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DIAGNOSTICS OF THE FORMATION OF RESEARCH SKILLS OF PRIMARY SCHOOL CHILDREN IN MATEMATICS LESSONS

The article discusses the problem of the formation of research skills of Primary school students in mathematics lessons. The relevance of the study is determined based on regulatory documents. In the course of the study, the essence of the concept of research skills in domestic and foreign studies through the theoretical method and the advantages of research skills are described. In accordance with the motivational, substantive and reflexive components of the formation of research skills of primary school students are selected through diagnostic methods. The results of the empirical study made it possible to comprehensively diagnose the level of development of students' research skills for each component. According to the obtained quantitative data, it was concluded that a formative research stage is necessary due to the low level of research skills of primary school students. The results of the study provide the following scientifically based recommendations: systematically introduce problem situations, logical tasks, and tasks of a research nature into the content of primary school mathematics lessons in order to develop students; develop a system of methodological tools and tasks for primary school teachers to organize students' research work. This study offers practical implications for the preparation and continuing professional development of primary school teachers. Diagnostic data on the development of research skills among primary school students in mathematics lessons may be incorporated into the educational process of pedagogical universities and colleges. In addition, the findings can serve as a resource for institutions providing teacher preparation, retraining, and professional development programmes.

Keywords: research skills, mathematics, interest, design, logical thinking, creativity, diagnostics.

Introduction

The need for the formation of a fully developed creative and research personality is growing. One of the reasons for this is the rapid development of modern science and technology, in an era of increased data flow. In order to quickly adapt to such innovative changes, it is necessary to master the level of search, research, and logical thinking within the framework of primary education subjects.

In this regard, the Law of the Republic of Kazakhstan “on education” obliges to increase the competitiveness of individuals who are concerned about the fate of the country of tomorrow [1].

“State General Obligatory Standards of preschool education, and training, primary, basic secondary, general secondary, technical and vocational, postsecondary education” [2] and the curriculum of grades 1-4 of the academic discipline “Mathematics” academic subject [3] define the main goals and objectives of Education, emphasize the need to creatively apply knowledge, think critically and, most importantly, form students skills’ to conduct research.

Additionally, the concept of development of preschool, secondary, technical and vocational education in the Republic of Kazakhstan for 2023-2029 reflects the development of functional literacy, critical thinking and research skills of students as priorities of the education system [4].

The announcement by the head of State K. Tokayev at the second central Asia-China summit next year as the “Year of Education and Scientific Research” [5] indicates the need to pay special

attention to the research work of students in the future and pay special attention to the formation of their research skills.

And this increases the need for primary school students not only to acquire knowledge, but also to gain comprehensive experience, to independently set learning goals, to design ways to implement them, to develop skills to monitor and evaluate their achievements, especially in engaging in research activities. In this regard, the problem of forming students' research skills by solving problems in elementary school mathematics education is highly crucial.

Theoretical studies indicate that certain aspects of fostering research skills in primary school students have been examined. However, the issue of developing analytical skills in students during mathematics instruction in primary grades remains insufficiently explored. This highlights the relevance of addressing the development of research skills among primary school students in mathematics lessons.

The purpose of the study is to diagnose the formation of research skills of primary school children in mathematics lessons.

Research objectives: to determine the essence of the concept of “research skill”; to determine the components, criteria and indicators of the formation of analytical skills in primary school children in mathematics lessons, to obtain the initial data on the formation of primary school children in mathematics lessons.

The scientific novelty and practical significance of the work are demonstrated by the diagnostic assessment of the formation of primary school students' research skills during mathematics lessons, as well as by the applicability of the research findings in higher pedagogical institutions and colleges, and in institutes for the training, retraining, and professional development of primary school teachers.

Materials and research methods

The study was grounded in a theoretical approach that enabled the clarification of key concepts related to the research topic, an examination of the the importance of research skills development among primary school students, and a review of relevant scientific literature. Empirical methods were subsequently applied to examine the research problem in practice, with the collected data presented in quantitative form. Specifically, the following were used: G.N. Kazantseva's “Studying Attitudes to the Subject of Research” method, the “Questionnaire for Determining Activity and Motivation for Learning Mathematics” (Author's Questionnaire), the “Determining Students' Research Skills” diagnostic chart (based on A.I. Savenkov), the “My Attitude to Research Activity” questionnaire (modified by Yu.A. Kazimirova), and A.V. Karpov's “Diagnosing the Level of Reflexivity Development” method. These methods were selected taking into account the motivational, substantive, and reflexive components of developing students' research skills in mathematics.

The following data were obtained as a result of a theoretical study of the study:

The concept of “Research” can be viewed as “both scientific work and a type of human activity aimed at obtaining knowledge, understanding and evaluating the essence, specificity, and patterns of development of phenomena, as well as searching for opportunities to apply the acquired knowledge, including in the study of the natural environment” [6].

Research skills are a person's ability to create new concepts and ideas by collecting data. These skills include methods, documentation, and interpretation of collected data. The research is conducted to evaluate hypotheses and disseminate the results in the most appropriate ways. Research skills are involved with experience [6].

Studies indexed in the Scopus database also addresses the issue of developing research skills among primary school students. A group of scholars led by Rizayeva examined the potential of mathematical problems in fostering research skills [7], while Fry, Nakar, and Zorn investigated the possibilities of an inquiry-based approach in mathematics and the pedagogical challenges associated with its implementation [8]. Domestic studies have explored the theoretical and diagnostic aspects

of cultivating a research culture and research skills [9, 10]. While Bapanova and her colleagues emphasized the need to employ diagnostic methods and criteria in assessing research skills [11], López Chira empirically examined an educational model aimed at developing the research skills of primary school students [12]. These studies form the theoretical basis of our research.

