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EFFECTIVE METHODS OF TEACHING ARITHMETIC PROGRESSION

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Abstract. In the article, it is important to teach arithmetic progression in school mathematics, therefore teaching students to find the sum of the first n terms of an arithmetic progression was comprehensively considered. The use of several methods of solving problems related to arithmetic progression arouses the student's interest in solving problems. Self-reporting in several ways will have a positive effect on their development. Learners should be taught to solve problems in two or more ways. By solving several problems with one method, students are taught to fully master that method, and teaching them to solve one problem with several methods leads them to inquisitiveness and comprehensiveness. That is why we offer a special method for students to quickly and correctly produce the report. Using this method, we can develop the student's memory, comprehensiveness and logic. We taught how to find the sum of the first n terms of an arithmetic progression using a non-standard method and gave several examples. The proposed methodology, special formula educates schoolchildren to be innovative, fast, versatile. It has been shown by actual reports that it is a methodology that leads students to solve problems quickly and easily. Education and upbringing of each student as an individual is carried out during each lesson, in the course of mastering each topic. A number of example problems for the proposed method are selected appropriately. The proposed special methods can be used by schoolchildren, young teachers, mathematics teachers.

Key words: school mathematics; algebra; teaching mathematics; mathematics teaching methodology; non-standard reports; solving problems in non-standard ways; arithmetic progression, independent work

Basic provisions

One of the tasks of teaching algebra at the level of basic secondary education is to acquaint students with the sequence of numbers and methods of their representation, arithmetic and geometric progressions. Encouraging students to solve problems based on the formation of knowledge on the sequence of numbers, the functional dependencies between them, the applications of progressions and the development of their mathematical thinking is a very complex and multifaceted task. Therefore, the contradiction between the level of mathematical literacy of students and the quality of knowledge in accordance with modern requirements requires improving the methodology for the formation and development of applied aspects of mathematical knowledge. In this regard, the implementation of the task of teaching algebra courses in the main school and improving its methodology is relevant.

Theoretical justification of the development of research activities of students in the process of teaching the topic of arithmetic and geometric progressions in secondary schools.

The results of our research work allow school teachers to effectively organize the teaching of arithmetic and geometric progressions, their applications in the algebra course and easily solve problems by providing students with examples of the place of progression in everyday life and the application of progressions in various forms.

Our goal is to develop a methodology for teaching arithmetic and geometric progressions in the basic school algebra course, to teach students to make correct and quick decisions by solving problems in the most effective ways.

Introduction

Main tasks:

1) study of research work on the formation and development of students ' cognitive activity, the experience of advanced teachers-scientists in the process of teaching algebra in the main school and its types;

2) development of a methodology for organizing the study of arithmetic and geometric progressions in the algebra course;

3) development of a methodology for forming the ability to solve applied problems using formulas, properties of arithmetic and geometric progression.

Basic formula for calculating the sum of the first *n* member of the arithmetic progression:

$$S_n = \frac{a_1 + a_n}{2} * n$$

To apply this formula, we must necessarily know the first member, the last member, and the number of members. In some reports, you will need to calculate the sequence number of the last member. It requires additional calculation. Take as an example, calculate the sum of all two-digit numbers multiplied by 5. The largest two-digit number that is a multiple of 5 is 95. But its ordinal number is unknown, i.e. to use the basic formula that calculates the sum of the first *n* member, we need to find the ordinal number 95. And if we convert a formula that calculates the sum of the first *n* member of the arithmetic progression to problems of this type and produce a new formula, it will be easier to solve problems of this type. Formula of the nth member of the arithmetic progression: $a_n=a_1+(n-1)d$

Let's find n in this formula:

$$(n-1)d = a_n - a_1$$

$$n - 1 = \frac{a_n - a_1}{d}$$

$$n = \frac{a_n - a_1}{d} + 1 = \frac{a_n - a_1 + d}{d} = \frac{a_n - (a_1 - d)}{d}$$

If we have the expression a_1+d equal to a_2, then let's assume that the expression a_1-d is a_0, that is, the Zero member of the arithmetic progression. To find a zero

member, you need to subtract the difference of the arithmetic progression from the first member.

$$a_0 = a_1 - d$$

$$a_1 - d$$

if we put a_0 instead of the expression: $n = \frac{a_n - a_0}{d}$

After such transformations are completed, a new modified Formula appears that calculates the sum of the first *n* member of the arithmetic progression.

$$S_n = \frac{a_1 + a_n}{2} * n = \frac{a_1 + a_n}{2} * \frac{a_n - a_0}{d} = \frac{(a_1 + a_n)(a_n - a_0)}{2d}$$

Now, using this formula, let's look at a few examples.

