

Using of Problem Tasks in Development of Creative Abilities of Pupils in Teaching Mathematics



SodikovUlugbekJurayevich

Abstract: This article is written about the result of research on the using of problem tasks in development of creative abilities of pupils in teaching mathematics. The aim of the research is to improve the development methodology of students' creative abilities, through a task-oriented to teaching. The tasks of the research are following from and analytically study those about the practical basis for the development of students' creative abilities using the problematic tasks to teaching mathematics; to improve the methodology for the development of creative abilities of students by teaching them mathematical modeling in solving problems of a non-standard and practical-applied nature; to develop and scientifically substantiate the structural-functional model of the organization of educational and creative activities of students in the process of teaching mathematics; to develop guidelines for improving the methodology, based on the problem task skills development. The article consists of from introduction, literature survey, methodology, discussions, recommendation, and conclusion.

Keywords: creative abilities, teaching mathematics, innovation technologies, problem tasks, interactive ways of education.

I. INTRODUCTION

In the modern world, according to the trends of modern development, special attention is paid to improving the practice of modernizing the sphere of mathematical education, and the methodological foundations of teaching. In developed countries, the work of the International Center for the Assessment of Practical and Scientific Literacy of Students (PISA), the Center for the Study of Trends in International Mathematical and Natural Sciences (TIMSS), which are conducted to improve the quality of teaching specific and natural sciences, improve theoretical and methodological and methodological foundations, the implementation of approaches aimed at developing students' creative abilities.

All over the world, research is underway to improve the quality of teaching mathematics, introduce advanced pedagogical technologies into the educational process, use the possibilities of intersubject integration processes in the educational process, and create methodological support aimed at developing students' creative abilities.

For example, the effective use of the possibilities of science in the teaching of mathematics, the improvement of teaching methods for solving problems in solving problem situations of practical-applied and natural-scientific content, the use in the educational process of scientific and methodological developments on the theoretical foundations of science are important. In Uzbekistan, reforms aimed at reforming the system of general secondary education, providing it with qualified personnel, targeted use of international best practices, expand the possibilities of introducing modern pedagogical approaches into the educational process, strengthening educational and methodological support, and developing students' independent thinking. Together with this, there is a need to improve methods aimed at the creativity of students.

II. METHODOLOGY

The object of study is the process of developing students' creative abilities when teaching mathematics in secondary schools.

The subject of the study is the methodology for the development of students' creative abilities using a task approach in the process of teaching mathematics.

Research Methods. The following methods were used during the study: a comparative analysis, retrospective analysis, simulations, discussions, interviews, tests, mathematical experimental, mathematics to - statistical analysis.

The scientific novelty of the research is as follows:

on the basis of determining the features of the didactic functions of tasks (teaching, developing, educating and controlling), the stages of development of students' creative abilities were determined;

in the process of teaching mathematics, the methodology for developing creative abilities of students was improved, based on the use of the principles of the task approach (goal definition, completeness, systematicity, consistency) in mathematical modeling (quantification, description, study of the relationship) of problem situations of a practical and applied nature;

the logical structure of the development of creative abilities based on the integration (target orientation, systematicity, reflection) of the algorithmic stages (types of tasks, solution steps, requirements) of the task approach and educational and creative activity was developed;

educational and methodological support (tutorials, teaching, and methodological aids) for teaching mathematics was improved on the basis of introducing methods for solving non-standard problems (analysis, synthesis, generalization, abstraction, comparison and variability) into the content of educational material.

Revised Manuscript Received on December 30, 2019.

* Correspondence Author

Sodikov Ulugbek Jurayevich*, Faculty of Social Science, Department of Education, The National University of Uzbekistan after named MirzoUlugbek, Tashkent, Uzbekistan.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](https://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

III. LITERATURE SURVEY

In the works of scientists of the republic, such as Zh.Ikromov [4], A.A. Abdukadirov [1], M. Mirzaakhmedov [6], D.I. Yunusova [12], and others, the theoretical and practical foundations of formation schoolchildren and students have creative skills.