Sky Ariella defines research skills as “the ability to find specific information on a certain topic” [13]. He says that research skills include “the ability to identify the necessary data, find and formulate the results, and then explain to others”. The author offers 12 much more important research skills, which include: data collection; analysing information and data from various sources; searching for information on the internet; writing reports; getting the interviews; planning and charting; critical thinking; studying the necessary issues; setting time; communication skills; using your own network; managing; assigning meaning, despite all the big and small information [13].

Advantages of research skills:

- increases interest: interest – curiosity is the passion for learning new things and a powerful engine of learning. Inquisitive people are able to listen well and are willing to consider not only their own ideas and perspectives, but also to the ideas and views of other people. Intrigued researchers ask many questions that naturally need to be answered and they especially focus on finding answers to the questions.

- Develops self – awareness: in addition to knowing the subjective opinions of others, it is crucial to develop research skills, as well as to know the benefits of knowing what research provides, we get to know many people through our research. From the very beginning of the research, the benefits we derive from it are reflected in beliefs and attitudes and encourage them to open their minds to look at others points of view and things.

- Empowering researchers to share their findings.

Providing researchers with a space and platform to present their research and share their results can be crucial to maintain motivation for future research.

Z.A. Isaeva characterised: “research skills are primarily gnostic and design skills, on the basis of which one can acquire new knowledge and master new actions”, “teacher's research skills are the ability to perform professional teaching activities in new conditions and new approaches and tools, the ability to apply research methods” [14]. We believe that, agreeing with the author's opinion, the solution of educational research tasks for the formation of research skills of primary school students is implemented within the framework of mathematical and logical thinking, the use of research methods and techniques.

Studying the above considerations, we formulate a research skill as an automated skill of students' intellectual and practical abilities necessary for searching, summarising, analysing and evaluating, demonstrating the results of information.

In accordance with the specifics of the mathematics subject, the main focus is on the deep assimilation of knowledge by students. Teachers face obstacles in making effective use of their time for research activities. It also depends on the composition of the research assignments. The study by K.T. Turalbayeva, G.S. Dzharasova, I.Zh. Zhumatova, G.T. Sagnaeva, and B.K. Asemova notes that the development of a database of math assignments is a multi-step process. It includes the stages from the preparation of tasks to verification, correction and approbation [15]. Assignments for developing research skills are also such a multifaceted process in which it is necessary to take into account such factors as the student's capabilities, specifics, condition, environment, etc.

Having studied the analysis that is defined as “the development of students' research skill through solving problems in teaching elementary school mathematics is a thought process aimed at thinking, reasoning, comparing, grouping, mastering, searching methods through solving educational and cognitive research tasks and creative, logical tasks of students”. Thus, an experiment is conducted to achieve the task of determining the level of developing analytical skills that are of great importance in the formation of schoolchildren' intelligence. in mathematics lessons.

The purpose of the ascertaining experiment is to determine the initial level of formation of research skills of primary school students and the process of formation of students' research skills.

Two groups (control and experiment) were taken to carry out experimental work. 63 students of the 3rd grade of the E. Izatullaev Comprehensive school in Turkestan region was acquired which was divided into control (31) and experimental groups (32).

During the organization of the exploratory and experimental work:

- the purpose of pedagogical experimental work is defined;
- the requirements for the experiment and the stages of its implementation are determined;
- the content of the experiment is characterised;
- the composition of the control and experimental groups participating in the experiment is described;
- the methods and approaches of determining the level of developing children's research skills.

To determine the initial level of research skill development, the participants completed a set of diagnostic tasks.

Diagnostic methods selected in accordance with the components of research skill development in primary school mathematics lessons are presented in Table 1.

Table 1 – Methods selected by components

Component	Methods
Motivational	1) Methodology of G. N. Kazantseva "study of attitude to the subject of study" 2) "questionnaire for determining educational activity and motivation in Mathematics" (author's questionnaire)
Content	1) diagnostic card "determining the research skills of students" (according to A. I. Savenkov) 2) questionnaire "my attitude to research activities" (Modification of Yu. a. Kazimirova)
Reflective	Methodology of A.V. Karpov "diagnostics of the level of development of reflexivity"

First, to determine the motivational component, we used the "methodology for studying the attitude of G.N. Kazantseva to the academic subject". This methodology is based on the DC section, in which we conducted research based on the materials of the first 3 sections.

Section I is devoted to writing the subjects that the student likes the most, as well as the subjects that he likes the most.

Part I:

The best of the subjects studied in school:

A. Subjects that I like: _____

B. subjects that I don't like: _____

The students "I love mathematics" were selected from two questions. Of the two groups that participated in the experiment, 56 out of 63 students said "love", and 7 wrote "dislike". The students who answered the question of part I positively were asked questions of part II, "I don't like mathematics" - of part III. In fact, there are 21 questions in both sections, we chose only 11 based on the age characteristics of younger students and depending on our research problem.

Part II.

Express your point of view, complete the sentence:

I love mathematics because...

1. It's an interesting subject.
2. I like that the teacher drives well.
3. Everyone needs mathematics.
4. Easy to learn.
5. Teaches you to think.
6. I'm learning observation and intelligence.

7. My friends love.
8. My parents consider math to be very important.
9. The teacher loves me.
10. It changes the environment.
11. I'm interested .

I don't like math because...

