. Such approaches make it possible to connect educational content with practical activities, strengthen independent and creative decision-making, and enhance reflective activity. At the same time, the mere availability of innovative pedagogical technologies does not in itself guarantee the development of creative thinking. Their purposeful selection, adaptation to learning tasks, provision of active student participation, and alignment with criteria for assessing creative activity are of particular importance. Thus, the key issue is not simply the use of innovative technologies, but rather their effective integration into the pedagogical process in a way that is specifically oriented toward developing the creative thinking skills of future primary school teachers. Scientific literature has extensively investigated the content of creative thinking, its constituent aspects, and various pedagogical approaches to its development. However, further in-depth research is needed into the impact of innovative pedagogical technologies on the creative thinking skills of future primary school teachers, the comparison of their potential, and their application in practical educational activities within an integrated pedagogical process. In particular, it is important to analyze the specific characteristics of primary education, the professional responsibilities of future teachers, and the practical manifestations of creative thinking in an interconnected manner.

Based on this, the aim of the study is to identify the pedagogical potential of using innovative pedagogical technologies in developing the creative thinking skills of future primary school teachers and to substantiate effective methods of applying them in the educational process. Within the framework of the study, the following objectives were established: to identify the potential of innovative pedagogical technologies for developing creative thinking; to determine methods for organizing pedagogical activities aimed at developing the creative thinking skills of future primary school teachers; and to assess the effectiveness of these approaches in the educational process. The scientific significance of the study lies in substantiating the pedagogical relationship between innovative pedagogical technologies and the creative thinking skills of future primary school teachers. Its practical significance is determined by demonstrating the possibilities of introducing innovative educational activities aimed at developing creative thinking into the process of preparing future primary school teachers.

RESEARCH METHODOLOGY. This study was aimed at determining the effectiveness of using innovative pedagogical technologies to develop the creative thinking skills of future primary school teachers. A mixed-methods methodological approach combining quantitative and qualitative methods was employed. The main component of the study was a pedagogical experimental intervention through which the impact of educational activities organized on the basis of innovative pedagogical technologies on students' creative thinking skills was examined.

The research process was organized in three stages: diagnostic, formative, and final. At the diagnostic stage, the initial state of participants' creative thinking skills was determined. During the formative stage, tasks and activities developed on the basis of innovative pedagogical technologies were introduced into the educational process. At the final stage, changes in participants' creative thinking indicators were reassessed.

Future primary school teachers studying in the field of primary education participated in the study. The participants were divided into experimental and control groups. In the experimental group, the educational process was organized on the basis of innovative pedagogical technologies aimed at developing creative thinking, whereas the control group continued to follow traditional and general pedagogical approaches characteristic of the existing educational process.

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The main criteria for selecting participants were that they were studying in the field of primary education, were at the stage of preparing for pedagogical activity, and participated voluntarily in the study.

A combination of innovative pedagogical technologies aimed at developing creative thinking was used during the experimental intervention. The selection of these technologies was based on their potential to expand students' opportunities to think independently, analyze problematic situations, generate diverse ideas, develop alternative solutions, and improve their ideas.

Problem-Based Learning

Through problem-based learning**,** students were presented with pedagogical situations involving multiple possible solutions. They were guided to identify the problem, analyze its causes, develop alternative solutions, and justify the most appropriate solution. This process contributed to activating students' skills in approaching problems from different perspectives and making independent decisions.

Project-Based Learning

Within project-based learning**,** students were encouraged to investigate pedagogical problems independently or in small groups and develop a practical product or solution. The project activity included stages such as defining the problem, collecting information, generating ideas, designing a solution, and presenting the results.

Design Thinking

The Design Thinking approach was applied to connect creative thinking with practical activity. Students participated in understanding the problem from the perspective of the user, i.e., the learner, clearly defining the problem, generating ideas, developing an initial solution, and improving it.

Collaborative Learning

The collaborative learning technology was aimed at exchanging ideas in small groups, comparing different perspectives, and developing a common solution. During group activities, each participant was encouraged to propose an independent idea and analyze the ideas of other participants.

STEAM Approach

The STEAM approach was used to ensure interdisciplinary connections, integrate theoretical knowledge with practical tasks, and expand opportunities for solving pedagogical problems creatively. In assessing students' creative thinking skills, the following key indicators of creative thinking were used: fluency, flexibility, originality, and elaboration**.**

Fluency represented the participant's ability to generate a number of meaningful ideas concerning a particular problem or situation within a short period of time.

