

ANNOTATION

of the thesis by Gabdullin Rustem Serikovich on the topic: “Scientific and methodological foundations of educational development of students of primary school in the process of finding solutions to contextual mathematical problems”, submitted for the degree of Doctor of Philosophy (PhD) in specialty 6D010900 - Mathematics

Relevance of the topic. Today Kazakhstan’s society is undergoing a series of social and economic transformations that promote the entry of Kazakhstan into the thirty most developed countries of the world as it is reflected in the presidential decree of Nursultan Nazarbayev, the first President of Kazakhstan. The decree was designed on December 14, 2012 and was aimed to implement the message of the Head of the State "Kazakhstan - 2050 Strategy: new political course of the established state" [1]. These transformations have significantly affected educational activities in general and were reflected in such documents as: The Message of the President of the Republic of Kazakhstan N.Nazarbayev to the people of Kazakhstan “New development opportunities in the fourth industrial revolution” [2], The Law of the Republic of Kazakhstan “About Education”, State mandatory educational standards of all levels of education (basic secondary education, general secondary education) [4], The state program for the development of education and science of the Republic of Kazakhstan for 2016-2019 [5].

The intensive process of updating the content of general secondary education in accordance with the State Program for the Development of Education and Science of the Republic of Kazakhstan for 2016-2019 aims at educating, training and developing a creative and critical-minded person who is capable of applying his/her knowledge, skills and abilities in everyday life, continuous self-improvement and self-realization. The main goal of higher education is to prepare competent specialists capable to work at the level of world standards, competitive in the labor market and responsible for their professional activities [5].

Mathematics as a science and as an academic subject is an integral part of school education, the study of which takes more time than studying other subjects. In the process of studying mathematics, students develop logical, critical, creative thinking, intuition, they master the ability to think critically, get an idea of mathematical objects and models; and what is most important, they learn to apply their knowledge in everyday life. The most common type of mental activity is solving mathematical tasks.

A task can perform various functions, among which it is possible to single out training, educational and developmental. Thus, tasks serve the main didactic goals: they form a system of knowledge, skills and abilities to solve various types of tasks, shape students’ creative thinking, contribute to the development of intelligence, world view, moral qualities, perform a cognitive role in learning. Therefore, tasks and the process of their solution are the basis for the realization of training, education and development goals [6].

Among all the tasks, the so-called contextual tasks are now coming to the fore. This is due to the fact that the contextual tasks reflect various aspects of life and carry a lot of useful information. Well-chosen and methodically well-placed tasks help students to master theoretical material, make the course of mathematics more interesting, cause the need for new knowledge and the ability acquire them independently. But besides the direct impact (formation of new knowledge), the content of the tasks has a hidden “subtextual” effect on students. Contextual tasks are used in PISA testing questions. The analysis of the results of this testing showed that most of our students do not cope with the solution of these problems [7].

A large number of psychological, pedagogical and methodical works are devoted to solving mathematical tasks. The most famous among all is the work of D.Poya, which deals with the general technology of solving mathematical problems. Such well-known scientists as S.I. Shokhor-Trotsky, Yu.M.Kolyagin, V.A.Oganesyanyan, Ya.I.Grudenov, M.B. Balk, G.D. Balk, L.M. Fridman, E.N.Turetsky, N.F.Talyzina, A.B. Vasilevsky, G.G.Mikulina, I.I.Ilyasov, V.I. Krupich and others seriously addressed this issue in their works. Among home scientists one can single out the works of K.G. Kozhabaev, D.Rakhymbek, A.E.Abylkasymova, A.K.Kagazbayeva, M.E.Esmuhan, M.O. Musabekov, etc.

There is also a number of dissertational studies devoted to the questions of finding solutions to mathematical problems or problems associated with learning how to solve problems, the authors of which are S. Utepkaliev, A. A. Papyshv, M. A. Kerimbekov, A. K. Karabaev, N. K. Madiyarov, Yu.A. Rozka, Khan Inca, O.M.Sherentsova, I. B. Shmigirilova, S. M. Mirzaev, T. B. Lee, T. A. Aldibaev, M. B. Ongarbaev and others. For teaching how to solve mathematical problems K.A. Tanatarov used applied problems, G.O.Zhetpisbaeva and A.A. Kostangeldinova used tasks with practical content, G.E. Kurmankulova used situational and production tasks, N.N. Medetbekova used game tasks with national and didactic content. However, the problem of finding solutions to mathematical problems does not lose its relevance since it is able to improve the quality of mathematical education in the country. Moreover, it can be said that the mathematical education is the basis of national security and economic power of our country.

