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Formation of skills to calculate the volumes of geometric bodies

The article is devoted to the formation of students' skills in calculating the volumes of geometric bodies. An effective reception of students' educational work at the final stage of solving the problem is proposed. In addition, the authors offer to familiarize themselves with the learning of the solution of the same problem in various ways, which helps students to move to a higher level in solving problems, choosing the most effective way to solve the problem. Authors analyzed the works of domestic and foreign researchers on the methods of learning activities that help students to better learn the material, systematize knowledge, help in solving problems. One of the main points to which special attention is paid is the training of students to study independently and creatively in order to include them in specially organized activities on the basis of sounded educational activities. The article also identifies the role of the student and the teacher in the process of performing independent work. An algorithm for drawing up a plan for solving problems is shown. It is noted that most of the methods of learning activity form the necessary skills. They help students to learn the material better, systematize knowledge, help in solving problems.

Keywords: calculation, task, solution, algorithm, method, equation, knowledge, Solution structure of the problem, level, organize.

The theme «Volumes of geometric bodies» is one of the most complicated, but at the same time necessary subjects in the 11th grade. It collected and summarized a lot of knowledge from planimetry and stereometry. The ability to calculate the volume of geometric bodies is necessary for students, for productive activities in the modern information world. Forming the skills to represent the most important geometric bodies surrounding us, calculate their volumes are of great practical importance, contribute to the formation of spatial representations and spatial imagination of students, and this is one of the most important goals of school education.

The theory of this topic and practical tasks also contribute to the development of: skills in identifying the geometric situation and the formation of a creative approach to solving problems of a different kind, the logic of thinking, cognitive activity, and the formation of observability. Forming skills in the calculation of geometric bodies, solving geometric problems on this topic, students also acquire many practical skills that will be useful in their future work or life. The process of forming skills to calculate the volume of geometric bodies will be more effective if training is based on the formation of methods of learning activities [1].

The importance of studying the polyhedra and the bodies of revolution in school is difficult to overestimate. An important role is played by acquaintance with them in connection with the preparation of schoolchildren for practical life, for work. Teacher should emphasize that the form of polyhedra and bodies of revolution have many parts of machines, devices, architectural structures, household items and so on. To form the ability of students to calculate the volumes of geometric bodies, to teach them to freely find the volume of bodies, realizing each step, the teacher must make sure that students accept this goal. To develop cognitive interest. The students will have motives for learning activities. They will be interested in «How to calculate»?

Following the developed methodology for forming the students' ability to calculate the volume of geometric bodies, it is necessary to teach students to study independently and creatively. To do this, it is necessary to include them in a specially organized activity. To develop the motives and goals of educational activity for schoolchildren, to teach how to implement and regulate it.

To control the consolidation of skills on the topic, a good exercise is the exercise «Find an error» and work to correct the errors found.

When forming skills to calculate the volume of geometric bodies, you can use the «Cube-Bloom» technique. On the faces of the cube are written the beginning of the questions:

1. Why?
2. Explain?
3. What's your name?

4. Suggest?
5. Think about it?
6. Share it?

For example, a question beginning with the word «Name» may correspond to a simple reproduction of knowledge.

Questions starting with the words «Why» correspond to the so-called procedural meanings. The student in this case must find cause and effect relationships, describe the processes that occur with a particular object or phenomenon.

Answering the question «Explain» the student uses concepts and principles in new situations, applies laws, theory in various specific practical situations, demonstrates the correct application of the method or procedure.

Assignments «Suggest», «Think up», «Share», are aimed at activating the mental activity of the student. He allocates hidden proposals, distinguishes between facts and effects, analyzes, evaluates the significance of data, uses knowledge from different areas, draws attention to the correspondence of the output to the available data. There are two ways to use this technique when the teacher asks appropriate questions and the student formulates questions.

The great mathematician D. Poya said: «If you want to learn how to swim, you can safely enter the water, and if you want to learn how to solve problems, then solve them». The solution of problems occupies a huge place in mathematical education. The task is a means of mastering and controlling the achievements of mathematical knowledge, skills and skills, as well as the main means of activating and developing students [2]. An integral part of the ability to solve problems is the ability to conduct a search that determines the level of the student's mathematical readiness.

The tasks develop the logical and algorithmic thinking of students, develop practical skills in applying mathematics, form a dialectical-materialistic worldview, are the main means of developing spatial imagination, as well as heuristic and creative activity.

