

ABSTRACT

to the dissertation of Darkhan Bolatovich Toibazarov on the topic "Scientific and methodological foundations of using applied problems in the professional training of future mathematics teachers", submitted for the degree of Doctor of Philosophy (PhD) in the specialty 6D010900-Mathematics

Relevance of the research. The President of Kazakhstan Kassym-Jomart Tokayev in his Message "Unity of the people and systemic reforms are a solid foundation for the prosperity of the country" outlined the main priorities for improving the welfare of the people of Kazakhstan. The most important and specific instructions of the Head of State are aimed, first of all, not only at improving the welfare of the population, but also relate to areas that contribute to this, in particular, education. Among the issues discussed in the Message, the improvement of the quality of education and the support of teachers are particularly noted.

Improving the level of mathematical education of future mathematics teachers and, as a result, teaching students at universities is a priority task of any state.

Recent changes in the field of secondary education in Kazakhstan determine new approaches to the renewal and development of the entire educational system. At the beginning of the XXI century, the main change in the field of Kazakh education is the entry of our country into the Bologna process, which is the basis of the education system of European countries, in order to build a common educational space. In this regard, there is a need to change teaching in schools and universities. The introduction of the results of mathematical scientific achievements of scientists of the Republic of Kazakhstan in education requires research in the field of educational mathematics.

Education standards around the world emphasize the importance of the ability to apply subject knowledge in mathematics in everyday life. Many methodologists point out the problems that arise from memorizing mathematics when the subject is not sufficiently connected with imagination. This means that students' mathematical abilities remain limited by applying rules or formulas, performing memorized algorithms for familiar tasks. They cannot transfer their knowledge to new types of problems or use mathematics as a modeling tool.

The problem of applied orientation occupies a leading place in the methodology of teaching mathematics in secondary and higher schools. It is reflected in the works of F.S.Avdeev, I.I. Bavrın, V.A.Gusev, G.V.Dorofeev, M.I.Zaikin, Y.M.Kolyagin, G.L.Lukankin, N.V.Metelsky, A.G.Mordkovich, E.D.Novozhilov, G.I.Sarantsev, N.A.Tereshin, M.I.Shabunin, M.V. Egupov, A.E.Abylkasymov, R.A.Sadvakasov, etc.

Currently, many Kazakhstani scientists, including B. Baimukhanov, A.E. Abylkasymova, A.M. Mubarakov, S.M. Seitova, E.Zh. Smagulov, A. Nugusova and others, note the need to make serious adjustments to the training of teaching staff at universities in the country.

Today Kazakhstan faces a difficult task of implementing long-term strategic projects aimed at making the country one of the 30 developed countries of the world by 2050, along with economic resources, one of the most important tasks is to increase the level of spiritual potential of human capital.

In the strategic plan of the Republic of Kazakhstan until 2025, the Law of the Republic of Kazakhstan "On the status of a teacher" dated December 27, 2019 No. 293-VI notes the need to improve the effectiveness of professional training of future teachers.

Modernization of education in Kazakhstan has been undergoing a serious update in recent years. The main objectives of the reforms carried out in Kazakhstan in the education system are to improve the quality of education through the use of the latest pedagogical technologies, the development of students' skills of independent learning and critical thinking, the ability to use theoretical material in practice, as well as the education of competitive youth. In connection with the above points, on the basis of the "State mandatory standard of education at all levels of education", the education system, the criteria assessment system and the format of the national unified testing are being updated.

The re-evaluation of the existing social practice carried out in our time changes the system of requirements for a specialist and the education system as a whole. In many countries, education is becoming a leading factor in the socio-economic development of society. It defines the future shape of society and determines it. A modern specialist should be capable not only of reproducing existing knowledge, but also of creative activity, non-standard thinking. Therefore, the educational process in higher education should ensure the disclosure and development of creative potential.

The task of professional development of teachers of mathematics and the corresponding training of students of pedagogical universities are relevant for all countries of the world. The results of Kazakh students according to international studies, PISA (2009, 2012, 2015 and 2019) indicate the need for revision of the system of secondary education. Modern Kazakh education should be competitive, high-quality, it is vital that our students are adapted to modern life.

Many researchers have been engaged in the implementation of the applied orientation of the process of teaching mathematics at different times. The works of Kazakhstani methodologists, including S.M.Seitova, A.Yunusova, R.A.Sadvakasova, E.Y.Bidaybekov, E.Zh.Smagulov, A.E.Abylkasymova, E.A.Tuyakova, etc., are devoted to this problem. In the CIS countries, the works of V.A. Dalinger, M.V. Egupova V.P. Kizilova, Y.M. Kolyagin, V.V. Pikan, N.V. Reshetnikova, N.A. Tereshin, V.V. Firsov, L.E. Khaimina, I.M. Shapiro, E.N. Erentraut, M.Tazhiev and others are devoted to this problem.

