



TRAINING OF FUTURE TEACHERS OF MATHEMATICS TO THE FORMATION OF RESEARCH SKILLS OF STUDENTS

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Abstract:

This article describes the preparation of future teachers of mathematics to the formation of research skills of students. Targeted formation of research skills of students in accordance with the modern model of education of Kazakhstan in the conditions of modernization of secondary education requires: improving the research training of students, ready for effective work in schools. The purpose of the study is to prepare future teachers of mathematics to the formation of research skills of students through solving math problems. The study used research methods as analysis of scientific-methodical and special literature on the research problem; study and analysis of curricula and standards of professional-pedagogical skills, curricula, textbooks and learning materials; pedagogical observation; interview; survey; testing. As a result, students showed willingness to formation of research skills of students through solving math problems. The paper shows methods of solving mathematical problems. The article proposes a solution to the problem of formation of research skills of students on the basis of the decision search task.

Keywords: *Research Competence; Research Skills; Methods; Search Tasks; University Education.*

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1. Introduction

The modern school needs professionally competent teachers, able to think creatively, to find creative solutions, be proactive, ready to teach students to independently search for information, project and research activities. In this context, is the main task of the higher school – to develop a new generation of teacher-researchers focused on the needs of innovative economy of knowledge.

The reform of school education in the framework of the Concept of modernization of education of the Republic of Kazakhstan the basic element of change highlights comprehensive school. However, the current educational practice shows that in the University system of training not

enough attention is paid to the preparation of future teachers of mathematics to research. To date, the theory and practice of vocational education do not have the technology of formation of research skills of students on the basis of solution of mathematical tasks; hence there is a need of training of future teachers of mathematics to the formation of research skills of students.

Accordingly, **the actual problem** of higher schools is to train future mathematics teachers to the formation of research skills of students through the development of research competence of the students themselves.

We previously defined the concept of "scientific competence" and identified pedagogical conditions of formation of research competence.

All of the above points to the relevance and unquestionable practical interest of this work.

- **The subject of research** is the creation of conditions for training of future teachers of mathematics to the formation of research skills of students.
- **The purpose** of the study is to prepare future teachers of mathematics to the formation of research skills of students through solving math problems.

2. Materials and Methods

The study used research methods as analysis of scientific-methodical and special literature on the research problem; analysis of the curricula and standards of professional pedagogical specialties; curriculum, textbooks and instructional materials; pedagogical observation, interview, questionnaires, tests;

Methodology- Methodological basis of research are the fundamental work in the field of: pedagogy and psychology; professional preparation of teachers in teacher education; theory and methods of teaching at the pedagogical University; research in the field of natural disciplines; the concept of competence-based education; research in the field of formation of research skills of students.

To achieve the purpose of the study was guided by the following hypothesis: if we introduce the research method in educational process of pedagogical universities, we will increase the level of readiness of students to the formation of research skills of students, as the increased independence and activization of cogitative activity of the student;

Experimental work was carried out during the production practice. Students wrote project work and his scientific ideas were introduced directly to the school.

At the end of the internships were organized by interview. Students at the final conference presented their research work on the formation of research skills of students. The results of the project work, reports, course work are assessed at the end of each semester. The students of the experimental group showed an increased result in the ability to solve problems of increased difficulty, and executions of the projects and coursework.

Training of future teachers of mathematics to the formation of research skills of students through the development of research competence of students is one of the main tasks of teacher education. We previously defined the concept of "scientific competence" and identified pedagogical conditions of formation of research competence. The concept of "research competence" was defined as follows: "the research competence of undergraduate mathematics is a holistic, integrated characteristic of personality of a future teacher of mathematics, manifested in his willingness to take an active research position in relation to the educational mathematical activity and allows obtaining the best research results" [7].

In our Kazakh state women's pedagogical University at the Department of mathematics conducted a lot of work to prepare highly qualified teachers for secondary schools in the framework of the competence approach. We have developed a course "Formation of research competence of teachers in the framework of the new paradigm of mathematics education".

