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PREPARING FUTURE MATHEMATICS TEACHERS TO SOLVE SCHOOL MATHEMATICAL PROBLEMS

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ABSTRACT

The preparation of future mathematics teachers through solving mathematical problems is one of the most important directions in the education system. To im-prove the quality of school mathematics education and effectively deliver it to students, teachers need both deep theoretical knowledge and practical skills. Dur-ing the process of solving mathematical problems, future teachers not only en-hance their subject-specific knowledge but also develop analytical thinking, logi-cal reasoning skills, creative approaches, and problem-solving abilities. This pro-cess deepens students' mathematical understanding, strengthens logical reasoning skills, and fosters pedagogical expertise. The aim of this research is to develop a methodology for preparing future mathematics teachers through solving school mathematical problems and to evaluate its effectiveness. The study will employ both theoretical and empirical methods. Theoretical methods include literature analysis and the study of methodological materials. Surveys conducted with fu-ture teachers serve as empirical methods, taking into account their results. As a result of this research, a methodology for solving mathematical problems will be developed, which will contribute to enhancing the subject-specific qualifications of future teachers and employing effective approaches in working with students. Additionally, methodological guides and resources for future teachers will be proposed. This program will serve as a foundation for optimizing the educational process and improving the quality of mathematics teaching. In turn, future teach-ers will contribute to enhancing students' mathematical knowledge and increasing their interest in the subject.

KEYWORDS: Mathematics, Future Teachers, School Mathematical Problems, Methodological Guides, Education System.

1. INTRODUCTION

The preparation of future mathematics teachers through solving school mathematical problems is a vital process aimed at harmonizing their theoretical knowledge and pedagogical skills. Teachers must be equipped not only with theoretical knowledge but also with practical experience to effectively teach mathematics to students. Solving specific school-level mathematical problems as part of the curriculum develops students' analytical thinking and teaches them to apply their knowledge in real educational situations [1].

Mathematics is one of the compulsory subjects studied in formal education. It is a fundamental science that plays a crucial role in everyday life, as well as in the development of science and technology [2]. The universality of mathematical knowledge, its a priori interdisciplinary nature, and its fundamental role in shaping a scientific style of thinking impose high demands on the preparation of mathematics teachers with-in the framework of the higher professional education system [3]. For this reason, it is recommended to apply several methods in preparing future mathematics teachers, taking into account the high professional requirements.

The use of innovative teaching technologies in the process of professional training of future mathematics teachers contributes to the development of students' critical thinking. It also demonstrates that the application of ICT in teaching mathematics enhances the interactivity and effectiveness of the educational process [4]. The importance of simulation modeling in training future mathematics teachers is significant. This method allows students to acquire professional skills, develop creative thinking abilities, and relate mathematical knowledge to real-life situations. Therefore, integrating simulation modeling technologies into the educational process contributes to improving the quality of mathematics teacher preparation [5]. The use of digital technologies in preparing future mathematics teachers facilitates the modernization of the education system. This process increases the efficiency of teaching and enables students to deepen their knowledge using new modern methods and technologies [6].

Teaching proofs and reasoning in preparing future mathematics teachers is essential, as future teachers must be able to effectively con-vey proof and reasoning skills to their students. For this, they them-selves must possess a strong understanding of the theoretical and practical aspects of the field. Developing proof and reasoning skills helps students gain a deeper understanding of mathematical proofs and their application [7]. Preparing future mathematics teachers through solving school mathematical problems is one of the key directions of the education system. This approach develops students' analytical thinking and teaches them to apply their knowledge in real teaching situations [8].

Developing problem-solving skills in mathematics is crucial not only for individuals but also for society, as mathematical knowledge under-pins scientific and technological progress, improving the social and economic development of society. The ability to solve mathematical problems fosters logical thinking, problem-solving strategies, and creativity among students [9].

In preparing future mathematics teachers, animation is shown to be an effective tool for visualizing and analyzing the process of solving mathematical problems. The use of animation helps students gain a deeper understanding of mathematical solutions and methods, justify their own solutions, and present them logically and accurately [10].

Stupel & Ben-Chaim's research offers a methodology for developing pedagogical and mathematical thinking through diverse approaches to solving mathematical problems. This study is one of the effective strategies used to deepen mathematical knowledge and enhance pedagogical methods for future teachers [11].

In the preparation of future mathematics teachers, the skill of solving mathematical problems not only helps teachers effectively convey mathematical knowledge but also directs them towards fostering creative thinking and decision-making abilities in students. This research highlights that solving mathematical problems is equally important for teachers and students and contributes to improving the pedagogical process [12].