Flexibility was assessed through the ability to generate ideas belonging to different categories and approach a problem from different perspectives.

Originality reflected the degree to which participants proposed new and unconventional pedagogical ideas that differed from common responses.

Elaboration was assessed based on the ability to expand an initial idea, improve it, and transform it into a practical solution. Creative tasks, problematic pedagogical situations, open-ended tasks, and the results of project activities were used in the assessment process. Participants' responses to each task were evaluated according to predetermined criteria.

The data obtained at the diagnostic and final stages of the study were systematized, and the results of the experimental and control groups were compared. The difference between the initial and final indicators was analyzed to determine the dynamics of the development of creative thinking skills.

Descriptive statistical methods were used to process quantitative data. Appropriate statistical criteria were applied to determine the statistical significance of differences between the groups. Where

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necessary, the mean, standard deviation, and statistical significance level were calculated. The results of the statistical analysis served as a basis for assessing the impact of the innovative pedagogical technologies used during the experimental intervention on creative thinking skills. Throughout the study, the principles of voluntary participation, confidentiality of the data obtained, and the use of results exclusively for scientific purposes were observed.

RESEARCH RESULTS. At the initial diagnostic stage of the study, the level of development of the creative thinking skills of future primary school teachers was examined. The assessment focused on such indicators of creative thinking as generating new and diverse ideas, evaluating and improving existing ideas, approaching problematic situations from different perspectives, and developing effective solutions. These criteria are consistent with approaches in international studies that view creative thinking as encompassing cognitive processes related to generating, evaluating, and improving ideas [1; 2].

During the experimental intervention, tasks organized on the basis of innovative pedagogical technologies were incorporated into the educational activities of future primary school teachers. Priority was given to pedagogical tasks that encouraged students not to reproduce ready-made answers, but to independently identify problems, generate multiple ideas, compare different solutions, create new solutions, and improve them. The OECD PISA 2022 Creative Thinking study also identifies pedagogical practices that support students' creative thinking, including encouraging original responses, providing opportunities to express ideas, group activities, brainstorming, discussion, and allowing time for independent exploration [2].

In the experimental groups, the use of problem-based learning involved presenting students with pedagogical situations that had several possible solutions. Their activities were organized through the stages of identifying the problem, analyzing its causes, developing alternative solutions, and pedagogically justifying the proposed solutions. This activity was aimed at activating aspects of creative thinking related to flexibility and diversity of ideas. International research likewise identifies problems that can be considered from different perspectives and tasks that allow learners to collaboratively design a solution or product as one of the pedagogical conditions supporting creative thinking [2].

As a result of using project-based learning, students were engaged in independently or collaboratively studying pedagogical problems, analyzing information, generating ideas, creating practical solutions, and presenting them. This process made it possible to develop creative thinking not merely as a theoretical concept, but as an activity manifested in the process of solving real pedagogical tasks. Contemporary systematic studies also identify experiential learning, STEAM, and interdisciplinary approaches as widely used pedagogical directions for developing creative thinking [3].

When using elements of Design Thinking, students first sought to understand a pedagogical problem from the perspective of learners' needs, clearly formulated the problem, generated as many ideas as possible, created an initial solution, and revised it. This sequence made it possible to connect the processes of generating, evaluating, and improving ideas within creative thinking [1]. As a result, students' activities shifted from simply selecting a single standard solution to actively searching for alternative options.

In the collaborative learning process, students were encouraged to discuss their ideas with group members, compare different perspectives, and develop a common solution. Such activities not only stimulated creative thinking but also enhanced communication and collaboration competencies. PISA 2022 data likewise indicate that pedagogical environments encouraging creative thinking, together

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with teaching practices that allow students to express their ideas and develop original solutions, are positively associated with creative thinking performance [2].

The use of digital and other contemporary technologies also creates additional opportunities for developing creative thinking. A systematic review by Li, Kim, and Palkar found that emerging technologies used in education can have a positive effect on the development of creativity, particularly when interactive learning environments are involved [4]. Therefore, in this study, the main criterion for using innovative technologies was not their novelty, but their capacity to ensure students' active thinking, idea generation, and independent development of pedagogical solutions.