1. I'm bored.
2. I don't like what the teacher gives.
3. Not everyone needs to know this.
4. It's hard to learn.
5. It doesn't teach you to think.
6. there is no need for observation, intelligence.
7. Friends don't like this subject.
8. My parents consider math less important.
9. The teacher hates me.
10. It does not affect the environment.
11. I'm bored.

Based on the results of the conducted methodology, the main, main motives of students in section I, i.e. the love of mathematics:

- It can be mastered very quickly;
- The teacher teaches mathematics in a clear and interesting way;
- Mathematics is a subject that everyone needs, anywhere.

Part II, that is, the motivation of some students for mathematics based on negative reviews:

- Not everyone needs to know math;
- Unclear, difficult;
- Does not understand some tasks.

The following types of educational motives of the attitude of students of grade 3 to the subject were identified; readiness to study mathematics; desire to know mathematics; cognitive and educational motives; understanding the need for mathematics; presence of research activity. Accepted, fulfilling their motivations.

The purpose of the questionnaire for determining educational activity and motivation in mathematics (author's questionnaire) is to determine the educational activity and motivation of Primary School students in mathematics. The questionnaire includes 6 questions. 63 students took part in the survey.

1. Do you enjoy solving math problems?
2. Do you like to solve problems in math class with interest and do additional assignments besides the textbook?
3. Do you have any problems doing your math homework?
4. Do you like solving problems in the textbook and completing tasks in math?
5. Do you enjoy writing scientific projects and doing research?
6. Do you want to have interesting logical research – problems and tasks in maths that develop research skills?

These diagnostic papers were selected based on the motivational component as it allows to identify students' interests and engagement to the subject, activity in mathematics, and attitude to research assignments.

The main goal of this methodology is to determine the initial level of formation of research skills in primary school children. Filling out the card is carried out according to the following criteria:

Low – level children are characterized by an unstable interest in educational and research work, and they can only complete tasks under the strict guidance of a teacher.; middle-level students are determined by their constant interest in educational and research work, the skills to

solve problems with the help of a teacher and the acquisition of individual skills that allow them to conduct educational and scientific research, the expression of creative components in choosing a topic, methods, and presentation of the results of cognitive search.; At a high level, students are characterized by the dominance of internal cognitive motives for educational and research work, the mastery of a set of skills that allow them to independently seek new knowledge, the manifestation of originality at each stage of research, as well as the presence of creativity and curiosity in research activities.

The diagnostic map for determining students' research skills is presented in the table below (Table 2).

Table 2 – Research skills of primary school children

Students names	Research skills of primary school children								total
	finding a problem	ask a question	Proposing a hypothesis	Defining a concept	classifying	observing	the ability to experiment	drawing conclusions	

Assessment criterias:

3 points – skill is formed;

2 балл – skill is being formed;

1 балл – skill is not formed.

The levels of development of research skills were assessed by the following indicators:

24-21 points – high level;

20-16 балл – medium level;

15-10 балл – low level.

The fourth method used is the questionnaire “my attitude to research activities”, adapted by Yu.a. Kazimirova in Kazakh (modified).

In order to determine the attitude of students to research activities and research skills, we changed the questionnaire of Kazimirova Yu.a. The questionnaire includes 4 questions that allow you to fully assess the attitude of children to research work.

1. “Do you want to engage in research activities?”

a) yes, I would like to try;

b) yes, I would like to be very engaged;

c) I have never thought about it;

d) no it does not interest me at all;

2. “What questions do you like to ask most often?”

a) how does it do the following?

b) why does this happen?

c) how did it come about?

d) I do not like asking questions.

3. “In what extracurricular subject do you like to attend a practical lesson?”

a) I like to go to the circle of artistic creativity, where I like to mix paints and experiment with different materials;

b) I like to go to the math club and solve logical, creative, research problems;

c) I go to the science club, where I like to look at different things under a microscope;

d) I do not participate in practical classes.

4. “Do you want adults to support your interest in scientific research?”

- a) Yes, because it is very interesting
- b) Yes, because I want to learn a lot
- c) Yes, because it will be useful for me in high school
- d) I do not need it, I do not want it

The criteria for evaluating the questionnaire are as follows:

1 question (1,2 – 2 points, 3 – 1 point, 4 – 0 point)

2 questions (1,2,3 – 2 points, 4 – 0 point)

3 questions (1,2,3 – 2 points, 4 – 0 point)

4 questions (1,2,3 – 2 points, 4 – 0 point)

The levels are determined as follows:

0- to 1 point – low level

2- to 4 points – medium, level

5- to 8 points – high level

Using the “Methodology for diagnosing the level of development of reflexivity” by A.V. Karpov, the last of the diagnostic methods - the reflective component of the development of students' research skills through solving problems in teaching elementary mathematics - was identified. Reflection is a single psychological reality both in the cognition of one's own inner world and in the cognition of the external world (including the subjective - “the world of others”). Furthermore, the author conditionally distinguishes two types of reflection: reflection on the content of one's own consciousness and reflection on the course and outcomes of one's own actions, as well as the inner world of another person. Students are asked to respond 27 questions without spending too much time considering their answers and to assign each question a number corresponding to one of the following response options:

- 1 – completely incorrect;
- 2 – incorrect;
- 3 – mostly incorrect;
- 4 – do not know;
- 5 – mostly correct;
- 6 – correct;
- 7 – completely correct.