The analysis of the above scientific works substantiates the relevance of the research topic. Applying diverse approaches to solving mathematical problems during the development of pedagogical programs and the preparation of future teachers enhances their thinking abilities and enables them to make effective decisions while working with students.

2. MATERIALS AND METHODS

The research on preparing future mathematics teachers through solving school mathematical problems stands out for its innovative approach. The reliability and validity of the study's results are substantiated by several factors: the scientific foundation of theoretical principles, the clear logic of

the research, the consistency and statistical significance of the empirical data collected, and the outcomes of testing in a pedagogical experimental setting. These methods and approaches were used to analyze the effectiveness and pedagogical outcomes of solving mathematical problems in the preparation of mathematics teachers.

During the research, scientific articles were analyzed, and research work was conducted. First, keywords relevant to the research topic were selected. Using the "Mendeley.com" database, scientific works were collected with keywords such as "mathematics education," "future teachers," "school mathematical problems," "methodological guides," and "education system."

Quantitative and qualitative methods were employed, and pedagogical experiments were conducted to monitor future teachers' skills in solving mathematical problems. Additionally, a survey was conducted to evaluate their ability to solve school-level mathematical problems.

Mathematical-statistical analysis methods were utilized to process the data obtained during the pedagogical experiment and to assess the development levels of students' interests. A total of 80 students participated in the pedagogical experiment. Quantitative data were collected in a quasi-experimental manner through pre- and post-experiment surveys of two groups. These data were analyzed to identify changes in students' skills in solving school mathematical problems. Furthermore, relationships between independent and dependent variables were established.

The pre-experiment survey results showed that the dependent variable was identical for both experimental and control groups. Based on the initial survey findings, a specialized course was conducted for 15 weeks in the experimental group, focusing on solving school mathematical problems. This course taught future mathematics teachers to apply creative and innovative approaches to problem-solving. In the control group, the same course was delivered using traditional methods, emphasizing only mathematical theory and rules.

After the course, another survey was conducted to measure the de-pendent variables in both groups. The pre- and post-experiment results were analyzed to determine the improvement in the dependent variable. This analysis demonstrated the extent to which the course influenced the development of students' skills in solving mathematical problems.

Table 1. Detailed Information About Participants in the Experiment.

Group	Total number	Percentage (%)	Total
Experiment	42	52%	80 (100%)
Control	38	48%	
Gender	**Female (45)**		80 (100%)
	Control 20	Experimental 25	
	Male (35)		
	Control 15	Experimental 20	

The content of the questionnaire consists of 10 main questions, and this questionnaire is aimed at determining the level of interest of future mathematics teachers in solving school mathematical tasks. Questions allow us to evaluate students' approaches to solving mathematical problems, the ability to think creatively and logically, as well as their interests in relation to methods and techniques for solving them.

H01: the methods and techniques used in the process of training future teachers of Mathematics by solving school mathematical tasks do not have a significant impact on the skills of future teachers to solve mathematical tasks.

H02: innovative teaching methods used in the process of training future teachers of Mathematics by solving school mathematical tasks significantly improve the skills of future teachers in solving mathematical tasks. Using the data collected based on the results of the survey, the effectiveness of the dependent variable between the control and experimental groups was evaluated.

The independent selective t-criterion was used in order to compare the levels of skills and interest related to solving mathematical tasks between the two groups on data after the experiment. This method made it possible to compare the changes between the two groups and determine the effectiveness of the dependent variable associated with solving mathematical tasks.

As a result of the analysis, it was shown that the abilities and interest of future mathematics teachers in the experimental group in solving mathematical

tasks improved significantly compared to the control group.

3. RESULTS

As a result of the search and compilation of articles on key words, the authors found a large number of articles related to the training of future teachers by solving school mathematical tasks. However, the authors selected only 10 articles for review. When selecting articles, such criteria as publication dates, Journal Rating, Research Base, study participants and methods used in the study were taken into account. The result of the analysis of scientific literature, substantiates the relevance of the research topic. The problem of training future teachers of mathematics by solving school mathematical tasks is currently of great importance, since teachers should be provided not only with subject knowledge, but also with methodological skills aimed at developing students ' logical thinking, analytical abilities. However, it is noticeable that the process of solving mathematical tasks has aspects that are not sufficiently studied in the development of pedagogical and mathematical thinking abilities of future teachers. The lack of research is especially relevant in relation to the role of solving school mathematical tasks in the development of the creative abilities of future teachers, as well as in the problems of deepening students ' mathematical skills through the use of various methods and techniques. In addition, there is a shortage of Special Research on the development of methods and tools that are necessary for the training of future teachers by solving school mathematical tasks.

