

ANNOTATION

of the dissertation of **Zhumaliyeva Lyazzat Daurenbaevna**
“Methodical foundation of mathematical tasks solving learning in general school”,

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The National program for advancement of education and science in the Republic of Kazakhstan for 2016-2019 clearly outlines the main directions and objectives of education system renovation - assurance of high quality of education and competitive recovery of the national educational system. Consequently, the need to further improve teaching methods and efficiency of students training becomes increasingly apparent.

Mathematical education is a part of continuous education system and is of great importance in ensuring personal intellectual development in modern society. And the study of mathematics in secondary school plays a systematically important role by developing cognitive abilities and logical thinking of students.

In accordance with the State compulsory education standard of secondary education (elementary, basic secondary, general secondary education) and educational programs, the objective of teaching the subject of mathematics is “... the mastering by students of specific mathematical knowledge necessary for practical application, the study of allied disciplines and continuing education; intellectual development of students, formation of thinking qualities characteristic of mathematical activity and necessary for everyday life; formation of quantitative literacy of students; development of techniques and skills required for mathematical tasks solving”.

Undoubtedly, problem solving is essential to teaching mathematics. At the same time, the ultimate teaching goals reduce to both mastering of procedures and methods of solving a particular system of problems, and digestion by students of concepts and methods of school course of mathematics. The well-structured methodology of teaching mathematical tasks solving is a useful aid in brain building and mathematical culture of students, as well as in developing their techniques and skills required for practical application of mathematics in everyday life.

However, the traditional system of teaching mathematics, focused on knowledge-centric model of education, places primary emphasis on the theory, while teaching of problem solving remains not up to par. As a result the abilities of students to apply the acquired mathematical knowledge and skills of problem solving remain insufficient. In addition, the results of the unified national testing being the most important form of exam for admission to higher educational institutions show that the techniques and skills of mathematical tasks solving by school leavers are at a low level. Thus, the mathematical tasks and methods of teaching to their solving represent an essential necessary tool for developing

abilities, logical thinking and quantitative literacy of students both in secondary school and in higher educational institution.

Selection of research topic is dictated by the needs for further development of pedagogical theory and practice in terms of teaching to solve mathematical tasks related to the existing contradiction between the expected and real results of teaching in secondary school and immaturity of methodical foundation for teaching of problem solving in conditions of updating of education content.

There is a great number of thesis researches devoted to formation and development of mathematical knowledge of students in general education schools. Beyond that, the psychological-pedagogical and methodological literature considers various aspects of problems application in teaching and personal development of students.

The works of D.B. Bogoyavlensky, J. Bruner, V.V. Davydov, K.Dunker, A.V. Zaporozhets, V.P. Zinchenko, A.N. Leontiev, A.M. Matyushkina, N.A. Menchinsky, L. Rubinstein and other psychologists give full consideration to significance and functions of problems in educational process and identify the main regularities in problem solving process.

The issues of improving the methodology for teaching of problem solving, defining the role and place of problems in teaching mathematics are also considered in the works of I.B. Bekboev, D.V. Klimenchenko, Yu.M. Kolyagin, D. Polya, L.M. Freedman, V.I. Krupich, P.M. Erdniev, B.P. Esipov, I.Ya. Lerner, A.V. Usova and others.

In Kazakhstan, a number of works of scientist-methodologists, such as A.E. Abylkasymova, B.B. Baimukhanov, M.E. Esmukhan, A.K. Kagazbaeva, A.M. Mubarakov, L.U. Zhadrayeva, E.Zh. Smagulov, L.T. Iskakova and others, was devoted to development of mathematical education, activation of mental activity of students and teaching of problem solving.

The study of math teachers' practice in school shows that the process of problem solving by students is not always a means of teaching them how to solve problems. In most cases, students and teachers focus undivided attention only on finding answer to question of the problem being solved. At the same time, the following important questions of finding solution to problem remain unaddressed: how can one independently find a way of solving a problem, what needs to be done for this, what techniques and methods of finding solutions to problems exist?

The analysis of scientific works and researches attests to the fact that for today these questions have not been duly responded, therefore, in light of modern requirements it is required to find the solutions for development of new methods of organizing learning activities of pupils for the purpose of formation of their ability to solve problems.

Therefore, the existence of objective contradiction between immaturity of methodological foundation for teaching of mathematical tasks solving in educational process of secondary school and the need for mastering by the students of techniques for solving mathematical tasks, including non-standard and advanced ones, determines the *relevance* of the research topic. The need to develop more advanced methods for teaching students to solve mathematical tasks, including

non-standard and advanced ones, determined the choice of topic for our study “*Methodical foundation of mathematical tasks solving learning in general school*”.

The above contradictions defined the *problem of research* as a theoretical and methodological justification for teaching students to solve mathematical tasks.

The research objective: development of methodological foundation for teaching of mathematical tasks solving in the process of teaching mathematics in secondary school and their implementation in practice.

The object of research: the process of teaching mathematics in secondary school.

The subject of research: the methods of teaching students of basic school to solve mathematical tasks.

The research hypothesis: if organization of learning activities of students and the methods of teaching to solve mathematical tasks in secondary school be systematically developed in accordance with new requirements, this will lead not only to improvement in mastering by students of mathematics course and increased level of their ability to solve mathematical tasks, but to heightening of student’s interest in studying mathematics.

The purpose, the subject and the hypothesis of the dissertation allowed defining *the following research tasks*:

- identification of role and significance of tasks, their functions, classification, methodological foundation for teaching of mathematical tasks solving as a means of development/ thinking of students in the process of teaching mathematics;

- development of methods for organization of teaching schoolchildren to solve mathematical tasks;

- development of teaching methods for solving textual and non-standard problems in a course of algebra;

- experimental verification of effectiveness of methodology for teaching to solve mathematical tasks in secondary schools and its implementation in educational process.