Among the 27 statements, 15 are formulated as direct items (question numbers: 1, 3, 4, 5, 9, 10, 11, 14, 15, 18, 19, 20, 22, 24, 25). The remaining 12 are inverse statements corresponding to the subjects' answers to direct questions to obtain the final score, and represent inverse numbers that must be taken into account when processing the results if they are replaced by numbers obtained by inverting the response scale, i.e. 1=7, 2=6, 3=5, 4=4, 5=3, 6=2, 7=1. Their numerically replaced indicators are given in Table 3.

Table 3 – Conversion of test scores into Sten values

Sten scores	0	1	2	3	4	5	6	7	8	9	10
test scores	more than 80	81-100	101-107	108-113	114-122	123-130	131-139	140-147	148-156	157-171	more than 172

Reflection is the process of a person's awareness of his inner world (thoughts, feelings, intentions) and the external world (including the inner world of other people). The author divides reflection into two main types;

1. Reflection on the content of one's own consciousness: reflection on the course and results of one's thoughts, feelings, and actions.

2. Reflection of another person's inner world: an attempt to understand other people's thoughts and feelings.

Evaluation of the results according to A.V. Karpov's methodology:

The results are evaluated using A.V. Karpov's methodology. A score of 7 or higher indicates a high level of reflexivity; a score between 4 and 7 signifies an average level; and a score below 4 indicates a low level of reflexivity. The quantitative and qualitative data obtained during the experiment are presented in the next section of the study.

Results and discussion

As a result of the “methodology for studying the attitude of students in the 3rd grade to the subject of study” by G.N. Kazantseva, three main levels of motivation of students were identified:

High level. 10-15 points – high level of motivation and educational activity to study, learn mathematics. Such children will have cognitive abilities and the desire to successfully fulfill all the requirements set by the school. Students carefully complete all tasks in mathematics, understand the essence of tasks and the main place of mathematics in the life of everyone and themselves.

Medium level. 5-9 points – good motivation to study mathematics. Most of the primary school children have such indicators and are successfully engaged in educational activities. The students tried to carefully complete the math assignments, understand the essence of the assignments and the main place of mathematics in the life of each person and themselves.

Low level. 1-4 points – primary school students have a low motivation to learn or study mathematics. Such children are poorly motivated in mathematics lessons, they want the lesson to be canceled. There are significant difficulties in educational activities.

G.N. Kazantseva's “methodology for studying attitude to the subject of study” made it possible to determine the level of motivation of Primary School students (Table 4).

Table 4 – Percentage indicators of the motivation level of primary school children “methodology for studying attitudes to an academic subject” by G.N. Kazantseva

groups	Indicators					
	Low	n	Medium	n	high	n
Control n=31	29%	9	45,2 %	14	25,8%	8
Experimental n=32	31,2%	10	43,8%	14	25 %	8

According to the results of the initial stage (identification): in the control group, the proportion of low-motivated students was 29% (9 students), while in the experimental group this figure increased slightly to 31.2% (10 students). This indicates that there is a significant proportion of students with low motivation for mathematics in both groups. The proportion of moderately motivated students in both groups is 14 students, which are 45.2% and 43.8%. The proportion of highly motivated students in both groups is similar: 8 students, which is 25.8% in the control group, 25% in the experimental group. This indicates that before the start of the study, the number of students with high levels of motivation for mathematics in both groups was approximately equal.

Initial results obtained according to G.N. Kazantseva's methodology shows that elementary school students have different levels of motivation for mathematics. Although the average level of motivation prevails, the proportion of low-motivated students is also significant. The proportion of highly motivated students is relatively small in both groups. This indicates the importance of work aimed at increasing motivation in the formative stage of study.

The results of the control and experimental groups are presented in the form of a diagram below (Figure 1).

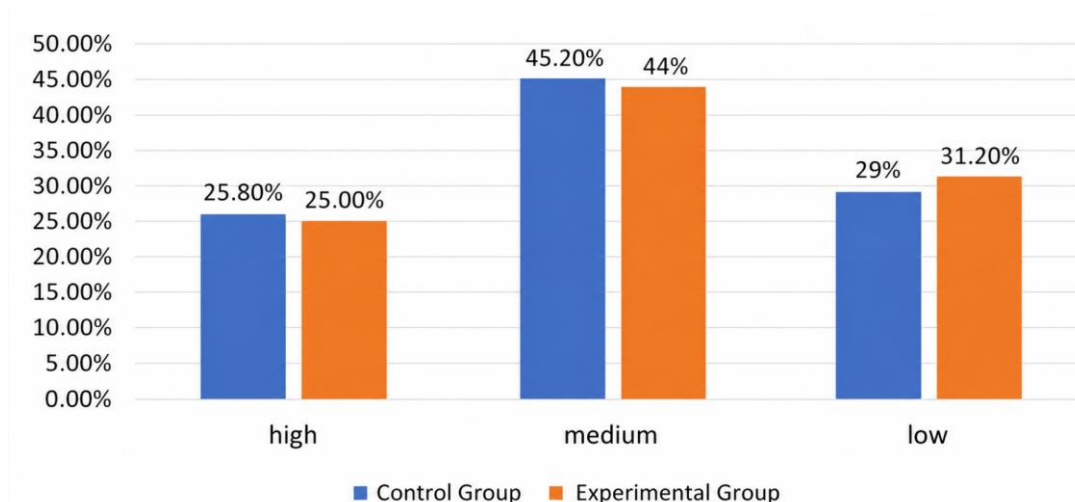


Figure 1 – Histogram of the Percentage Indicators of Primary School Students' Motivation Levels Based on G.N. Kazantseva “Methodology for Studying Attitudes Toward a School Subject”

The questionnaire For determining academic activity and motivation in mathematics (author's survey) allowed us to obtain the following results:

1. *Do you like it when you publish a report?* 52% in the control groups and 53% in the experimental groups showed positive answers to the first question. Negative responses were 48% in the control groups and 47% in the experimental groups. Consequently, the enthusiasm of both groups for writing the report was half of the class.