Example №1: Calculate the sum of all two-digit numbers multiplied by 5.

Solution:

The first two-digit number that is a multiple of 5 is 10, i.e. a_1=10. the last digit is 95, i.e. a_n=95. the difference is 5, i.e. d=5. Now let's calculate a_0:

$$a_0 = a_1 - d = 10 - 5 = 5$$

Now let's use a new modified formula that calculates the sum of the first *n* member of the arithmetic progression

to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(10 + 95)(95 - 5)}{2 * 5} = \frac{105 * 90}{10} = 105 * 9 = 945$$

Example №2: Calculate the sum of all two-digit numbers multiplied by 7.

Solution:

The first two-digit number multiples 7 is 14, i.e. a_1=14. the last digit is 98, i.e. a_n = 98. the difference is 7, i.e. d=7. Now let's calculate a_0: a_0=a_1-d=14-7=7

Now let's use a new modified formula that calculates the sum of the first *n* member of the arithmetic progression

to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(14 + 98)(98 - 7)}{2 * 7} = \frac{112 * 91}{2 * 7} = 56 * 13 = 728$$

Example №3: 65+66+67+...+111+112 calculate the sum.

Solution:

The first member is 65, i.e. a_1=65. the last member is 112, i.e. a_n = 112. the difference is 1, i.e. d=1. now let's calculate a_0: a_0=a_1-d=65-1=64 Now let's use a new modified formula that calculates the sum of the first *n* member of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(65 + 112)(112 - 64)}{2 * 1} = \frac{177 * 48}{2 * 1} = 4248$$

Example №4: Calculate the sum of all natural numbers from 80 to 150, including 150. Solution: The first member is 80, i.e. a_1=80. the last member is 150, i.e. a_n = 150. the difference is 1, i.e. d=1. now let's calculate a_0: a_0=a_1-d=80-1=79 Now let's use a

new modified formula that calculates the sum of the first *n* member of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(80 + 150)(150 - 79)}{2 * 1} = \frac{230 * 71}{2 * 1} = 8165$$

Example №5: Calculate the sum of all two-digit natural numbers.

Solution:

The first member is 10, i.e. a_1=10. the last member is 99, i.e. a_n=99. the difference is 1, i.e. *d*=1. now let's calculate: Now let's use a new modified formula that calculates the sum of the first *n* member of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(10 + 99)(99 - 9)}{2 * 1} = \frac{109 * 90}{2 * 1} = 4905$$

Example №6: Calculate the sum of three-digit even numbers.

Solution:

The very first member is equal to 100, i.e. a_1=100. The last member is 998, i.e. a_n=998. the difference is 2, i.e. *d*=2. Now let's calculate a_0: Now let's use a new modified formula that calculates the sum of the first *n* member of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(100 + 998)(998 - 98)}{2 * 2} = \frac{1098 * 900}{2 * 2} = 247050$$

Thus, the proposed method can be called the most effective approach to teaching arithmetic progression. Students should always be taught how to create reports in several ways. Teaching tasks in two or more ways, if possible, contributes to the logical development of students.