The training of future teachers of mathematics by solving school mathematical tasks provides effective teaching methods. This method allows students to apply their mathematical knowledge in real life. Promotes the development of critical thinking and problem-solving skills for future mathematics teachers. By solving mathematical tasks, the path to effective organization of active communication and team-work opens up. This will help develop the mathematical and pedagogical abilities of future teachers. Increases the ability of future mathematics teachers to use creative and innovative approaches to increase their interest in mathematical skills. Also, the solution of mathematical tasks gives future teachers a professional orientation and opens the way to improving their pedagogical skills. This method ensures that future mathematics teachers are prepared for changes and methodologies in the field of education by acquiring the necessary skills in the training process [13].

An important role is played by the process of training future teachers of mathematics, the development of their reading and teaching skills. Mathematics teachers deepen their knowledge and improve their professional skills by solving mathematics tasks at school. For this purpose, it is necessary to use effective methodologies. Solving mathematical tasks at the school level is the main tool for the professional training of future teachers. Teaching students to solve various tasks, from simple problems to complex mathematical problems, will allow future teachers to develop mathematical logic and creative thinking.

Figure 1: Methodology for Solving Mathematical Problems.

As a result of using the "teaching problem solving strategies" approach in the methodology for solving mathematical tasks, students learn different computational approaches and master their application in different situations. The use of a step-by-step explanatory approach shows the progress of solving the problem in steps, explaining the logical basis of each step develops the mathematical thinking of future teachers. Demonstrating several ways to solve each task using the multi-variant problem approach will help future teachers develop their own learning methodology. The training of future teachers of mathematics by solving school mathematical tasks deepens their professional

knowledge and increases their pedagogical skills. This process allows teachers not only to improve their mathematical skills, but also to form the ability to conduct classes in effective and interesting ways for students.

Example 1 solving geometric problems Goal: to prepare future mathematics teachers for geometry lessons at school.

Calculation calculate the height of an isosceles triangle if its side is 10 cm long.

Method for the teacher: in the process of solving this problem, ways to apply the Pythagorean theorem are explained and effective methods of communicating the steps of the solution to students are discussed.

Example 2 practical problems Goal: to use problems for the development of students ' life skills.

Calculation one item is sold in the store with a 15% discount. If the starting price of the item is 2000 tenge, find the price received at a dis-count.

Method for the teacher: future teachers will be shown ways to communicate percentage calculations in a language that students under-stand, as well as explain the importance of connecting with everyday life.

Example 3 Combinatorics problems Goal: the development of logical thinking.

Calculation how to choose 2 people out of 5?

Method for the teacher: future teachers are shown methods of ex-plaining combination formulas and communicating them to students through visualization.

These examples are based on the effective organization of communication between theory and practice in the process of preparing future mathematics teachers.

The method of mathematical and statistical analysis of the data obtained during the pedagogical experiment was effectively used. This method made it possible for future mathematics teachers to evaluate their mathematical skills, analytical thinking abilities and methodological creativity by solving school mathematical tasks. The use of the method of mathematical and statistical analysis requires some calculations. for the calculation of the t test, the arithmetic mean, standard deviation are the main parameters.

The calculation of the arithmetic mean value is shown in the expression (1).

$$\hat{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

Where

$\hat{X}$ — arithmetic mean;

X_i — each element in a data set;

n — number of elements (number of samples).

The next step is to determine the standard deviation. A parameter that shows how many times the results deviate from the standard deviation mean. The determination of the standard deviation is carried out according to the expression (2).

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \hat{X})^2$$

Where

S — sample standard deviation;

X_i — each element in a data set;

$\hat{X}$ — sample mean;

n — number of elements (number of samples).

The result of determining two parameters allows you to determine the T test. the T test determination expression (3) is shown in the expression.

$$\hat{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

Where

$\widehat{X_1} - \widehat{X_2}$ — average values of the first and second group;

n_1 & n_2 — size of samples of the first and second group;

S_1 - S_2 – standard deviation of samples of the first and second groups.

In the calculation of the value of P, the value of the Test t and the degree of freedom (df) are used. As a result, the statistical significance of the difference between the two groups is determined. The study analysed the results of preliminary tests for the control and experimental group in order to assess the ability of future mathematics teachers to solve school mathematical tasks. According to these results, we used the t-test to assess the difference between the two groups. with the help of the t-test, the level of solving mathematical tasks of the experimental group and the statistical significance of indicators in the control group were determined. The difference between the two groups before the study is shown in Table 2.