Formation of research competence of students and, through them, students occurs when research activities. Research activity of schoolchildren is an organized creative and educational work of students that meets on the structure of scientific activity and forms in the result of research skills, cognitive motives, promotes the assimilation of new knowledge and ways of working [4].

3. Results and Discussions

In this paper, we consider the preparation of future teachers of mathematics to the formation of research skills of students through solving math problems.

In school learning activities in mathematics, especially brightly expressed process of mastering of research skills. When solving mathematical problems, as pointed out by A.J. Hinchin, brought the right mindset and especially the students are accustomed to a full-fledged argument. The decision must be fully justified, are not allowed illicit generalizations, unsubstantiated analogy, the requirement of completeness disjunction (all cases given in the problem), marked on the completeness and consistency of the classification. When solving mathematical problems students have formed a special style of thinking: respect for formal logic reasoning, concise expression, clear division of the course of thought, accuracy of characters [9]. Thus, mathematics education contributes to the intellectual activity of the students. The solution of problems, theorem proving is a kind of research. Since the solution of complex problems is when the search operation is used research method.

The research method involves the construction of the learning process, like the process of scientific research. The implementation of the main stages of the research process is carried out in an accessible form. Research method differs from other teaching methods by the nature of the learning activities I.Y. Lerner and V.A. Slastenin determines the nature of the research method as "a way of organizing search, creative activity of students to address new problems" [6]. The research method involves the independent solution of a cognitive task, selection of appropriate methods of solution under the guidance of a teacher. In the process of research activities are most fully manifested initiative, independence and creativity.

In the modern school students are also working on an educational project of the student. An important feature of this research method is that in the process of solving some of the problems a new problem arises. Educational research is different from research in several significant features. Students in the process of problem-based learning self-discover "new" that science has long been open. Students at this stage of his training activities are considered to be pioneers. The application of the research method in teaching forms the research skills of students. Educational research is conducted by students under the guidance of a teacher. Such assistance should be invisible. Students should think that they reached the goal.

Initial skills in research activities can be obtained by students in the classroom during problem solving and theorem proving. Research activity takes place at solutions of the problem. Mathematical tasks have are the educational, developmental and educational functions. As you know, in the process of problem solving occurs:

- education of such qualities as intellectual honesty, objectivity, perseverance, independence, ability to work;
- orientation of the student to search beautiful, elegant solutions in several ways, contributing to the formation of aesthetic education;
- students extracted mathematical knowledge and develop research skills
- development of creative mental activity.

In the process of research activities solve the following methodological tasks:

- how to teach students to seek and find the way evidence and solutions;
- how to help students to find ways of solving problems.
- how to form research skills of students.

The best that can be done by the teacher for the learner is that through unobtrusive assistance to give him a brilliant idea".

D. Polya [5] gave the following scheme of solving the problem:

- 1) Understanding the problem;
- 2) Solutions plan;
- 3) Implementation of the plan;
- 4) The study of the obtained solutions.

The student must answer the following questions:

- 1) The original data of the problem. What is known?
- 2) What are you looking for?
- 3) What's the problem?
- 4) Earlier solved such task?
- 5) Do you know any similar problems? It can be used?

At the pedagogical University played a major role courses of a methodological cycle for the preparation of future teachers of mathematics. The course "Workshop on the solution of mathematical problems" covers the most important topics of school mathematics course.

For example, when solving planimetric tasks, students get the opportunity to learn ways and methods of solving planimetric problems: square method, analytical method, method of auxiliary circle, a doubling of the median, the theorem on the bisector of the internal angle of a triangle

and the theorem of tangent and secant to the circle, drawn from one point, facts about the circles associated with triangles and quadrilaterals, angles associated with a circle is about proportional segments, the properties of altitudes and their intersection [1, 2].
Consider the planimetric tasks.

Task 1:

In the quadrilateral ABCD $\angle DAB = 90^\circ, \angle DBC = 90^\circ, DB = a, DC = b$. Find the distance between the centers of two circles, one of which passes through the points D, A иB, the other through the points B, C и D [8].