2. *Do you want to solve problems in math class with interest and solve additional problems besides the textbook?* We see that the majority of both groups answered negatively, that is, those who answered “No” in the control groups showed 55%, and in the experimental groups-54%. Those who answered “Yes” showed 45% in the control groups and 46% in the experimental groups. From these indicators, it follows that, first of all, it is necessary to interest students in mathematics.

3. *Do you have any difficulties doing your math homework?* 41% in the control groups and 38% in the experimental groups showed positive answers to this question. Negative responses were 59% in the control groups and 62% in the experimental groups. We can see that the overwhelming majority answered this question in the negative. Therefore, first of all, we believe that if we explain the tasks to students when doing classwork and interest them in various methods, then we will not have problems with homework.

4. *Do you like to solve problems and complete tasks in a math textbook?* 48% in the control group and 51% in the experimental group showed positive answers to the question. Negative responses were 52% in the control groups and 49% in the experimental group. This shows that half of the respondents can perform research tasks in a textbook.

5. *Do you like writing a paper on a math research project and doing research work?* When asked “no”, the overwhelming majority chose the answer “no”, indicating 66% in the control group and 69% in the experimental group. We conclude that in order to interest students in project work in mathematics and to involve them in research work, it is necessary, first of all, to perform educational and cognitive research work performed in the classroom, solve additional logical research tasks, and develop research skills. And those who chose the answer “yes” showed 34% in the control groups and 31% in the experimental group.

6. *Would you like to work on interesting logical inquiry tasks that contribute to the development of research skills during mathematics lessons?* 61% of the control group and 58% of the experimental group answered this question affirmatively. This indicates a demand among students for interesting logical inquiry tasks in mathematics.

The table below shows the results of the survey conducted during the ascertaining experiment (Table 5).

Table 5 – Survey questions and results

Questions	Answers			
	Control group		Experimental group	
	yes	no	yes	no
1. Do you like Mathematics?	52%	48%	47%	53%
2. Do you want to solve problems in mathematics class with interest and solve additional problems in addition to the textbook?	45%	55%	46%	54%
3. Are you having trouble doing your math homework?	41%	59%	38%	62%
4. Do you like to solve problems on the conditional sign in the textbook and perform tasks in Mathematics?	48%	52%	51%	49%
5. Do you like to write a research project in Mathematics and engage in research work?	34%	66%	31%	69%
6. Do you want mathematics to have interesting logical-research problems and tasks that form the skill of research?	61%	39%	58%	42%

The results of the survey of control and experimental groups are shown in Figures 2, 3 in the form of a diagram.

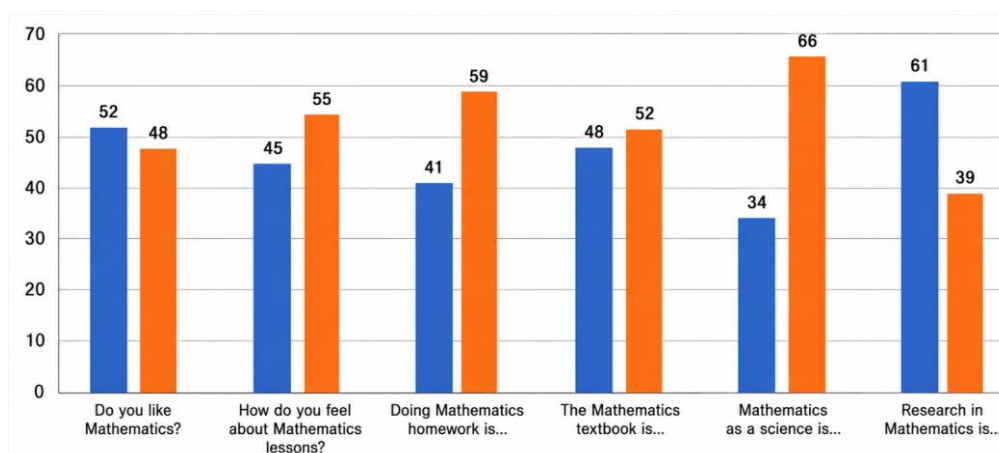


Figure 2 – Control group survey results

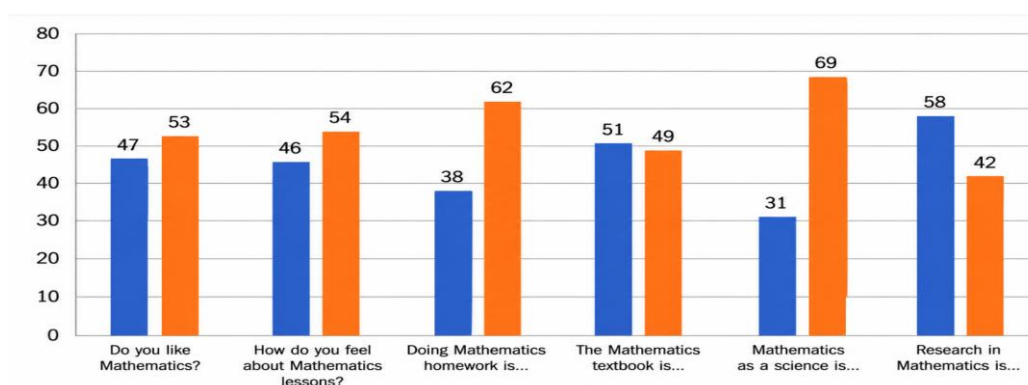


Figure 3 – Experimental group survey results

After analyzing the survey results, the following conclusions can be drawn:

General interest in mathematics (Question 1):

The proportion of mathematics enthusiasts in the control group (52%) is higher than in the experimental group (47%). This shows that the overall positive attitude towards mathematics slightly prevails in the control group.