The problems of the problematic approach in education were considered in the works of N.R. Gaybullaev [2], A.A. Normatov [7], D. M. Makhmudova [5] and others.

In the countries of the Commonwealth of Independent States, in the works of such scientists as D.Poia [8], G.F. Valieva [11], and others examined the problems of modernization of mathematical education and the task approach.

Such as J. Gilford [3], J. Reznulli [10], A. Renier [9] and others, the problems of using, in the process of mathematical education, problematic, non-standard problems and the possibility of their use were investigated.

IV. THEORY AND DISCUSSION

An analysis of these works showed that, based on a specially selected system of problems for the course of mathematics, it is possible for students to form creative mathematical activities and develop mathematical thinking.

It can be noted that the main attention of scientists conducting research in the framework of the problems of teaching mathematics at school is paid to the structure of textbooks and teaching aids and their modernization.

In most cases, the methods for solving problems in them basically requires the method of algorithmic solutions. This reduces the opportunities and the area for showing the practical and informational activities of students.

As noted in a number of studies, students are more interested in tasks related to synonyms of terms, such as problematic, creative, research, heuristic, interesting, logical. Methods for solving such problems are always not very simple.

In recent years, in studies devoted to the methodology of teaching mathematics, the "task approach" has become more and more solid. The reason is that the main focus is on the formation of students' "learning skills", which are the basis of educational activity.

The process of solving problems is an important type of educational activity, it is during this process that students master the theoretical material, the skills of using mathematics in practice, form creative activity and develop creative abilities.

When solving such problem situations (tasks), it is necessary to use mathematical modeling and the possibility of non-standard problems. It is these situations that reflect the problems of our scientific research.

Based on the analysis of existing literature, policy documents, the scientific, methodological, pedagogical and psychological literature examined the problems of developing students' creative abilities, the growing need for individuals who can solve rapid changes in society, the need to prepare young people for a rapidly changing environment in society and the world.

Based on the analysis of the psychological and pedagogical literature on the research problem, attention was paid to the explanation of terms such as "know",

"change", "use knowledge creatively", "create". The means of developing educational abilities associated with the creative activities of students were classified.

Based on the analysis of literature on the research topic, an analysis was made of the methods of formation of creative activity and the development of the creative abilities of students. It was substantiated that most of the methods used to develop students' creative abilities in the learning process are methods of scientific knowledge, they mainly consist of observation, analysis, and synthesis, system analysis, historicism and logic, modeling, in particular, mathematical modeling, abstraction, generalization, classification, analogy, induction, deduction, experiment and experiments.

To justify the structure and content of educational and creative activities of students in the process of teaching mathematics, taking into account the features of the activities for its organization, the concepts of "creativity", "creative task", "educational and creative activity", and "educational and creative task" were analyzed and concretized. The importance of independent activity in the formation of students' creative activity and creative abilities was explained.

An analysis was made of the problems of using non-standard tasks in the process of teaching mathematics at school. Having paid attention to the characterization and presentation of the concepts "task", "standard task" and "non-standard task", the possibilities of developing students' creative abilities based on creating problem situations and an acmeological approach were shown.

It was shown that non-standard tasks occupy an important place in the assimilation of mathematical knowledge, the formation of motivation, independent creative activity by students. In explaining the concepts of "task" and "creative task", we, in our study, approach the "educational creative task" as a new goal in explaining to students by the teacher. The solution to educational creative tasks requires students to use the experience of thinking and practical actions. In turn, this is aimed at actively mastering students' knowledge and skills.

In the study, an analysis of the main approaches to the formation of students' creative abilities was carried out, and also, V.A. Krutetskiy about the possibilities of problematic non-standard tasks in the development of their abilities.

It should be noted that in the process of teaching mathematics, problem tasks are a special kind of educational creative tasks. In the process of solving these problems, the initially acquired knowledge is changed, activated, the experience of using knowledge is enriched, the quality of thinking and thinking skills are improved.

Psychological, pedagogical and methodological approaches were formulated that were necessary for the process of solving non-standard problems to determine the features of the development of students' creative abilities in the process of teaching mathematics.

