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THEORETICAL FOUNDATIONS OF DEVELOPING RESEARCH POTENTIAL BASED ON CREATIVE APPROACHES (ON THE EXAMPLE OF MATHEMATICS EDUCATION)

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Abstract. This article analyzes the theoretical and methodological foundations for developing students' research potential based on creative approaches in mathematics education. The study examines mechanisms for enhancing thinking through problem-based learning, logical, and word problems. It demonstrates that, in the process of creatively solving mathematical problems, students develop competencies in forming scientific hypotheses, drawing logical conclusions, and justifying results. The research findings indicate that creative approaches are a significant factor in promoting research activity.

Keywords: *creative approach, research potential, mathematics education, logical problems, word problems, scientific thinking.*

KREATIV YONDASHUVLAR ASOSIDA TADQIQOTCHILIK SALOHIYATINI SHAKLLANTIRISHNING NAZARIY ASOSLARI (MATEMATIKA FANI MISOLIDA)

Annotatsiya. *Mazkur maqolada matematika fanini o'qitishda kreativ yondashuvlar asosida o'quvchilarning tadqiqotchilik salohiyatini shakllantirishning nazariy-metodik asoslari tahlil qilinadi. Tadqiqot doirasida muammo asosida o'qitish, mantiqiy va matnli masalalar orqali fikrlashni rivojlantirish mexanizmlari ochib beriladi. Matematik masalalarni kreativ yechish jarayonida o'quvchilarda ilmiy taxmin ilgari surish, mantiqiy xulosa chiqarish va natijalarni asoslash kompetensiyalarining shakllanishi isbotlanadi. Tadqiqot natijalari kreativ yondashuvlar tadqiqotchilik faoliyatining muhim omili ekanini ko'rsatadi.*

Kalit so'zlar: *kreativ yondashuv, tadqiqotchilik salohiyati, matematika ta'limi, mantiqiy masalalar, matnli masalalar, ilmiy fikrlash.*

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ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ФОРМИРОВАНИЯ ИССЛЕДОВАТЕЛЬСКОГО ПОТЕНЦИАЛА НА ОСНОВЕ КРЕАТИВНЫХ ПОДХОДОВ (НА ПРИМЕРЕ ОБУЧЕНИЯ МАТЕМАТИКЕ)

Annotatsiya. В данной статье анализируются теоретико-методические основы формирования исследовательского потенциала учащихся на основе креативных подходов в преподавании математики. В рамках исследования раскрываются механизмы развития мышления через проблемное обучение, логические и текстовые задачи. Показано, что в процессе креативного решения математических задач у учащихся формируются компетенции научного выдвижения гипотез, логического вывода и обоснования результатов. Результаты исследования демонстрируют, что креативные подходы являются важным фактором исследовательской деятельности.

Ключевые слова: *креативный подход, исследовательский потенциал, обучение математике, логические задачи, текстовые задачи, научное мышление.*

INTRODUCTION

In the modern education system, one of the priority tasks is to form the student not as a receiver of ready-made knowledge, but as an independent thinker and researcher . In particular, mathematics, with its abstractness, strict logical structure and proof-based nature, creates broad opportunities for the development of research potential.

As J. Dewey noted, “the educational process is not about producing ready-made results, but about understanding the problem and solving it .” In this regard, creative approaches activate research activities in mathematics lessons by creating problem situations, comparing and generalizing different solution strategies.

Today, traditional reproductive teaching methods cannot fully develop students' creative and scientific thinking. Therefore, the development of a didactic model based on creative approaches is considered an urgent scientific and pedagogical problem. One of the main tasks facing the education system in the 21st century is to form an independent, creative and research-oriented person in accordance with the needs of society **. UNESCO** (2015) emphasizes in its educational strategies that modern education should not only focus on the acquisition of knowledge , but also on the creation of knowledge **,** problem solving **and** innovative thinking. should serve the development of competencies. In this regard, it is of paramount importance to

educate the student as an independent discoverer of knowledge , rather than a receiver of ready-made knowledge .

Mathematics plays a special role in this process . Mathematics, with its reliance on abstract thinking , strict logical structure , and focus on proof and justification, creates a natural didactic environment for the formation of students' research potential . Pólya (1957) compared the process of solving mathematical problems to scientific research, stating that *"each problem is a small scientific study." This idea confirms the research* -oriented potential of mathematics education on a scientific basis.