Enthusiasm for solving additional tasks (Question 2): in both groups, the proportion of those who do not have the motivation to solve additional tasks prevails (55% and 54%). This suggests that motivation to solve additional extracurricular tasks is not high in both groups.

Difficulties with homework (Question 3): In both groups, the proportion of those who have difficulty completing homework is high (59% and 62%). This indicates that students have difficulty completing their math homework. In the experimental group, this indicator is slightly higher.

Sympathy for solving problems in the textbook (question 4): The answers to this question in the two groups are very similar. The sympathy for solving problems in the textbook is approximately equal in both groups.

Interest in research (Question 5): Both groups have low interest in research (34% and 31%). This suggests that younger students generally have low motivation to engage in scientific projects.

The need for tasks that develop research skills (question 6): On this issue, the proportion of those in both groups who answered “Yes” to the need for tasks that develop research skills is higher (61% and 58%). These findings suggest that students are inclined to incorporate research elements into mathematics lessons. The analysis of the survey results obtained during the ascertaining experiment led us to conclude that specific measures are required to enhance primary school students’ learning activity and motivation to study mathematics.

According to the content component of the ascertaining experiment, A. I. Savenkov made it possible to determine the quantitative and qualitative indicators of the levels of students' research skills using the methodology “determining students' research skills” (Table 6).

Table 6 – Percentage indicators of students' research skills derived from the methodology of A.I. Savenkov “determining students' research skills” on the content component of the detection experiment

Groups	Low	Indicators				
		n	Medium	n	High	n
Control n=31	38,7 %	12	48,3%	15	13%	4
Experimental n=32	40,6%	13	43,8%	14	15,6%	5

The results of the ascertaining experiment conducted in accordance with the present methodology showed that:

Low level: in the control group, the low level of research skills was 38.7% (12 students), in the experimental group this indicator was increased to 40.6% (13 students). This may mean that in the experimental group, the initial level of research skills decreased slightly compared to the control group or she had problems with its formation.

Average level: in the control group, the average level of students was 48.3% (15 students), in the experimental group this figure decreased to 43.8% (14 students). This also indicates a decrease in the proportion of middle-level students in the experimental group.

High level: the proportion of students demonstrating a high level of research skills was 13% (4 students) in the control group, compared with 15.6% (5 students) in the experimental group. The difference indicates a modestly higher proportion of students reaching the high level in the experimental group.

The results of the control and experimental groups are presented below in the form of a diagram (Figure 4).

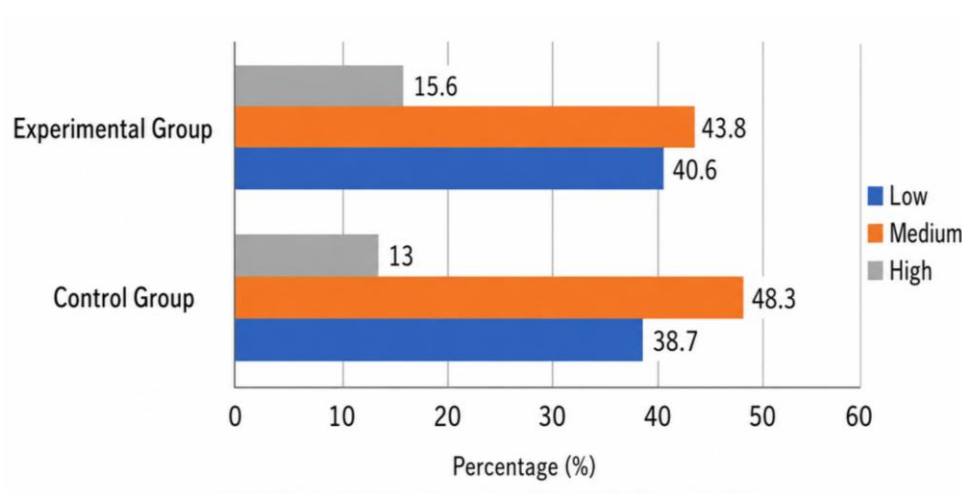


Figure 4 – The results of diagnostics according to the methodology of A.I. Savenkov determining the research skills of primary school children

It can be seen from the picture that most of the students are intermediate and low level. Low motivation of students in the field of research the figure shows that the majority of students are at an average and low level, as well as the fact that they act only under the guidance of a teacher, are not ready for independent activity-indicates the need for students to develop research skills.

Summing up the results of the stage of the study of the substantive component of the experiment by A.I. According to Savenkov, the results of the methodology “determining students' research skills” show that in the experimental group, some indicators of the initial level of research skills (at low and medium levels) slightly deteriorated compared with the control group, and the proportion of students at a higher level increased slightly.

Receiving the first experimental data, the first experimental data on the results were obtained at the initial stage of this experimental work, later in the formative experiment, a set of skills is organized that allow students of the experimental group to independently search for new knowledge, as well as solving problems in teaching mathematics to elementary grades and activities, In order to increase the dominance of internal cognitive motives of students' educational and research work, it is necessary to develop a methodological system for the formation of students' research skills.

According to Table 7, the following results of the survey “my attitude to research activities” were obtained.