Solution:

The Teacher holds preliminary. The repetition of theoretical material:

- Diameter of the circumscribed circle around a right triangle is the hypotenuse;

Theorem of Thales.

- Students delve into the content of the task;
- students distinguish the original data of the problem; Students will make a drawing.

A well-executed drawing facilitates the search for solutions.

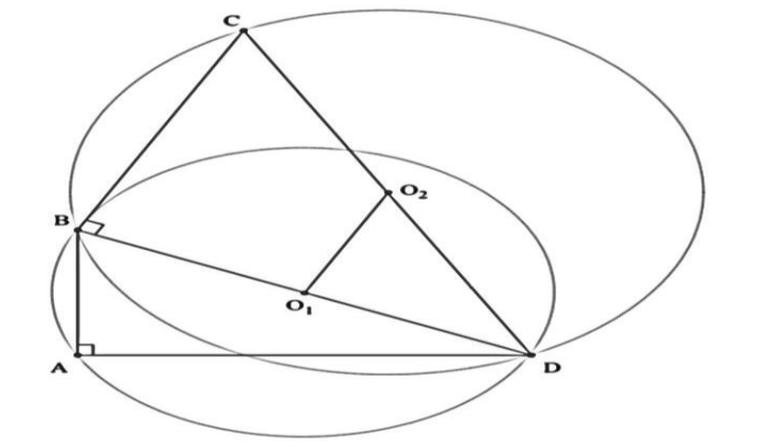


Figure 1:

A circle passing through the points D, A and B, described around a right triangle $DAB (\angle A = 90^\circ)$. Therefore, its center (point O_1) lies in the middle of the hypotenuse BD.

Similarly, the center of the second circle (point O_2) lies in the middle of the hypotenuse CD.

We have an angle $\sphericalangle BDC$, point O_1, O_2 the middle of its sides DB, DC. The picture tells what you need to apply the inverse theorem of Thales: "If straight, crossing the other two are straight, cut off at both of them equal segments, starting from the vertex of the angle, then these lines are parallel (Figure 1).

Then cut O_1O_2 is the middle line of the triangle DBC .

From $\triangle DBC (\angle B = 90^\circ)$ by the Pythagorean theorem $BC = \sqrt{b^2 - a^2}$.

Here, $O_1O_2 = \frac{1}{2}BC = \frac{1}{2}\sqrt{b^2 - a^2}$.

Answer: the distance between the centers of the circles is equal to $\frac{1}{2}\sqrt{b^2 - a^2}$.
Research skills form the solution of one problem two ways. Here is an example.

Task 2:

By given three sides of a triangle a, b and to find the lengths of the medians drawn to the sides.

Solution:

The problem is solved using the spherical law of cosines. We show two methods of solving the problem.

1-method:

Triangle ABC add to a parallelogram ABCD. Apply the property of the diagonals parallelogram (Figure 3):

$$(2m_b)^2 + b^2 = 2a^2 + 2c^2,$$

Here $m_b = \frac{1}{2}\sqrt{2a^2 + 2c^2 - b^2}$

Similarly, we find:

$$m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2} \text{ и } m_c = \frac{1}{2}\sqrt{2a^2 + 2b^2 - c^2}$$

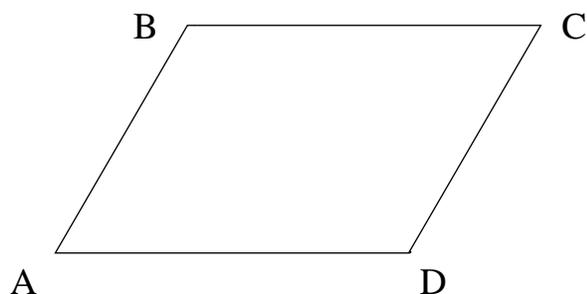


Figure 2:

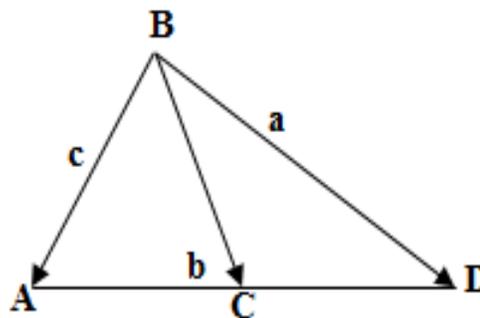


Figure 3:

2-method:

Apply the vector method (Figure 3.).

$$\overrightarrow{AB} = \vec{c}, \overrightarrow{BC} = \vec{a}, \overrightarrow{AC} = \vec{b}, \overrightarrow{BD} = \vec{m}_b.$$

$$\vec{a} + \vec{c} = 2\vec{m}_b \tag{1}$$

$$\vec{a} - \vec{c} = \vec{b} \tag{2}$$

Constructed in two parts in the square, we have:

$$a^2 + 2\vec{ac} + c^2 = 4m_b^2 ; \quad (3)$$

$$a^2 - 2\vec{ac} + c^2 = b^2 , \quad (4)$$

Pocino fold equality(3) and (4):

$$2a^2 + 2c^2 = 4m_b^2 + b^2$$

$$m_b = \frac{1}{2}\sqrt{2a^2 + 2c^2 - b^2}$$

Similarly, we find:

$$m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2} \quad \text{и} \quad m_c = \frac{1}{2}\sqrt{2a^2 + 2b^2 - c^2} .$$

Answer:

$$m_b = \frac{1}{2}\sqrt{2a^2 + 2c^2 - b^2} ; m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2} ; m_c = \frac{1}{2}\sqrt{2a^2 + 2b^2 - c^2} .$$

4. Conclusions and Recommendations

Systematic solution of problems promotes conscious and strong mastering of the theory helps to see its practical value, forming research competence. Thus, we see that the solution search task is an effective method in the preparation of future teachers of mathematics to the formation of research skills of students.

Introduction of research method in educational process of pedagogical higher education institutions have increased the level of readiness of students to the formation of research skills of students. This hypothesis was confirmed. During the pedagogical practice students has shown independence in the work with students. The third year students have successfully completed group project work on the topic: "Methods of solving mathematical problems in 5-8 classes". The students of the experimental group showed an increased result in the ability to solve problems of increased difficulty, and executions of the projects and coursework.

References

- [1] Atanasyan, L.P, A ,Butuzov, V. F., Kadomtsev, S. B. ,Yudin, I. I. Geometry. Moscow: Education; 1997. – 176 p.
- [2] Atanesyan, L. S., Denisova N., Silaev E. V. Course of elementary geometry. Moscow: Syntax Press, 2007.
- [3] Didactics. Part II. The process of technology learning: textbook / Author-compiler of V. I. Smirnov. – Nizhny Tagil : Tagil state socially-pedagogical Academy, 2012. – 544 p.
- [4] The organization of research activity of schoolchildren. Available at
- [5] <http://veselajashkola.ru/shkola/organizaciya-issledovateljskoj-deyatelnosti-shkolnikov/>
- [6] Polya D. How to solve the problem. The translation from English edited by Y. M. Hayduk. Moscow: Academic pedagogical publishing of the RSFSR, 1959.

- [7] Slastenin V. A. etc. Pedagogika: Ucheb.a manual for students. ouch. PED. proc. Institutions. Moscow: Publishing center "Academy", 2002. - 576.
- [8] Kaskatayeva. B.R. (2014) Pedagogical conditions for forming the research competency in future teachers of mathematics. Proceedings of the 7th International Scientific Conference "Rural Environment, Education, Personality –REEP 2014", pp103-109. [online] [08.02.2014]. Available at <http://lufb.llu.lv/conference/REEP/2014/Latvia-Univ-Agricult-REEP-2014proceedings.pdf>
- [9] The information search system. The task of geometry. Task № 435. Available at <http://zadachi.mccme.ru/2012/#&page44>
- [10] Khinchin. Ya Pedagogical articles. Moscow: Izd.Academy of PED.Sciences of the RSFSR. Available at <http://scilib.uk.to/Math/Khinchin/Khinchin.htm>

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