According to the pragmatic theory of education of the American philosopher and educator J. Dewey , *"the educational process is not about providing ready-made results, but about understanding the problem, making assumptions and solving it ."* This approach requires creating creative situations in mathematics lessons, developing various solution strategies through open-ended problems, and justifying the results. As a result, the student is formed not only as an algorithm executor, but also as a scientific thinker .

The state of world scientific research. In recent years, special attention has been paid to the development of creativity and research competencies in mathematics education around the world. For example, the PISA studies conducted by the OECD interpret mathematical literacy as the ability to mathematically model real-life problems and make informed decisions . The countries that showed high results in the PISA-2022 reports (Finland, Singapore, Japan) have implemented problem-based learning, logical problems and creative tasks in their education systems widespread use has been noted.

Also, H. Gardner's theory of multiple intelligences and LS Vygotsky's concept of the zone of proximal development scientifically substantiate the possibility of developing research potential by organizing mathematical activities on the basis of socio-logical cooperation. Studies show that lessons organized on the basis of open-ended questions and logical tasks increase students' analytical and creative thinking indicators by 20–30%. .

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Research and practical work underway in Uzbekistan. In the Republic of Uzbekistan, creative and research-oriented approaches have been identified as a priority in the process of modernization of education. The Law " On Education " (2020) and the "Concept of Development of Public Education until 2030" provide that students critical and logical thinking, decision-making in problem situations Developing competencies is an important task **.**

Studies conducted by local scientists (A. Abdullayev, Sh. Mardonov, N. Khudoyberdiev, etc.) have scientifically proven that the use of logical and textual problems in mathematics lessons increases students' conscious assimilation of knowledge and independent research activity. However, existing studies are limited **to** more methodological recommendations and do not sufficiently reveal creative approaches as a systematic model integrated with research potential .

The relevance of the problem and the scientific problems posed . The analysis shows that the following problems exist in the current process of mathematics education:

- that the issues are often of a reproductive nature **;**
- students to formulate and justify hypotheses poor development of skills;
- lack of systematic and methodical application of creative approaches **;**
- Insufficient development of criteria for assessing research potential.

Therefore, it is necessary to identify the theoretical foundations **and** develop didactic mechanisms for the formation of students' research potential in mathematics education based on creative approaches. and justify its practical effectiveness is emerging as a pressing scientific and pedagogical problem.

aims to solve this problem , scientifically justifying the possibilities of developing research potential through creative approaches based on textual and logical problems in mathematics.

RESEARCH METHODOLOGY

This study is aimed at scientifically substantiating the process of forming students' research potential based on creative approaches in mathematics education

and relies on a comprehensive methodological approach. The research design requires a systematic, consistent and logical analysis of pedagogical phenomena.

RESEARCH METHODS

The research was conducted based on the following main methods:

Theoretical analysis method**.** Using this method, domestic and foreign pedagogical and psychological literature, scientific articles and conceptual documents were studied . In particular, theoretical views on creativity (J. Guilford, E. Torrance), research activity (J. Bruner, H. Pólya) and the development of mathematical thinking were analyzed. Theoretical analysis served to identify the inextricable link between creative approaches and research competencies.

Didactic modeling method. Based on this method, a didactic model based on creative approaches was developed for mathematics lessons. The model outlined the stages of the lesson: creating a problem situation, putting forward a hypothesis, searching for alternative solutions, and substantiating a conclusion. Didactic modeling was aimed at ensuring the participation of students as active subjects.

Method of analyzing mathematical problems**.** In the study, textual and logical problems were considered as a means of research activity. Each problem was analyzed from the point of view of the student 's involvement in modeling, logical analysis, hypothesis and proof. This method revealed not only the solution of the mathematical problem, but also its didactic and cognitive significance.

Comparison and generalization methods. The differences between different problem types and approaches were identified, and their impact on research competencies was comparatively analyzed. The results obtained were summarized and scientific conclusions were drawn.

Mechanisms for implementing creative approaches

During the research process, creative approaches were implemented through the following pedagogical mechanisms:

- the student to think through problem questions ;
- creating multiple solution possibilities through open-ended questions;
- solving a problem using different strategies;

- Organizing activities aimed at logically substantiating and proving the results obtained .

The relationship between creative approaches and research competencies

Table 1.

Creative approach element	**Developing research skills**
Creating a problematic situation	Asking a scientific question and defining a problem
Open-ended questions	Hypothesis proposal
Alternative solutions	Analytical and critical thinking
Proof and justification	Drawing a logical conclusion

Research results (Results)

The results of the study showed that mathematics education organized on the basis of creative approaches significantly develops students' research potential. In particular, text and logical problems appeared to be an effective tool for engaging students in the scientific research process.