Table 7 - The obtained percentage indicators of the survey by Y.A. Kazimirova “my attitude to research activities”

Groups	Indicators					
	Low	n	medium	n	high	n
Control n=31	32,3%	10	51,6%	16	16,1%	5
Experimental n=32	40,6%	13	46,9%	15	12,5%	4

According to the results of the modified survey by Yu.A. Kazimirova, there is a decrease in the level of general interest in research activities in the experimental group. In particular, the proportion of low-level students has increased, while the proportion of middle and high-level students has decreased. The study shows that more than a third of students lack the knowledge, understanding and specific skills of research activities. In the experimental group as a whole, there may be a decrease in interest in research activities compared to the control group or the presence of certain difficulties in its development. In this regard, it can be shown that the research work carried out did not have a positive effect on increasing students' interest in research in the experimental group and

even had the opposite effect. Therefore, the results may indicate the need to revise methods and approaches in future work.

The results of the survey “my attitude to research” (Yu.A. Kazimirova) are shown in Figure 5.

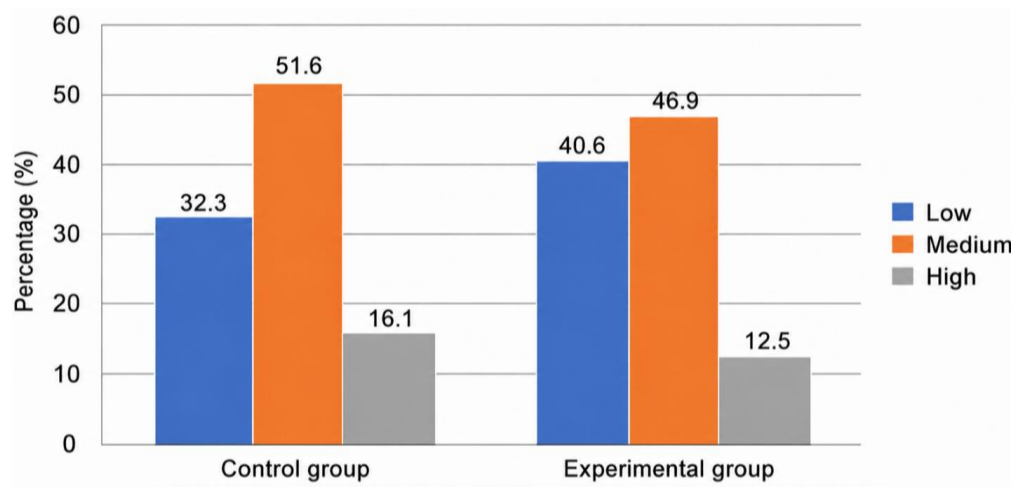


Figure 5 – Diagnostic results according to the method of Yu.A. Kazimirova “my attitude to research activities” at the stage of defining the experiment

The results obtained during the research method, selected according to the reflexive component, are presented in Table 8.

Table 8 - Results of the methodology for determining the reflexive level of students according to the “methodology for diagnosing the level of development of reflexivity” by A.V. Karpov

Levels	Groups			
	Control group n=31		Experimental group n=32	
	%	n	%	n
Low level of reflexivity development	22,6 %	7	21,8%	7
The average level of development of reflexivity	29 %	9	31,3%	10
High level of reflexivity development	48,4%	15	46,9%	15

Table 8 presents the results obtained using the “methodology for diagnosing the level of reflection development”. It shows that the proportion of students demonstrating a low level of reflection is roughly the same in both groups (22.6% in the control group and 21.8% in the experimental group). This may indicate that these students find it difficult to critically evaluate their own actions.

The percentage of students in the experimental group demonstrating a medium level of reflection (31.3%) is slightly higher than that of the control group (29%). This means that reflexivity is higher in the experimental group than in the control group.

In both groups, the proportion of students with high reflexivity is approximately the same (48.4% in the control group and 46.9% in the experimental group). This suggests that the experimental work did not significantly increase the high level of reflexivity of the students.

The results obtained using A.V. Karpov's methodology indicate the predominance of high-level reflexivity in younger schoolchildren, especially in the process of developing research skills in

mathematics (more than 45% in both groups). This means that students have a high ability to analyze their actions. The low level of reflection is relatively low in both groups.

Although there was a slight increase in the proportion of students with average reflexivity in the experimental group, there was no significant difference between the groups in terms of the overall level of high-level reflexivity. This may indicate that the actions aimed at developing reflection are still small or that they do not have a rapid effect on the already formed level of reflexivity of students.

Thus, the first stage of defining the experimental work was done as follows:

- Firstly, in the control and experimental groups on the “methodology for studying attitudes to an academic subject” in order to determine the level of motivation of younger schoolchildren for an academic subject, there is not much difference in all levels of motivation of students to study and study mathematics.

- Secondly, the “Questionnaire for identifying academic activity and motivation in mathematics” based on the results of the author's survey of primary school students in order to identify academic activity and motivation in mathematics showed low interest in writing research papers in mathematics in control and experimental groups.

- Thirdly, as the diagnostic card “identification of students' research skills” shows, the low motivation of students in the field of research, as well as the fact that they act only under the guidance of a teacher, are not ready for independent activity, indicates the need for students to develop research skills.

- Fourthly, as the results of the survey “my attitude to research” show, it is clear that students do not attempt research, are inactive, often neglect it, and more than a third of students do not have any knowledge, understanding and specific skills of research activity. This indicates the need for students to develop research skills.

Fifth, according to the results of the reflexive level, both groups had almost the same levels of students, and there were no very high-level students in both groups who could reflect on their actions.