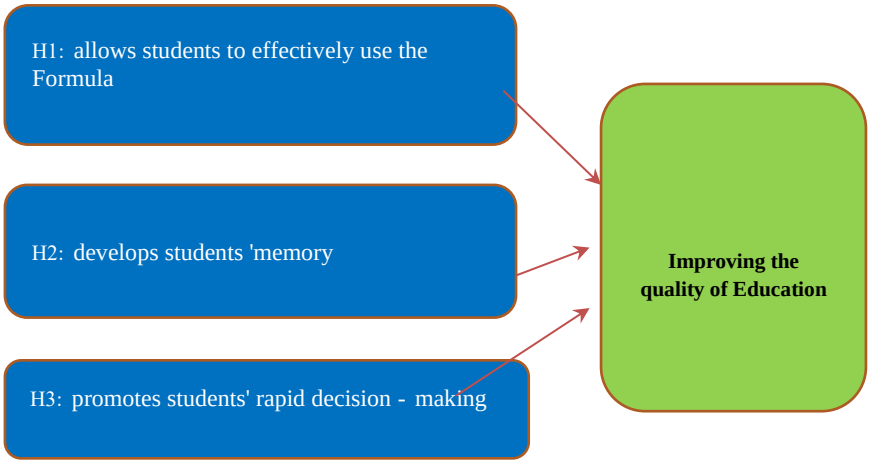
Objectives of the study

The aim of the study is to offer the most effective way for students to find the sum of the first N terms of an arithmetic progression.

Hypotheses

1) allows students to effectively use the Formula
2) develops students 'memory
3) promotes students' rapid decision – making

Model



Research materials and research methods

In the methodological basis of the research work, we implemented the methods of systematic analysis of the main concept of teaching mathematics, the professional orientation in the course of teaching mathematics, and got its future opportunities. During the research, we analyzed the main features of teaching mathematics.

Based on the scientific works of the CIS countries and Kazakh mathematicians, we focused on the study of the main concepts of teaching, as well as on the quick, application of students' mathematical knowledge in practice. Within the framework of the research, our scientific research was carried out in two stages. In the first stage, a theoretical study of the main concepts of teaching mathematics was carried out, and the importance of the research topic in the system of scientific education was determined. In the second stage, professional orientation in teaching mathematics was implemented and improvement works were carried out. The results obtained during the research were compared with the results and conclusions of other researchers. The research contributed to the completion of our work, making clear objective conclusions.

Based on the results obtained in the final stage of the work, conclusions were made with the main idea of studying the features of the formation of the theoretical basis of mathematics education.

Additional systematic methods were used in the study:

Theoretical: analysis of psychological, pedagogical and methodological literature, analysis of real data, generalization, systematization; control method.

Experimental: the period of analysis, identification, formation and control of pedagogical and psychological documents, methods of processing results (quantitative and qualitative analysis of the obtained data) [2].

Results

Since the purpose of the study is the most important subject of school mathematics, "Arithmetic progression", we have proposed a special formula that is effective and can be used by students regularly during calculations in the teaching of arithmetic progression. The effectiveness of teaching arithmetic progression according to our proposed methodology was proven by applying it to schoolchildren in the subjects "Algebra", "Algebra and Analysis Initiatives", by using it in pedagogical practice for 3-4 year mathematics students, as well as by actual experience in training courses for future mathematics teacher specialists.

The task of a methodologist-mathematician is to increase the student's interest in mathematics by using the simplest, easiest and most understandable methods, and to make a great contribution to raising the level of the quality of education.

The research was conducted in general education schools of Almaty city. Our experiment aimed at differentiating the effective methods of teaching the topic of arithmetic progression was implemented in the 2021-2022 academic year and 2022-2023 academic year. 120 students and 30 interns, school mathematics teacher participated in the experiment. During the experiment, students were divided into 2 groups, one group used the special method considered in this study, and the second

group was conducted using the traditional teaching format. At the beginning of the experiment, the progress of both groups was checked, and indicators of educational levels were recorded.

At the end of the experiment on the subject of the research, the educational indicators of the students of both groups were determined by observation work. First, we determined the indicators of the education levels of the two groups using the Student's t-test for dependent samples and analyzed it. As a result, we made sure that the educational level of the students in the experimental group was significantly higher than that of the students in the control group. We were able to scientifically prove the effectiveness of our proposed method through the results of the experiment.

The conducted theoretical and experimental research on the problem of pedagogical conditions for the development of students' research skills in the process of teaching the topic of arithmetic progression in middle school allowed us to draw the following conclusions.