The works of foreign researchers as Bock W. and Brake M. are devoted to the problem of strengthening the applied orientation of the school mathematics course with the help of mathematical modeling and applied problems. The authors studied the role of mathematical modeling in the process of teaching mathematics and noted that the active solution of applied problems increases the effectiveness of teaching mathematics and promotes the development of students' interests. Kim

M.K. and Cho M.K. conclude in their works that students learn more meaningfully within the framework of practice-oriented learning, as this helps them find a connection between school education and their real life.

The content of methodological training of future mathematics teachers at the university is presented in the works of Nugusova A.N., Smagulov E.Zh., Seitova S.M., Bidaybekov E.Y., etc. In the UN countries Guseva V.A., Novik I.A., Roganovsky N.M., Smantser A.P. The implementation of their proposed content allows students to reflect various aspects of applied mathematics, many of which have been repeatedly discussed in scientific research. However, a number of issues of this problem need to be resolved in the modern conditions of updating the Kazakhstani education system.

The main means of implementing the applied orientation of teaching mathematics are problems. The works of P.T. Adanasov, M.M. Ashurov, I.B. Bekboyev, S.S. Vardanyan, G.M. Wozniak, N. Gaibullaev, T.A. Kanekanyan, N. A. Tereshin, N. L. Tikhonov, I.M. Shapiro are devoted to the study of the didactic possibilities of applied problems.

According to Abylkasymova A.E., "teaching to solve problems is a difficulty in mathematics. In this regard, the following issues are relevant: modeling, organization of collective and individual activities of students in the process of solving problems; development of tasks by levels of complexity; development of systems of applied tasks; development of tasks of a creative nature, etc."

In the dissertation research by A.K. Bekbolganova, the problems of theoretical justification and practical development of the methodology of using ICT for the implementation of the applied orientation of the mathematics course are shown. The role and functions of applied problems in teaching mathematics in college are considered.

In these conditions, the intention of teachers to implement the applied orientation of mathematics has noticeably increased. Experimental studies have convincingly proved that the most effective method of activating mathematics teaching is familiarizing students with the elements of applied mathematics and solving problems of an applied nature. The views of most methodologists agree that solving mathematical problems with practical content is an important part of teaching mathematics at school. The increased attention to the applied component of mathematical education of schoolchildren of Kazakhstan can be traced in the content of the control and measuring materials of the UNT test tasks on the subject of "Mathematical literacy".

At the same time, it must be admitted that attention which paid to the development and usage of applied tasks as a means of professional training of school teachers in the practical activities of pedagogical universities and in specialized literature is little.

The Minister of Education and Science of the Republic of Kazakhstan Aimagambetov A. notes that in secondary education, students of the Republic of Kazakhstan take part in 5 international studies, where the main ones are PISA, TIMSS, PIRLS. In TIMSS, Kazakhstani students are among the top 10 leading countries in academic knowledge of mathematics and natural sciences. But in the

PISA-2015 study, our students showed low functional literacy, i.e. schoolchildren know a lot, but do not know how to apply their knowledge. The essence of the PISA study is that the level of knowledge and skills of students should be considered not from the point of their success at school, but the ability to apply their knowledge in everyday life. In this regard, since 2016, an updated secondary education program has been introduced in Kazakh schools. According to the minister, the effect of the updated programs can be observed already by PISA 2021 and PISA - 2024, since schoolchildren will study according to the updated content for 7-8 years. In this regard, one of the main directions of improving mathematical education is to strengthen the applied orientation of the mathematics course, to link its content and teaching methods with practice.

The analysis of research on applied aspects of teaching mathematics at school and the problems of improving the professional training of mathematics teachers in pedagogical universities revealed the following **contradictions**:

1. Between the need of modern society for highly qualified teaching staff and the need to strengthen the level of applied orientation of the process of teaching mathematics at the university;
2. The need to update educational programs in pedagogical universities in the conditions of updating the content of secondary education and insufficient reflection of this trend in educational practice.
3. Between the need for methodological preparation of a teacher for teaching applied tasks and the insufficient development of his methodology in pedagogical universities;

The noted contradictions caused the choice of the research problem, which consists in the necessity to substantiate the theoretical and practical aspects of applied problems in the professional training of future teachers of mathematics, as well as the development of a methodological basis for the use of systems of applied problems, contributing to improving the quality of knowledge, skills and abilities in mathematics.