At the final diagnostic stage, the creative thinking indicators of the experimental and control groups were reassessed. Changes in students' creative thinking skills were identified through a comparative analysis of the initial and final diagnostic results. Particular attention was paid to fluency, flexibility, originality, and elaboration**.**

In interpreting the results, the development of creative thinking was not limited to an increase in the number of new ideas; it was also assessed through the development of the ability to evaluate ideas, improve them, and transform them into effective solutions appropriate to a particular problem. The concept of creative thinking developed by the OECD likewise considers generating, evaluating, and improving ideas as interconnected processes [1]. Thus, the main criterion for evaluating the research results was the degree to which the educational process using innovative pedagogical technologies engaged future primary school teachers in creative thinking. The technologies used in the study contributed to creating an active learning environment that encouraged students to consider problems from different perspectives, develop alternative ideas, discuss them, and transform them into practical pedagogical solutions. These findings are generally consistent with conclusions from contemporary international studies suggesting that innovative pedagogical technologies can serve as effective tools for developing creative thinking [2–4]. At the same time, it should be emphasized that the technology itself is not the decisive factor; rather, the way in which it is integrated with pedagogical tasks, the learning environment, and assessment criteria is a key determinant of outcomes.

DISCUSSION. The findings of the study demonstrate that the purposeful use of innovative pedagogical technologies provides significant pedagogical opportunities for developing the creative thinking skills of future primary school teachers. Comparison of the findings with recent scientific studies indicates the growing importance of active, interactive, and problem-oriented pedagogical approaches in developing creative thinking. In particular, a systematic review of creativity in higher education published in 2025 identified pedagogical strategies and practices, interactive learning environments, and active learning activities as key factors influencing the development of creativity among university students [5]. This finding supports our study's approach that innovative pedagogical technologies should not be organized merely as a collection of individual methods, but rather as a learning environment that stimulates students' active thinking and independent activity. In this context, the development of creative thinking is determined not by the external novelty of a technology, but by the extent to which it enables students to generate ideas, analyze problems, seek alternative solutions, and improve their own solutions.

A 2025 systematic literature review devoted to creativity among future teachers indicates that research in this field has not yet been sufficiently systematized. The review, which covered 27 empirical studies published between 2014 and 2024, identified diverse interpretations of creativity and insufficient attention to the specific characteristics of future teachers [6]. This situation demonstrates the scientific relevance of our study's focus on future teachers in the field of primary education.

The use of problem-based learning in the study enabled students to analyze problematic pedagogical situations and develop alternative solutions. This finding is consistent with the results of a

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meta-analysis published in 2024, which examined the effects of pedagogical approaches based on problem situations on creativity using empirical studies [7]. The advantage of problem-based tasks is that they encourage students to consider different aspects of a problem and develop several possible solutions rather than simply searching for a single "correct answer."

The results of using project-based learning also demonstrate that creative thinking can develop through activity. During project work, students proceed through stages of identifying a problem, searching for information, generating ideas, creating a product or solution, evaluating the results, and improving them. A 2024 systematic review of STEAM education similarly noted that project-based and inquiry-oriented learning are among the most frequently used didactic strategies for developing creativity [8].

The role of the STEAM approach in our study can also be explained from this perspective. A 2024 systematic review covering 45 studies showed that a large proportion of STEAM research considers it an interdisciplinary educational approach and that project-based and inquiry-based strategies are widely used [8]. At the same time, the authors emphasize the predominance of quantitative approaches to assessing creativity and the need for deeper investigation of the sociocultural dimensions of creative activity. This conclusion is also important for our study: it is appropriate to assess creative thinking not only through test results but also in conjunction with students' processes of generating ideas and developing solutions in real pedagogical activities.

The results obtained through the use of the Design Thinking approach further clarify the potential of innovative pedagogical technologies for developing creative thinking. A 2025 systematic review of Design Thinking in higher education indicates that this approach is increasingly emerging as an active methodology that supports creativity, user-centered thinking, interdisciplinary collaboration, and the practical resolution of complex problems [9]. This aspect is particularly important in preparing future primary school teachers, as future educators need not only to possess knowledge of educational content but also to create new pedagogical solutions based on an understanding of learners' needs.

Another important aspect of the research findings is that creative thinking is considered not merely an individual ability, but a competence that can be developed through an appropriate pedagogical environment. A comprehensive systematic review of creative thinking published in 2025 likewise identifies educational and methodological strategies, active methods, and learning environments that encourage creativity as important factors in developing creative thinking [10]. The relationship between creative thinking and primary education also provides an important theoretical basis for this study. A 2025 bibliometric and systematic review of creative thinking in primary education analyzed studies published between 2014 and 2024 and identified constructivist, inquiry-STEM, arts-integrated, and digital-hybrid approaches as dominant directions in creative pedagogy [11]. These approaches also indicate methodological foundations that can be applied in the preparation of future primary school teachers.