In psychological, pedagogical, and methodical literature, studies and articles devoted to this problem, the authors dedicated all sorts of methodological recommendations for organizing a search for a solution to mathematical problems in a specific subject, in which the boundaries of its applicability are determined. This attitude to the problem makes it difficult to transfer the recommendations received to other types of tasks.

In all the reviewed papers there is patient work of the authors and their personal understanding of the essence of the process of finding solutions to mathematical problems, as well as the methods for its implementation offered to students. Many of the dissertation research were generally written in the period when the knowledge paradigm prevailed and in this paradigm the student acted only as an object of study [8].

Such a large number of psychological and pedagogical literature, dissertation research, which were experimentally proved, speaks of considerable experience in this matter. But on the other hand, all this knowledge is scattered and not ordered, they need theoretical generalization which will allow to reveal objective laws and interrelations oriented to modern requirements for the content of education. Not only because this problem was solved inefficiently, but because the emphasis was placed not on what it should be placed. Therefore, a special study in which the effectiveness of the proposed methodology for learning how to find a solution to problems will be theoretically and experimentally substantiated is needed [9].

The studies do not reveal the educational potential of the process of finding solutions to contextual tasks. There are no special studies that describe the technology for implementing educational and developmental functions for finding solutions to contextual mathematical problems.

The search for ways to solve the above problems formed the basis of this study and determined the choice of the topic of the thesis "Scientific and methodological foundations of educational development of students of primary school in the process of finding solutions to contextual mathematical problems".

Aim of the research – the development of methods for using technologies of the process of finding solutions to contextual mathematical problems for the implementation of educational and developmental functions of a school mathematics course.

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

The subject of research - is the didactic possibilities of finding solutions to contextual mathematical problems and using them as means of educating and developing students.

The hypothesis of the research - if you identify and implement the educational and developmental capabilities of the search process for solving contextual mathematical problems, this will contribute to the students' conscious mastery of the program material, increase the creative activity of schoolchildren, contribute to their intellectual development, increase interest in the subject, and make the student an equal subject of educational activity.

Objectives of the study:

1. Determine the role and place of educational and developmental learning objectives in the modern paradigm of education and identify its methodological foundations in the process of teaching mathematics.

2. Based on the analysis of psychological, pedagogical and scientific-methodical literature in mathematics, determine the role and place of the search process for solving contextual mathematical problems in educational and developmental education of students in mathematics. Identify and justify the main directions of implementing educational and developmental functions in the process of finding solutions to contextual mathematical problems.

3. Develop a set of training tasks compiled with the aim of implementing educational and developmental functions and developing skills and abilities to solve contextual mathematical problems.

4. Experimentally test the effectiveness of the developed methodology of educational and developmental education in mathematics through the search for solutions to contextual mathematical problems.

To solve the tasks and test the formulated research hypothesis, **the following research methods** were used in the work:

- theoretical and methodological analysis of psychological, pedagogical and scientific-methodical literature, educational and methodological documentation (state educational standards of primary and secondary schools, educational and work programs), materials of domestic and foreign scientific and practical conferences, Internet resources on the problem of research;

- empirical: diagnostic methods (direct observation, interviewing, anonymous questioning), the study of teachers' best practices, conducting a pedagogical experiment;

- statistical: mathematical processing of the results of a pedagogical experiment, analysis of quantitative statistical parameters.

The theoretical basis of the study was philosophical, psychological, pedagogical work of prominent scientists, psychological and pedagogical, scientific and methodological literature, work on the problems of upbringing and developing students, educational and methodical documentation (state educational standards of primary and secondary schools, educational and work programs), materials of scientific conferences, Internet resources on the problem of research.

Sources of the research: Law of the Republic of Kazakhstan "About Education"; the State program on developing education and science in Kazakhstan, State compulsory standard of secondary education (primary, basic secondary, general secondary education); International PISA reports; educational documentation; psychological and pedagogical, scientific and methodical literature on the problem of the research.

The main stages of the research. The study was conducted in 2015-2018 and included three stages.

The first stage of the experiment (2015-2016) is a recital experiment, during which theoretical approaches to the problem and a research program were developed. The main objective of the ascertaining experiment was to analyze the state of teaching mathematics, studying both traditional methods of teaching a course of mathematics and the use of interactive learning technologies.

At this stage, the conceptual foundations of the research were identified and the state of elaboration of the research problem was identified, the selection of diagnostic tools and the collection of experimental pedagogical materials were carried out.

The second phase of the study (2016-2017). During the second stage of the study, pedagogical conditions for generating interest were modeled and refined by attracting contextual mathematical problems, information and communication technologies to the learning process when solving them. At this stage, we have decided on the necessary components of the teaching methodology for finding solutions to contextual tasks as the basis for the development and upbringing of students in the process of teaching mathematics.