Insufficient research into the problem of the methodology of constructing a scientific and methodological system of applied problems in the process of teaching mathematical disciplines, in the preparation of future mathematics teachers for professional activity and the establishment of suitable solutions determined the topic of the dissertation "**Scientific and methodological foundations of using applied problems in the professional training of future mathematics teachers**".

In accordance with the posed problem, the object, subject and aim of the research were determined.

The aim of the research: scientific and methodological substantiation of the effectiveness of the use of systems of applied problems in the professional training of future mathematics teachers.

The object of the research is the process of teaching mathematical disciplines in the system of higher pedagogical education.

The subject of the research: the system of applied problems in teaching mathematical disciplines.

The hypothesis of the dissertation: if students are taught according to the developed scientifically-based methodology, considering the model of the system of applied problems, then it will be possible to ensure a sufficient level of professional and methodological training of the future mathematics teacher, as this contributes to improving the quality of their professional training in universities.

In compliance with the aim of research, based on the hypothesis of the study, the following tasks were identified:

1. To identify the psychological and pedagogical foundations of applied orientation in teaching mathematics;
2. To determine the theoretical and practical aspects of applied tasks in the professional training of future teachers of mathematics;
3. To develop a scientific and methodological model for using the system of applied problems in teaching mathematical disciplines;
4. Experimentally test the ways of implementing the methodology of teaching systems of applied problems in teaching mathematical disciplines at the university.

The research methods: analysis of domestic and foreign scientific works on philosophy, pedagogy, psychology and methods of teaching applied problems; analysis of educational programs, textbooks, dissertation research, conference materials; generalization of experience in teaching applied problem solving; application of empirical methods of scientific cognition, such as conversation, observation, lectures and practical classes with students; pedagogical experiment and analysis of experimental activities.

The theoretical and methodological basis of the study is formed by the following approaches:

-applied aspects of teaching mathematics at university (V.V. Firsov, N.A. Tereshin, I.M. Shapiro, M.V. Egupova, S.M.Seitova, A. Nugusova, M.Tazhiev, R.A.Sadvakasova, H.Freudenthal, A. Treffers);

-teaching methods and organization of educational activities, including teaching mathematics (Y.K. Babansky, A.Ya. Bloch, A. E. Abylkasymova, E. U. Medeuov, B. Baymukhanov, R.Tasbolatova, G.O.Kozhasheva, A.M. Matyushkin, N.A. Menchinskaya, etc.);

-the study of methodical training of future teachers of mathematics (A.A. Stolyar, S.M. Seitova, A. Nugusova, A.M. Mubarakov, O.S. Satybaldiev, E.A. Tuyakov, A. K. Karazbaeva, etc.);

- theoretical foundations of teaching mathematical problems solving (Yu.M. Kolyagin, V.I. Krupic, M.Friedman, etc.).

The sources of research: the Law of the Republic of Kazakhstan "On Education", the state mandatory standard of higher education, the professional standard "Teacher", the Message of the Head of State to the people of Kazakhstan, the study of documents related to education, scientific works of domestic and foreign scientists in the field of pedagogy, psychology and mathematics, official materials of the Ministry of Education of the Republic of Kazakhstan, regulatory documents of the Republic of Kazakhstan, etc.

The scientific novelty of the research consists in the fact that:

1. The psychological and pedagogical foundations of applied orientation in teaching mathematics are investigated;
2. The requirements for the selection and use of applied problems in teaching mathematical disciplines at the university are formulated;
3. A scientific and methodological model of the system of applied problems in teaching mathematical disciplines has been developed, which contributes to improving the professional training of future teachers of mathematics.

The theoretical significance of the research results lies in that: the scientific and methodological system of applied tasks in the teaching of mathematical disciplines and the improvement of the professional training of future teachers of mathematics meets the basic requirements of higher pedagogical education.

The practical significance of the research involves that the dissertation includes material that can be used by students of the training direction "6B015 Teacher training in natural science subjects" in the educational program "Mathematics", "Mathematics and Computer Science". The research examines the problems of teaching methods for solving applied problems in teaching mathematical disciplines for the preparation of future teachers of mathematics. The presented model of applied problem systems can provide methodological assistance to school teachers, undergraduates, doctoral students and young university teachers.

The reliability and validity of the research results are provided by the analysis of scientific and educational literature on the problem under study, adequate in logic to the goals and objectives of the study; the use of a set of scientific research methods, a rational combination of theoretical and experimental types of research; the use of statistical methods and mathematical processing of experimental data confirming the success of the experimental study.