In the process of teaching mathematics, problem solving is the main form and means in organizing the mathematical activity of students.

Figuratively speaking, problem solving is the foundation of teaching mathematics. Scientists methodologists from foreign countries, the countries of the Commonwealth and our republic have investigated some aspects of the problem approach in teaching mathematics. Their analysis is described in detail in the text of the dissertation.

In the process of teaching mathematics, mathematical problems are used in determining the goal, establishing educational content, realizing the goal of education, in setting out a new topic, in determining the degree of mastering of the topic, in forming and developing students' necessary knowledge, skills, abilities, repetition, generalization, and consolidation of topics covered, the formation of students' independent creative thinking, the development of creative abilities, and finally, to determine general knowledge, the degree of skills acquired by students. The most important, the correct use of mathematical problems is the most important tool for the development of logical thinking of students, the formation of a scientific worldview of attitudes and the development of their personal qualities.

As a prominent mathematician and teacher D. Poia wrote, "What does mastering mathematics mean? This is the ability to solve not only standard tasks, but also tasks requiring independent thinking, health, original thinking, and search. Therefore, the main task of a mathematics course at school is to pay attention to the methodological aspects of the problem-solving process." [8]

Today, the main task of mathematical education is to develop students' learning abilities, so the idea of a problem approach has become widespread.

Problem solving, being an important manifestation of the educational process, in solving problems students master subjects, for example, the theoretical foundations of mathematics, master practical skills, ways of creative and independent thinking.

The results obtained during the study show that due to the incomplete use of the above functions, the use of tasks in the practice of teaching mathematics, the need for additional searches and studies to improve the use of tasks was clarified. They were mainly determined by depth, flexibility, stability, awareness, the ability to think, the independence of student thinking, and the dissertation shows the possibilities of forming such abilities.

To solve the above problems, the necessity of using a complex of an appropriate number of targeted basic tasks was substantiated. Specific features and requirements were formulated for the implementation of the task approach. In the research process, the main approaches to solving problems at school were formulated, the need was shown here to consider tasks as an object of study analysis. It was determined that the student's ability to design a solution path and finding a solution method is a qualitatively important indicator.

The study outlines the possibilities of using the task approach in various sections of the mathematics course at school. For example, four aspects of the successful solution of geometric problems:

- skill to correctly and quickly complete the task scheme;
- ability to carry out work on solution methods (mostly analytical);

- availability of a reserve of certain key tasks that ensure the transition from theoretical material to tasks;
- The need for the formation and improvement of skills for substantiating problem solving was emphasized.

In conclusion, I would like to note that standard and non-standard tasks, when teaching mathematics, perform all the basic didactic functions. In addition, the targeted use of various tasks forms a productive approach to solving problems among students.

They affect the development of dynamics (mobility) in students, the elasticity of thinking.

This is all to serve the development of all students in the formation of creative activity and the development of creative abilities, the formation of skills in an unfamiliar situation.

V. EXPERIMENTAL RESULTS AND DISCUSSION

For the experimental work, the necessary preparatory work was selected and carried out at school No. 106, Uchtepa district, Tashkent city, the state specialized secondary school for foreign languages and exact sciences at the Ministry of Public Education, school No. 38 of the Karakul district of the Bukhara region, school No. 18 of Angren district of Tashkent region, as well as school number 33 of the Chust district of Namangan region. Experimental work was carried out in two parallel high schools. If in the control classes the educational process was conducted on the basis of a traditional lesson, then in the experimental group they were conducted according to the methodology proposed by us. To ensure the truth of the experimental results, we used the Pearson chi-square criterion, which is one of the mathematical-statistical methods:

Table I. The results of learning students in the experiment

Groups		Student Acceptance Indicators				Number of Students
		0-54%	55-70%	71-85%	86-100%	
Exp. group	VI. THE BEGIN OF EXP.	32	52	73	24	181
	The end of exp.	12	26	92	51	181
Cont. group	VII. THE BEGIN OF EXP.	30	55	71	23	179
	The end of exp.	32	50	73	24	179