Table 2: The Difference between the Two Groups before the Study.

Group	n	X	Sd	df	t	p
CG	38	5,3	1,9	78	0,3247	0,7462
EG	42	5,45	2,2			
* n is the number of elements in the sample, X is the arithmetic mean value, Sd is the stand-ard deviation, df is the degree of freedom, T is an Independent t test, the average difference is important at p ≤ 0.05;						

The results of the two pre-study groups t (78) = 0.3247, P > .05.this, in turn, indicates that there is no significant difference between the students before the study. In the process of preparing future teachers of mathematics by solving school mathematical tasks, the method used for the experimental group contributed to increasing the interest of students. This method made it possible for future teachers to have a deep understanding of the subject of mathematics and achieve high results in solving mathematical tasks. The use of the method of solving school mathematical tasks contributed to the development of students ' mathematical thinking, improved their logical and analytical skills. A distinction was made between the control group, which was educated by the traditional method, and the experimental group, which was educated by the method of solving mathematics tasks. It was noted that the experimental group had a high interest and results in solving mathematical tasks, which indicates the effectiveness of the method of solving school mathematical tasks in teaching mathematics. The difference between students in the post-research period is shown in Table 3. These results prove the effectiveness of using the method of solving mathematical tasks for future teachers and show that they contribute to improving the quality of teaching.

Table 3: The Difference between the Two Groups after the Study.

Group	n	X	Sd	df	t	p
CG	38	5,5	1,8	78	6,7829	0,0001
EG	42	7,8	1,2			
* n is the number of elements in the sample, X is the arithmetic mean value, Sd is the stand-ard deviation, df is the degree of freedom, T is an Independent t test, the average difference is important at p ≤ 0.05;						

The statistical significance of the test result on the level of students after the study was: t(78)=6.7829. p < 0.05, that is, it shows that there is enough evidence to reject the null hypothesis. Based on the results obtained, the H01 hypothesis was refuted. That is, innovative teaching methods used in the process of training future teachers of mathematics by solving school mathematical tasks significantly improve the skills of future teachers in solving mathematical tasks. In conclusion, it should be noted that the training of future teachers of mathematics by solving school mathematical tasks allows them to improve their mathematical skills and develop the ability to think analytically, draw logical conclusions and work creatively in the learning process.

4. DISCUSSION

The results of this study provide opportunities for using the method of solving school mathematical tasks, in particular, the effectiveness of future teachers in developing mathematical skills, making the educational process interactive, and new approaches aimed at improving the ability to think mathematically. By comparing these results with the results of other scientific papers, it is possible to demonstrate in detail the advantages and limitations of the method of solving mathematical tasks. It shows that there are differences between the interest of future teachers in solving mathematical problems and the difficulty of teaching them. In addition, they note the need to improve their experience in solving the problems of teaching methodologies and mathematical education [14]. Solving mathematical problems in the education system, contributes to the development of logical thinking and deep learning of students [15]. It shows that by combining various strategies for solving problems in the educational program, it is possible to increase the desire of students to solve the problem, and these approaches contribute to improving the quality of mathematical education [16]. It is noted that the method of solving mathematical tasks by students contributes to the development of students ' critical thinking abilities, deepening their mathematical understanding and increasing interest in learning [17]. Our scientific research shows that future mathematics plays an important role in the process of preparing teachers for solving school mathematical tasks. The use of new methods in teaching mathematics increases students ' interest in solving mathematical tasks and contributes to the development of their logical and critical thinking abilities.

5. CONCLUSION

Training of future teachers of mathematics by solving school mathematical tasks is one of the most important and effective areas in the education system. The results of the study show that by solving mathematical tasks, the analytical thinking abilities and mathematical skills of future teachers are significantly developed. This process forms for future teachers not only theoretical knowledge, but also the ability to effectively convey them to students, to teach mathematics in an interesting and understandable way. In conclusion, the training of future mathematics teachers by solving school mathematical tasks is an important tool that increases their professional competence and contributes to improving the quality of Education. This process will make mathematics more effective and interesting by introducing new teaching methods and technologies. The research emphasizes the integration of

theoretical knowledge and hands-on practice, fostering critical thinking, pedagogical strategies, and subject mastery. Results indicate that structured training programs, incorporating real-world mathematical problems and reflective teaching methods, significantly enhance teacher competence and confidence. This approach not only prepares future educators for effective classroom management but also develops their ability to inspire analytical and creative problem-solving skills in stu-dents, ensuring a robust foundation for their professional growth.

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