The following provisions are submitted for defense:

1. The identified psychological and pedagogical foundations of applied orientation in teaching mathematics are the theoretical basis of the research;
2. Theoretical and practical aspects of applied tasks in the professional training of future teachers of mathematics are the methodological basis of the study;
3. The developed scientific and methodological model of using the system of applied problems in teaching mathematical disciplines, contributes to the professional training of teachers of mathematics, and also meets the basic requirements of pedagogical education.

The research base: an experimental study was conducted on the basis of Zhetysu University named after Ilyas Zhansugurov, the Kazakh National Women's Pedagogical University and secondary schools No. 1 named after Abai and No. 2 in Taldykorgan.

Stages of the research. In accordance with the aims and objectives, the research work was conducted in three stages:

At the first stage (2017-2018), the literature on various aspects of the problem was analyzed. The features of the implementation of the applied orientation of teaching mathematics at school and university are analyzed. The theoretical analysis of the literature and the data obtained during the ascertaining

experiment served as the basis for the formulation of the purpose and objectives of the study, the nomination of a working hypothesis (ascertaining experiment).

On the second (2018-2019) stage a methodical system of applied problems in mathematics in teaching students was designed and specific recommendations for its use (a search experiment) were formulated.

In the third stage (2019-2020) the methodological system of applied tasks was tested, the effectiveness of its application was checked, the theoretical and experimental results obtained were processed and generalized, adjustments were made to the methodological system, conclusions were formulated and the dissertation was designed (forming experiment).

Approbation and implementation of the research into practice:

- the main provisions and results of the study were heard and discussed at scientific and methodological seminars of the Department of Mathematics and Computer Science of ZHU named after I.Zhansugurov, the Department of Mathematics of the Women's National Pedagogical University, and were also reflected in the textbook "Methods of solving applied problems in mathematical disciplines (for example, "Mathematical analysis"). The results of the study were presented during a scientific internship at the Center for development of higher and secondary specialized, professional education at the Ministry of Internal Affairs (Tashkent, Republic of Uzbekistan).

- at Zhetysu University named after I.Zhansugurov, from 27.01.2020 to 29.02.2020, professional development courses were held for teachers of mathematics in secondary schools of Almaty region and Taldykorgan on the topic: "Development of professional competence of a mathematics teacher in the context of the updated content of education" (Center for professional development and complementary education, 72 hours).

- the obtained research results were reported at scientific and practical conferences: the international conference Bulletin "EUROTALENT-FIDJIP" (Paris, France, 2018), the international scientific and practical conference "Modern Mathematical education: experience, problems, prospects" (Kokshetau, 2018); the international scientific and practical online conference "Uvaliev Readings-2020", "Relevant issues of science and education development", (Ust-Kamenogorsk, 2020).

Publications. The main content of the dissertation was presented in collaboration with domestic and foreign scientific consultants in foreign publications, journals recommended by the Committee for Quality Assurance in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan and in international scientific and practical conferences. As a result of the research, 15 scientific works were published.

1. Scientific papers published in publications included in the Scopus database - 1 (percentile by education - 93, quartile by education - Q2);
2. Scientific works published in publications recommended by the Committee for Control in the field of education and Science of the Republic of Kazakhstan - 5;
3. Scientific papers published at international scientific conferences-2;
4. Scientific papers published in foreign peer-reviewed journals-3;

5. Textbook recommended by the Academic Council of the University-1;
6. Electronic textbook recommended by the Academic Council of the University-1;
7. Copyright certificates - 2.

The structure and content of the dissertation. The dissertation consists of normative references, abbreviations, an introduction, two chapters, a conclusion, a list of references and appendices.

The introduction formulates the relevance, scientific apparatus of the research problem: aim, object, subject, scientific hypothesis of the study, tasks, theoretical and methodological foundations, stages and methods of research, research base, scientific novelty, theoretical significance, practical significance and provisions submitted for defense.

The first chapter discusses the theoretical foundations of the application of applied problems in the course of mathematical disciplines of the university. A comparative analysis of foreign and domestic scientists engaged in teaching methods for solving problems of an applied nature is made. In the methodological literature, many different interpretations of the term "applied problem" are given, this only emphasizes the need to develop a universal explanation of them. The role of applied tasks in the process of teaching mathematics and the features of their application in the educational process are considered.

The second chapter presents methodological requirements and a scientific and methodological model of the system of applied problems, and also discusses the stages of modeling in solving applied problems. The classification of applied tasks is given, according to the subject area to which the task belongs. The methodology of research organization is described and the results of experimental research are presented.

In conclusion, the main results of the dissertation research are formulated, as well as conclusions and recommendations for their further use in research in the field of pedagogy and methods of teaching mathematics, as well as the prospect of further research.

List of sources: in the course of the research, sources consisting of 120 titles were used.

The appendix presents the material developed during the research, which is not included in the dissertation work.