Table II. The general results obtained as a result of the experiment

	Experimental group n=181				Control group m=179			
Grade	5	4	3	2	5	4	3	2
Number of relevant rating	51	92	26	12	24	73	50	32
Average arithmetic valuation	$\bar{x} = 4$				$\bar{y} = 3,5$			

Performance ratio	$\kappa = \bar{x} / \bar{y} = 1,14$	
Confidence gap	$3,88 \leq \bar{x} \leq 4,12$	$3,36 \leq \bar{y} \leq 3,64$

In order to determine the degree of formation of students' creative abilities, we used methods of self-assessment and expert assessment:

Based on the chart indicators, the results of mathematical-statistical analysis carried out according to the Student-Fisher method showed the proximity of the marked indicators in the experimental and control groups at the stage of the approving experiment.

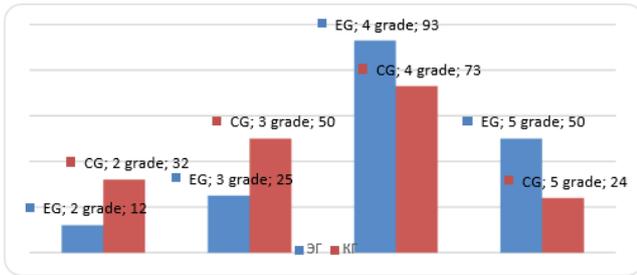


Figure 1. Diagram of a general statistical analysis of the pedagogical experiment.

The analysis shows that the average level of development of the creative abilities of students in the experimental and control groups, at the end of the experiment, is a significant difference.

Thus, the development of creative abilities and the degree of assimilation of students increased to a certain level in the process of the task approach, that is, problem solving, practical, applied, non-standard content. Thanks to the use of the task approach during the study of mathematics at school, positive results were achieved in the quality of training, the degree of mastery of students. Their statistical analysis is presented in figure 2.

An analysis of the results of the experimental work carried out in secondary schools, thanks to the task-oriented approach to teaching mathematics, showed that the level of development of the creative abilities of students in the experimental group increased by an average of 6% compared with students in the control group. This proved the possibility of increasing the effectiveness of teaching mathematics at school, using the problem approach.

VIII. RECOMMENDATION

The results obtained in the course of the research, along with showing the significance of the study, also showed that this study is not exhaustive in solving the problem. In our opinion, it would be advisable to conduct new research on the following topics:

- create a collection of perfect tasks necessary for the development of educational activities and creative abilities of students in schools and academic lyceums in and out of classes;
- there is a need for special research on the influence of students' creative abilities on the formation of personal and spiritual qualities of children in the process of teaching them mathematics.
- the results obtained in the course of our study prove that there is a need to develop a scientific concept for the formation of creative activity and the development of creative abilities of students, and there is a need to develop a

wider range of studies in the direction of developing creative thinking of students.

IX. CONCLUSION

Scientific-theoretical and methodological-practical studies conducted on the topic of the methodology for developing the creative abilities of students through a task-oriented approach to teaching mathematics led to the following conclusions:

1. The current state of the problem of the development of students' creative abilities was studied in detail on the basis of the analysis of psychological, pedagogical and scientific-methodical literature. In particular, the need was identified for the formation of supporting knowledge and skills in teaching students how to solve non-standard problems. The development of students' creative abilities requires the cultivation of effective motives, the formation of faith in one's own strengths, a positive psychological environment throughout the lesson, and the desire to study mathematics and master learning activities.

2. On the basis of the analytical, scientific, theoretical and practical studies, it was determined that the methodological basis in the formation of creative activity and the development of creative abilities of students, during a teaching at the school of mathematics, is the task approach. Conducted theoretical and experimental studies, the results of scientific research on the topic showed that previously put forward scientific assumptions found their full confirmation.