Analysis of philosophical, psychological, pedagogical literature, normative and program documentation proved the relevance of developing research skills in secondary schools. With a general understanding of research skills as skills necessary for independent implementation of research or part of it, an insufficient elaboration of the list of research skills has been revealed, when the identified skills are focused on a specific subject area, do not maintain a degree of generality, or cannot be studied using pedagogical methods. Refinement of the list includes systematization of research skills by stages of research activity.

Educational and research activities based on algebra, or more precisely in teaching arithmetic progression, are educational mathematical activities. An analysis of mathematical and pedagogical literature on the problem of teaching algebra draws attention to the special role of mathematical formulas. This fact determines the need to organize two stages of teaching algebra in the form of educational mathematical activities, which differ in the degree of independence of students in conducting research. The change of these stages does not have a fixed time frame and is determined by the students' abilities to conduct research. When t passing each stage, you should use educational tools that correspond to its content. At the first stage, the educational tool should set examples of actions with algebra material. At the second stage, the educational tool should pose a problem and indicate a method for solving it, giving students the opportunity to independently conduct research.

Thus, the theoretical prerequisites for the pedagogical conditions for the development of students' research skills in the process of teaching algebra in middle school were identified: the list of research skills was clarified; theoretically substantiated the pedagogical conditions for the development of students' research skills in the process of teaching algebra in middle school, aimed at organizing algebra teaching in the form of solving educational problems, placing students in an active position of researchers, organizing educational and research activities at its different levels using a set of specific educational tools.

Based on the results of experimental work, the following conclusions can be drawn.

The program material for the school algebra course for grades 7-9 can be grouped around such educational and subject problems. Educational tools, the text of which is organized as a solution to educational subject problems in the process of educational mathematical activities, contribute to the development and independent implementation by students of various types of educational mathematical activities, as well as effective support by adults in the development of students' research skills.

The main indicators of the development of students' research skills in the process of teaching algebra in middle school are the levels of development of students' mathematical thinking. At the first level of development of mathematical thinking, characterized by actions with formulas in known ways, there is the ability to apply the results of research. At the second level, characterized by the establishment of the ability to reorganize research results and substantiate hypotheses (formulas). At the third level of development of mathematical thinking, characterized by the application of knowledge in non-standard situations, the ability to formulate hypotheses and pose problems becomes.

Analysis of the results of experimental work on the pedagogical conditions for the development of students' research skills in the process of teaching algebra in middle school made it possible to record in the experimental classes by the end of the experiment the preservation or increase in the level of development of mathematical thinking, stable performance in algebra. The experimental work carried out proved the effectiveness of a set of pedagogical conditions for the development of students' research skills in the process of teaching algebra in middle school.

Thus, in the course of theoretical and experimental work, the provisions of the hypothesis were confirmed, the research tasks were solved and the goal was achieved. We have identified the following directions for further research:

- development of research skills of middle school students who, by the time they start studying algebra, do not have experience in educational and research activities;
- study of the conditions for the development of research skills of high school students using algebra material;
- a more detailed study of the relationship between research skills and mathematical actions.

Discussion

During the experiment conducted on the research problem:

- students have the ability to quickly solve the problem using the formula;
- efficient calculation of arithmetic progression problems using one formula instead of several formulas.

As a result of the experiment, it is shown that the proposed method is important and effective in teaching arithmetic progression.

Conclusion

Teaching schoolchildren an effective way to find the sum of the first n members of arithmetic progression is considered. The use of various methods in the production of reports increases the interest and passion of students in the production of reports.

Working with oneself has a positive impact on the development of activity. A special methodology is proposed, which will help students make quick and correct decisions. Using this approach, we can form students' memory, comprehensive deep thinking, and logical thinking. The special methodology can be used by schoolchildren, young teachers and math teachers [2].

Recommendations

Based on the results obtained, it is better to take as a basis interdisciplinary continuity in high school mathematics [2].