Another important issue related to the effectiveness of innovative pedagogical technologies is their purposeful rather than mechanical application. A 2024 systematic review of innovative pedagogical practices in higher education analyzed the transition from traditional teaching to active, collaborative, and technologically enriched pedagogical practices [12]. This conclusion demonstrates that when selecting innovative technologies in our study, their name or modernity should not be the primary criterion; rather, their capacity to generate creative activity should be prioritized. Overall, the findings of the study are consistent with the main trends in scientific research over the past decade. Contemporary studies increasingly examine the potential of active pedagogical strategies, interactive learning environments, project activities, problem-based learning, STEAM, and Design Thinking for developing creative thinking [5–12]. However, the effectiveness of these approaches depends less on

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their isolated application than on their integration into a coherent learning activity that enables students to think independently, collaborate, generate ideas, and test them in practical pedagogical situations. From this perspective, the use of innovative pedagogical technologies in developing the creative thinking of future primary school teachers can be viewed not only as a means of improving creativity indicators, but also as a factor that expands their capacity to independently analyze problematic situations, make pedagogical decisions, and develop new methodological solutions required for future professional activity.

CONCLUSION. The findings of the study demonstrate that the purposeful and systematic use of innovative pedagogical technologies provides important pedagogical opportunities for developing the creative thinking skills of future primary school teachers. The study established the importance of creating conditions in which students are not limited to acquiring ready-made knowledge, but are able to independently identify problems, propose diverse ideas, develop alternative solutions, evaluate them, and improve them.

Within the framework of the study, problem-based learning, project-based learning, Design Thinking, collaborative learning, and the STEAM approach were considered effective pedagogical tools aimed at developing creative thinking. Their common characteristic is their ability to strengthen students' participation as active subjects of learning and expand opportunities for independent thinking and creative decision-making.

The findings indicate that the pedagogically purposeful application of an innovative technology is more important than the technology itself. In particular, open-ended tasks, problematic situations, project activities, group discussions, and practical pedagogical tasks create favorable conditions for stimulating students' creative thinking activity. The study also established that relying solely on the number of ideas is insufficient when assessing creative thinking. The diversity and originality of students' ideas, their ability to develop those ideas, approach problems from different perspectives, and pedagogically justify proposed solutions should also be taken into account comprehensively. Overall, the purposeful integration of innovative pedagogical technologies into the process of preparing future primary school teachers contributes not only to the development of creative thinking but also to the formation of competencies necessary for independently analyzing problematic situations, making pedagogical decisions, and developing new methodological solutions in future professional activity.

RECOMMENDATIONS

Increasing the proportion of creative-thinking-oriented tasks in higher pedagogical education. It is advisable to regularly provide future primary school teachers with open-ended tasks involving multiple solutions, problematic pedagogical situations, and creative projects.

Applying innovative pedagogical technologies in an integrated manner. It is recommended that problem-based learning, project-based learning, Design Thinking, collaborative learning, and the STEAM approach be integrated rather than used separately, in accordance with the content of the academic subject and the intended educational objectives.

Improving the criteria for assessing creative thinking. It is advisable to use indicators such as fluency, flexibility, originality, elaboration, and the creative resolution of pedagogical problems in the assessment process.

Strengthening students' independent and collaborative activities. Conditions should be created for developing diverse perspectives through small-group discussions, brainstorming, project activities, pedagogical cases, and creative presentations.

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Applying digital technologies on the basis of pedagogical objectives. When using digital tools, the main criterion should not be their technological novelty, but their ability to engage students in generating new ideas, processing information, and developing pedagogical solutions.

Connecting future teachers' creative pedagogical experience with practice. It is recommended that students be engaged in developing creative lesson plans, didactic materials, and problem-based tasks based on real or simulated primary education situations.

Organizing the development of creative thinking as a continuous process. It is advisable to systematically integrate these skills into the content of pedagogical, methodological, and practical subjects rather than limiting their development to separate sessions.

Developing teachers' competence in using innovative methods. It is recommended that higher education institutions organize practical seminars and training sessions for faculty members on creative pedagogy, Design Thinking, project-based learning, and STEAM approaches.

The approaches and recommendations developed in the study can be used in organizing the professional preparation of future primary school teachers, improving practical classes in pedagogical subjects, and developing tasks aimed at assessing creative thinking. Future research should examine the effects of innovative pedagogical technologies on individual components of creative thinking through long-term experimental studies, compare results across different higher education institutions and educational contexts, and empirically investigate the potential of digital and artificial-intelligence-based tools for developing creative thinking.

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