3. It was found that teaching mathematical modeling of problematic mathematical problems of non-standard, practical and applied content, aimed at a systematic, regular study of mathematics by students, in the process of teaching mathematics, has an effective impact on the development of their creative qualities. The use of these tasks serves the development of students' creative abilities, acquired knowledge, experience, and personal qualities form their ideas for solving problems, and form skills for predicting their actions, controlling and critically evaluating their own.

4. A structural-functional model for the development of creative abilities in students was developed.

5. A system of tasks of non-standard, practical and applied content was developed and proposed, aimed at raising students' interest in knowledge, independence and spiritual, creative qualities. The stages of solving problems of practical and applied content were developed through mathematical modeling and the necessary knowledge, skills, and qualifications required for each stage were indicated.

6. Methods of using students' tasks of non-standard, practical and applied content were formulated and necessary recommendations were given.

7. To determine the effectiveness of the developed methodology, experimental work was carried out. At the stage of the formation of the experimental work, it was substantiated that regular, purposeful use of tasks of non-standard, practical and applied content is an effective way to develop students' creative abilities.

REFERENCES

1. Abdukadirov A.A., vaboshqalar. Aniqfanlarnioqitishda keys texnologiyalaridan foydalanish uslubiyoti. Oquv uslubiyat qollanma. – Tashkent, «Fan vatexnologiya», 2015. pp. 200-228.
2. Gaybullayev N.R. Prakticheskiye zanyatiy aktsredstvopovisheniya effektivnosti obucheniyamatematike. – Tashkent.: Oqituvchi, 1989. pp. 206-243.
3. Gilford, D. J. Tri storoni intellekta. Psixologiyamishleniya. D. J. Gilford. – Moscow. Progress, 1965. – pp. 426-525.
4. Ikromov J. vaboshqalar. Oquvchilardamantiqiyisbotlashgabolganetiyoj nitarbiyalash//Matematika oqitishni takomillashtirishgadoir metodiktavsiyalar. – Chimkent, 1989. pp. 36-42.
5. Maxmudova D.M. Talabalar damustaqilijodiy faoliyatni rivojlantirish jarayonidamumamolimasalalardan foydalanish. Avtoref. diss. falsafadoktor (PhD). 13.00.02. – T.: OZMU, 2018. p. 45.
6. Mirzaahmedov M.A. vaboshqalar. Algebra 8-sinf: umumiy o'rta'lim maktablarining 8-sinfi uchun darslik. – Tashkent: "O'zbekiston Milliy ensiklopediyasi" Davlat ilmiy nashriyoti, 2014. pp. 194-241.
7. Normatov A. A. Professionalno-pedagogicheska yopodgotovkastudentov-matematikov pri provedeniipraktikumapogeometrii. Avtoreferat, 13.00.02 kandidata pedagogicheskix nauk. Tashkent, 1993. p. 45.
8. Poya D. Kakreshit zadachu. – Lvov: Kvantor, 1991. pp. 163-216.
9. Reni A. Dialogi o matematike. – Moscow, Mir, 1980, chapter "V mire nauki i texniki". pp 300-376.
10. Renzulli D.J., Ris M. Model obogashay ush goshkolnogo obucheniya: prakticheska yoprogrammasti mulirovaniya odarennostid etey. Osnovni esovremenniekonsepsii tvorchestva odarennosti. – Moscow, Molodayagvardiya, 1997, pp 312-37.
11. Valiyeva G.F. Zadachniy podxod k formirovaniyu chebno-issledovatel'skoy kulture starshklassnikov: avtoref. diss.kand. nauk: 13.00.01. – Vladimir, 2012. pp. 25.
12. Yunusova D. Vzaimosvyaz matematikisredneyivisshe yshkolikak faktor selostnogopoznaniyamatematiki. Pedagogika'lim. – Tashkent, 2001. №2. pp. 73-75.

AUTHORS PROFILE



Sodikov Ulugbek Jurayevich obtained his Bachelors's and Master's Degree in Mathematics from The Tashkent State University named after Mirzo Ulugbek. He has published 2 methodical tutorials, more than 14 Journals, and 40 papers, in both national and international conferences.