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АРИФМЕТИКАЛЫҚ ПРОГРЕССИЯНЫ ОҚЫТУДЫҢ ТИІМДІ ӘДІСТЕРІ

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Аңдатпа. Мақалада мектеп математикасында арифметикалық прогрессияны оқыту маңызды, сол себепті білім алушыларға арифметикалық прогрессияның алғашқы n мүшесінің қосындысын табуды үйрету жан-жақты, әрі тереңдетіліп қарастырылды. Арифметикалық прогрессияға қатысты есептерді шығарудың бірнеше тәсілдерін қолдану оқушының есепті шығаруға деген қызығушылығын оятады. Өз бетімен есепті бірнеше тәсілмен шығару олардың дамуына оң әсер етеді. Білім алушыларға есептерді екі немесе одан да көп тәсілмен шығаруды үйрету керек. Оқушы бір әдіспен бірнеше есептерді шығарту арқылы оларды сол әдісті толыққанды игеруге үйренсе, ал бір есепті бірнеше әдіс-тәсілдермен шығару арқылы олар ізденушілік, жан-жақтылық қасиетке жетеленеді. Сол себепті біз, білім алушылардың есепті тез және дұрыс шығаруына арналған арнайы әдісті ұсынып отырмыз. Бұл әдісті қолдану арқылы біз оқушының есте сақтау қабілетін, жан-жақтылығын және логикасын, ізденушілік қабілетін дамыта аламыз. Арифметикалық прогрессияның алғашқы n мүшесінің қосындысын стандартты емес әдіспен табуды үйретіп, бірнеше мысалдар келтірілдік. Ұсынылып отырған әдістеме, арнайы формула мектеп оқушыларын жаңашылдыққа, шапшаңдыққа, жан-жақтылыққа тәрбиелейді. Білімалушылардың есепті тез, әрі оңай жолмен шығаруына жетелейтін әдістеме екені нақты есептер арқылы көрсетілді. Әр оқушыны жеке тұлға ретінде оқытып-тәрбиелеу, әр сабақ барысында, әр тақырыпты меңгерту барысында жүзеге асырылады. Ұсынылып отырған әдіске бірнеше арифметикалық прогрессияға мысал есептер өте орынды таңдап алынған. Ұсынылып отырған арнайы әдістерді мектеп оқушыларына, жас мұғалімдерге, математика мұғалімдеріне, математик-студенттерге, магистранттарға дидактикалық материал тұрғысынан таптырмас құрал деуге болады.

Тірек сөздер: мектеп математикасы, алгебра, математиканы оқыту, математиканы оқыту әдістемесі, стандартты емес есептер, есептерді стандартты емес тәсілдермен шешу, арифметикалық прогрессия, өздік жұмыс

ЭФФЕКТИВНЫЕ МЕТОДЫ ОБУЧЕНИЯ АРИФМЕТИЧЕСКОЙ ПРОГРЕССИИ

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Аннотация. В статье рассматривается обучение учащихся нахождению суммы первых n членов арифметической прогрессии. Использование разных методов к решению математических задач может стимулировать интерес учащихся к дальнейшему выбору профессии, например стать математиком. Самостоятельная работа оказывает положительное влияние на их развитие, поэтому мы даем особый акцент на это. Обучающихся необходимо научить решать задачи двумя или более способами. Решая несколько задач одним методом, учащиеся учатся полностью владеть этим методом, а обучение решению одной задачи несколькими способами приводит их к любознательности и всесторонности. Именно поэтому мы предлагаем обучающимся специальную методику, позволяющую быстро и правильно решить задачу. Используя этот метод, мы можем развивать память, всесторонность и логику, и исследовательский потенциал обучающихся. Методика удовлетворяет требованиям

индивидуального подхода к обучению школьников решению математических задач и является эффективным при его применении. Подобрано несколько примеров нахождения суммы первых n членов арифметической прогрессии нестандартным методом. Приведены несколько примеров предлагаемого метода. Специальные методы могут использовать как дидактический материал школьники, молодые учителя, учителя математики, студенты-математики, магистранты.

Ключевые слова: школьная математика, алгебра, обучение математике, методика преподавания математики, нестандартные задачи, решение задач нестандартными способами, арифметическая прогрессия, самостоятельная работа

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