Conclusion

Pedagogical diagnostics allowed us to collect reliable information about the state of formation of research skills of 3rd grade students in mathematics lessons.

Despite the positive results achieved, we cannot say that the research problem has been fully resolved. This is because developing research skills in primary school students is a complex process requiring long-term, systematic effort. Therefore, additional comprehensive research is needed to study the most effective pedagogical methods and conditions for the development of research skills in younger schools.

Based on the results of the study, the following recommendations were formulated:

- systematic inclusion of problematic situations, logical tasks, and research tasks in the content of primary school mathematics lessons in order to develop students' research skills;

- development of a system of teaching aids and assignments for organizing student research for primary school teachers.

It cannot be said that the research problem was completely solved, because it was very difficult. It is necessary to continue a comprehensive study of the problem of forming the research skills of elementary school children with formative research in order to implement not only in mathematics lessons, but also in any primary school subject and improve the results obtained. Future research may aim to expand the implementation of training research activities not only in math lessons, but also in other primary school subjects. In addition, it is important to analyze the long-term effects of student-based learning academic performance, critical thinking, problem solving skills, and lifelong learning skills. Research contributes to the improvement of educational practice and the improvement of the overall quality of primary education.

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МАТЕМАТИКА САБАҚТАРЫНДА БАСТАУЫШ СЫНЫП ОҚУШЫЛАРЫНЫҢ ЗЕРТТЕУ DAҒДЫЛАРЫН ҚАЛЫПТАСТЫРУ ДИАГНОСТИКАСЫ

Мақалада математика сабақтарында бастауыш сынып оқушыларының зерттеу дағдыларын қалыптастыру мәселесі қарастырылған. Нормативтік құжаттарға сүйене отырып, зерттеу өзектілігі айқындалған. Зерттеу барысында теориялық әдіс арқылы отандық және шетелдік зерттеулер бойынша зерттеу дағдысы ұғымының мәні айқындалып, зерттеу дағдысының артықшылықтары сипатталған. Диагностикалық әдістер бастауыш сынып оқушыларының зерттеу дағдыларын қалыптастырудың мотивациялық, мазмұндық және рефлексивтік компоненттеріне сәйкес іріктелген. Эмпирикалық зерттеу нәтижелері әр компонент бойынша оқушылардың зерттеу дағдыларының даму деңгейін жақ-жақты диагностикалауға мүмкіндік берген. Алынған сандық деректерге сүйене отырып, бастауыш сынып оқушыларының зерттеу дағдыларының төмендегіне байланысты қалыптастырушы зерттеу кезеңінің қажет екендігін тұжырымдаған. Зерттеу қорытындысында ғылыми негізделген келесідей ұсыныстар берілген: бастауыш сыныптың математика сабақтарының мазмұнына оқушылардың зерттеу дағдыларын дамыту мақсатында проблемалық жағдаяттар, логикалық тапсырмалар, зерттеушілік сипаттағы тапсырмаларды жүйелі енгізу; бастауыш сынып мұғалімдеріне арналған оқушылардың зерттеушілік жұмыстарын ұйымдастыру бойынша әдістемелік құралдар мен тапсырмалар жүйесін әзірлеу. Математика сабақтарында бастауыш сынып оқушыларының зерттеу дағдыларын қалыптастырудың диагностикалануы мен ғылыми зерттеу нәтижелерін жоғары педагогикалық оқу орындары мен колледждерде, бастауыш сынып мұғалімдерін даярлау және қайта даярлау біліктілікті арттыру институттарында пайдалануға болатыны бұл зерттеу жұмысының практикалық маңыздылығын көрсетеді.

Түйін сөздер: зерттеу дағдысы, математика, қызығушылық, жобалау, логикалық ойлау, шығармашылық, диагностика.

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ДИАГНОСТИКА РАЗВИТИЯ ИССЛЕДОВАТЕЛЬСКИХ УМЕНИЙ У МЛАДШИХ ШКОЛЬНИКОВ НА УРОКАХ МАТЕМАТИКИ

В статье рассматривается проблема формирования исследовательских умений у младших школьников на уроках математики. Актуальность исследования обоснована с опорой на нормативные документы. В рамках теоретического подхода раскрывается сущность понятия «исследовательские умения» на основе анализа отечественных и зарубежных исследований, а также описывается значимость данных умений. Методы диагностики были подобраны в соответствии с мотивационным, содержательным и рефлексивным компонентами процесса формирования исследовательских умений у учащихся начальной школы. Результаты эмпирического исследования позволили всесторонне оценить уровень развития исследовательских умений учащихся по каждому из компонентов. На основе полученных количественных данных был сделан вывод о необходимости проведения формирующего этапа работы, направленного на развитие исследовательских умений у учащихся начальной школы. На основе результатов исследования предлагаются следующие научно обоснованные рекомендации: систематическое включение в уроки математики в начальной школе проблемных ситуаций, логических задач и заданий исследовательского характера для формирования у учащихся исследовательских умений, а также разработка методических материалов и системы заданий для учителей начальных классов, способствующих организации исследовательской деятельности учащихся. Практическая значимость данного исследования подтверждается тем, что методы оценки развития исследовательских умений у младших школьников на уроках математики – наряду с самими результатами исследования – могут быть использованы в педагогических вузах и колледжах, а также в учреждениях, занимающихся подготовкой, переподготовкой и повышением квалификации учителей начальных классов.

Ключевые слова: исследовательские навыки, математика, интерес, проектная деятельность, логическое мышление, креативность, диагностика.

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