The third stage (2016-2018) was aimed at introducing the developed guidelines, checking the availability and effectiveness of the developed methodology, with its subsequent correction and analysis of the results obtained. The conclusions of the study were formulated.

The novelty of the research is as follows:

1) the necessity of teaching mathematics is scientifically based; possible ways to implement educational and developmental education in mathematics and the ways of finding solutions to contextual problems are offered;

2) the principles of the selection of tasks and the construction of a complex of contextual tasks aimed at the implementation of the educational and developmental function of training are determined;

3) a methodology for organizing the teaching of dialogization of the process of finding a solution to contextual tasks (the result is the mastering of the substantive content of the organization of dialogue and the ability to carry them out independently in the search for the solution of problems) has been developed;

The theoretical significance of the research results is due to the contribution to the theory and methodology of teaching mathematics: the selection and composition of contextual tasks are made, the requirements for the construction of a complex of contextual problems are developed, the educational and developmental functions of finding solutions to problems are shown.

The practical significance of the research results is that the educational and developmental functions of the process of finding solutions to contextual tasks are disclosed and can be transferred to any tasks; requirements for the construction of a complex of contextual tasks, tools for organizing the search for solutions to contextual problems have been developed. Recommendations on the use of ICT in solving contextual problems are given. The results of the study can be useful to teachers of mathematics and students who study mathematics independently.

Statements for the dissertation defense:

1. The educational and developmental functions of the process of finding a solution to the contextual tasks will be provided if the following requirements are met:

a) the search for the solution of contextual problems is determined by the information capacity of the problem, i.e. by the objective information reflected in the task;

b) the internal structure of the search for the solution of the context task is expressed in the form of schemes, models that reflect the analysis of the condition and the search itself;

c) learning how to find a solution to a contextual task is the nomination of local ideas based on the information component of the task and interdisciplinary connections present in the plot of the task.

2. Learning how to find a solution to contextual tasks consists in using interactive learning methods such as dialogue, which contributes to the successful mastery of search activities in teamwork and independent activity.

3. Experimental evidence of the effectiveness of the implementation of the developed methodology.

The personal contribution of the author consists in the independent performance of work, participation in all stages of work on the dissertation research, in direct participation in obtaining data at the diagnostic stage, at the end of the formative experiment and at the stages of independent work.

Approbation of practical results was carried out in the process of experimental work with students of Akmola and North Kazakhstan regions. The results of the research were reported at the following conferences: “Science in the modern world” (Kiev, 2016), “Ualihanov's readings - 20”, (Kokshetau, 2016), “Higher pedagogical education: traditions and innovations”, (Kokshetau, 2016 г.), “Ualihanov readings- 21”, (Kokshetau, 2017), “Mathematics. Education. Culture ”, (Togliatti, 2017), “ Youth, Science, Creativity-2017 ”, (Omsk-2017), VI Congress of the Turkic World Mathematical Society, (Astana, 2017), “Contemporary Mathematical Education: Experience, Problems, Prospects” dedicated to the 80th anniversary of the doctor of pedagogical sciences, professor K.G. Kozhabaev, as well as at methodological seminars held within the framework of the “Week of Science” among students and postgraduates at meetings of the Department of Physics and Mathematics of Ualikhhanov Kokshetau State University.

Publications on the results of the study. On the topic of the dissertation research 16 works were published, including 1 article in the journal included in Scopus international database, 3 articles in the journals recommended by the Committee for Control of Education and Science of the Republic of Kazakhstan, 1 article in the journal recommended by the Higher Attestation Commission of Russia, 7 articles in collections of materials of international conferences within the republic and outside the republic, 1 article in the collection of materials of the republican conference, 1 article in the materials of the inter-university conference (Omsk), 1 methodological manual, 1 program of an elective course.

The structure and scope of the thesis. The dissertation research consists of introduction, two sections, conclusion, list of used literature (215 items) and appendixes. The total number of pages is 151.

The introduction shows the relevance of the dissertation research, identifies the purpose, object, subject, research objectives, and research hypothesis, reflects the novelty of the research, theoretical and practical significance of the work, etc.

The first section analyzes what constitutes educational and developmental goals, characterizes contextual tasks, shows how they differ from traditional tasks, and looks at finding solutions to problems from different points of view.

In the second section methodological recommendations on the selection and compilation of contextual tasks, the design of a complex aimed at the implementation of the educational and developmental function of finding a solution to problems are proposed, and a method for organizing a search for solving problems are proposed. The data obtained during the experiment was processed.

In the conclusion, the final results of the dissertation research are summarized.