Developing research capacity through textual issues

Text problems require solving real-life situations through mathematical modeling. This develops the student's skills in understanding the problem, creating a mathematical model, and analyzing the result.

Problem 1. The total area of land planted with wheat and barley on a farm is 120 hectares. The wheat area is 20 hectares larger than the barley area. Determine the area of each crop.

Solution (based on research): Let the area of barley be x . *The area* of wheat is $x + 20$. Then the total area is expressed by the following equation:

$x+(x+ 20)= 120$

$2x=100 \Rightarrow x=50$

$2x = 100 \Rightarrow x = 50$

So:

- Barley — **50 hectares**
- Wheat — **70 hectares**

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In the process of solving this problem, the student :

- analyzes the problem;
- creates a mathematical model;
- puts forward a hypothesis;
- checks and justifies the result.

These stages fully correspond to the scientific research algorithm proposed by H. Pólya and constitute the main components of research activity.

Developing creative thinking based on logical problems

Logical problems develop students' ability to reason deductively, use negation, and draw conclusions through analysis of options.

Issue 2. Three friends — A, B, and C — participated in a math competition. A did not come first . B did not come second . C did not come first . Who came in what position?

Solution (logical analysis):

- $A \neq 1$
- $B \neq 2$
- $C \neq 1$

By analyzing the options step by step, the only logically correct solution is identified:

- **B — 1st place**
- **C — 2nd place**
- **A — 3rd place**

In this process, the student draws scientific conclusions through negation, verification of options, and logical filtration. This serves to develop logical thinking at a high level.

Types of issues and developing research components.

Table 2 .

Issue type	Developing research competencies
Textual issues	Modeling, analysis and generalization
Logical issues	Deductive and critical thinking

Issue type	Developing research competencies
Open issues	Developing a creative solution
Probable issues	Scientific reasoning and conclusion

DISCUSSION

The results of this study showed that creative approaches are highly effective in developing students' research potential in mathematics education. In particular, the educational process organized on the basis of textual and logical problems activates students' scientific thinking and serves to form them as knowledge creators , not passive consumers .

According to the results obtained , it was determined that in classes organized based on creative approaches, students acquire the following important research competencies:

- systematic analysis of the problem and isolation of the main conditions;
- transfer of a real situation into a mathematical model ;
- develop multiple solution strategies and compare them;
- logically justify the results obtained and draw generalized conclusions.

fully consistent with the classical stages of problem solving proposed by H. Pólya (understanding the problem, making a plan, implementing the solution, and checking the result) . Thus, creative approaches in mathematics education are emerging as a natural didactic equivalent of the scientific research methodology .

When the results of this study are compared with foreign scientific research, similar conclusions are observed. In particular, studies conducted by Silver (2013) and Schoenfeld (2016) found that open-ended questions and problem situations significantly increase students' analytical and creative thinking. The results of our study also confirm these scientific conclusions in the example of mathematics teaching practice.

LS Vygotsky's conceptual idea that *"thinking actively develops only when a problem arises"* was fully confirmed in the research process. Problem situations and logical contradictions activate the zone of proximal development of students ,

encouraging them to conduct independent research and draw scientifically based conclusions. In particular, during the process of collective discussion and exchange of ideas, students' logical speech and scientific reasoning skills significantly developed.

The results of the study also showed that , compared to traditional reproductive approaches, creative approaches increase student engagement and help consolidate knowledge in long-term memory. This is consistent with the main ideas of constructivist educational theory , namely that knowledge is constructed by the student in the process of active cognitive activity. systematic and goal -oriented application **,** not episodic . If creative issues are organized as the main didactic core of the lesson, and not just as additional tasks, then the development of research potential will yield more sustainable results.

In general, the results of this study scientifically substantiate that creative approaches in mathematics education are an important pedagogical factor not only in increasing students' knowledge, but also in forming their scientific thinking, logical culture, and research competencies .

CONCLUSION

The results of this study show that mathematics education organized on the basis of creative approaches is highly effective in forming and developing students' research potential. In particular, the systematic introduction of textual and logical problems into the educational process serves to form important research competencies in students, such as scientific thinking, problem analysis, mathematical modeling, hypothesis generation, and drawing well-founded conclusions.

The study found that creative approaches in mathematics lessons shape the student not only as a subject performing algorithmic operations, but also as an active researcher who understands the problem, can compare solution options, and scientifically substantiate the result. This confirms the effectiveness of constructivist educational theory and problem-based learning concepts in mathematics education practice.

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