The research methods:

- carrying out of theoretical analysis of scientific and theoretical problems aimed at teaching to solve mathematical tasks, as well as of philosophical, psychological, pedagogical, methodological and mathematical literature on the basis of compulsory educational standards, mathematics curriculum, textbooks, teaching aids and academic and methodological complexes;

- performance a pedagogical experiment to test the research hypothesis and processing of its results;

- discussion of research results at methodological seminars and research and practice conferences.

Theoretical foundation of research: philosophical, psychological, pedagogical, methodical and mathematical papers on research problem; methodology of teaching to solve mathematical tasks in secondary school.

Scientific novelty of research:

1. The role and place of tasks in teaching mathematics have been further defined; classification of tasks and the essence of such concepts as “problem” and “problem solution” as a means of developing cognitive abilities in students and formation of new concepts in the process of teaching mathematics have been determined.

2. The principles of construction of a system of differentiated problems, including non-standard ones, and the methods for their solutions aimed at developing logical thinking of students have been specified.

3. Methods for organization of teaching to solve mathematical tasks and methodology of teaching to solve textual and non-standard problems in the course of algebra of the basic school have been developed.

Theoretical significance of the research lies in the fact that a system of mathematical tasks in algebra and differentiated class assignments aimed at formation of learning activities of students in the process of their teaching to mathematics have developed on the basis of the integrity principle, and effective methods for their solution have been proposed.

Practical significance of the research: the theoretical provisions and methodological recommendations developed in the dissertation for teaching of mathematical tasks solving and organization of learning activities of students in the process of teaching mathematics can be used by teachers of mathematics in their practical activities to improve the quality of students’ knowledge and skills. The results of the research can be used to improve the content and methods of teaching mathematics in both secondary schools and in teacher’s institutes for training of future teachers of mathematics.

Basic provisions for defense:

1. Theoretical aspects of teaching to solve mathematical tasks in secondary school and the essence of the concepts of “problem” and “problem solving” formulated by us on the basis the systemic-activity approach to educational process.

2. Methodological features of constructing a system of differentiated problems and organization of learning activities of students aimed at developing their ability to solve problems.

3. Methods of teaching to solve textual and non-standard problems in the course of algebra, which contribute to raising the level of mathematical knowledge of secondary school students.

Publications based on the results of research. There are in total 15 published works on the subject of the dissertational, including 3 works included in the editions recommended by the Committee for Control of Education and Science of the Republic of Kazakhstan, 5 works in collected books of international scientific conferences, 1 work in collected books of republican scientific conferences, 1 work in the national academic journal, 1 work in the Russian academic journal, 1 work in the magazine included in the Scopus-1 database and 3 teaching aids.

Based on the updated content of school mathematics education and the respective curriculum, approved by the Ministry of Education and Science of the

Republic of Kazakhstan, we co-authored the study guide “Algebra: Collected book of problems for general education schools”. - Almaty: Mektep, 2017. - 36 p. in Kazakh, Russian, Uighur and Uzbek languages, and the students of the basic schools of the republic are being trained using this study guide. We also co-authored the study guide “Methodical foundation for teaching of mathematical tasks solving in school”. - Almaty: Mektep, 2017. - 252 p. And it is addressed to teachers of departments of methodology of teaching mathematics in universities, teachers of mathematics of general education schools, specialists of advanced training institutes, candidates for a doctor degree (PhD), candidates for a master’s degree and students of higher educational institutions.

The provisions and the results of dissertation have been discussed at international conferences: “Problems of improvement in teaching mathematics, physics and computer science in school and higher educational institution” (Almaty, 2014), “Topical problems of teaching mathematics in school and teachers institute” (Moscow, 2015), “Radiation-thermal phenomena and innovative technologies” (Almaty, 2015), “Topical problems of teaching mathematics in school and higher educational institute in the light of ideas of L.S. Vigotskiy” (Moscow, 2016), “Mathematical modeling of mechanical systems and physical processes” (Almaty, 2015), “Relevant scientific studies in the modern world” (Pereyaslav-Khmel'nitsky, 2017), the Republican scientific and methodological seminar, and at the meetings of the department of methodology of teaching mathematics, physics and computer science of the Institute of mathematics, physics and computer science of the Kazakh national pedagogical university named after Abay.

Structure and scope of the dissertation

The dissertation consists of introduction, two sections, conclusion, list of literature references and appendix.

The relevance of the research topic is substantiated; the objectives, tasks, object, methodological and theoretical foundation of the research and the research hypothesis are determined; the scientific novelty, theoretical and practical significance of the research are formulated; the stages and methods of the conducted research, the provisions to be defended, information on approbation and implementation of research results are defined **in the introduction**.

The essence of the concepts of “problem” and “problem solving”, classification and functions of problems are determined, the principles for constructing a system of differentiated problems and methods for solving problems, including nonstandard and advanced ones, aimed at developing techniques for solving mathematical tasks, are substantiated **in the first section**, “Theoretical foundation for teaching of mathematical tasks solving”.

The second section, “Experimental work on the methodology of teaching to solve mathematical tasks” presents the techniques for organization of teaching to solve mathematical tasks and methods of teaching to solve textual and non-standard problems in the course of algebra of the basic school, summarizes and systematizes the results of our experimental work.

The main theoretical and practical conclusions drawn by us in the course of the study are formulated, methodological recommendations on the results of the dissertation research are given and prospects for further research on this problem are determined **in the conclusion**.

The list of literature references includes philosophical, psychological, pedagogical, methodical and special literature analyzed by us in the course of the research.

The appendix contains the materials used in the process of the research.