When solving problems for calculating the volumes of geometric bodies, we use the method of specifying an algorithm-a formula. Since we are at the first level of mastering the skills to calculate the volume of geometric bodies, we use the cluster «Volumes of geometric bodies», «Square of figures». Such tasks must be solved by ready drawings.

When solving such problems, the level of mathematical development of students is manifested. Since in order to solve it you need to be able to work with a geometric drawing, the ability to view and select the figures necessary for the solution in the drawing. Analyzing the condition of the problem, students can select the necessary connections and relationships in the drawing. This requires a good knowledge of the basic concepts and theorems, the ability to analyze, transform, reformulate the problem, conduct reasoning, isolate the problem, that is, a sufficiently high logical preparation.

Learning to learn how to work with a drawing is facilitated by exercises on ready drawings that provide invaluable assistance in mastering and fixing new concepts and theorems. It is possible to assimilate and repeat a much larger amount of material within a minimum of time, thereby increasing the pace of work in the lessons.

In addition, these exercises contribute to the activation of the thinking activity of students, teach the ability to competently argue, find common ground and make differences, compare and contrast, draw the right conclusions. Most of these tasks are rationally used as oral exercises. When they are carried out, students' active thinking activity takes place, which in turn leads to an effective involuntary memorization of the definitions, properties and attributes of the studied figures. The definitions, properties and features of the figures in question are periodically repeated during the execution of a variety of exercises, resulting in a productive memorization.

Tasks on ready drawings prepare students for memorization and independent solution of such problems for which these exercises are elements [2]. Exercises on ready drawings allow to improve the process of forming the ability to solve geometric problems, have a positive impact on the development of creative thinking necessary for solving stereometric problems. Students are able to analyze the task situation, given by the drawing, generalization and specification of the drawing. They master the methods and methods of studying the geometric situation, the geometric drawing, analyze the condition of the problem and correlate it with the drawing, choose the most effective way of solving the problem.

If the problem does not have an algorithm for solving it, then it is necessary to draw up a plan and solve the task according to the compiled plan.

1. Write down the formula for finding the volume.
2. Substitute in the formula all known quantities.
3. Ask the question: «What quantities are not yet known?», And answer it.
4. Find the unknown through known, but not used yet in the solution.
5. Calculate the volume.

It is expedient for students to formulate the methods of teaching at the stage of finding a plan for solving the problem and at the final stage when the problem has already been solved.

One of the effective methods in working with problems of calculating the volumes of geometric bodies is the reception of work with support tasks. The acceptance of the selection of support tasks, their solution and use in solving complex problems is aimed at developing the students' thinking abilities, developing skills to independently update knowledge and experience, combining algorithmic and heuristic activities, highlighting the essential links between the elements of the task, transferring knowledge to new situations, reformulating the problem, to carry out mental tests to solve it.

When teaching students to solve complex problems at the stage of finding a plan for a solution, it is advisable to apply a system of instructive instructions using «support» tasks. The most important indication is the following: «Compare this problem with previously solved» support «problems. Select the «support» tasks that are similar to the situation with this task or part of it. In what ways can they help with the solution? Complete the drawing. Reformulate the problem, assuming that solutions of the identified «support» problems are known. Try to solve this problem».

It is advisable to work with supporting tasks in accordance with the following stages:

1. Solve several similar tasks.
2. Find a common approach to their solution.
3. To present a general approach to their solution in the form of a prescription.
4. Apply this rule to other tasks in this series.

The study of the structure of the solution of the problem after the formulation of its solution is aimed at understanding the general nature of the solution of the problem so that the basic ideas and facts of its solution could be used in solving other problems.

An effective method of teaching students at the final stage of solving the problem is to compile complex problems from simple ones. To achieve this, they are encouraged to do the following:

1. Analyze the solution of this problem and the structure of its solution. Formulate the problem that you solved in the first step. Mentally solve this problem.
2. Select the component task that you solved in the second step. Formulate its condition so that the problem solved in the first step is contained in it as a component. Mentally solve the task.
3. Continue writing tasks to the type given, using the same instructions as in point two.

Another method is to receive a solution of the same problem in different ways.

This method of teaching, which consists in solving the same problem in different ways, contributes to a deeper assimilation by the students of each method of solving problems, a systematic repetition by the students of the material passed. In addition, learning to solve the same problem in different ways prepares students for a transition to a higher level in solving problems, choosing the most effective way to solve the problem.

Teaching students to solve geometric problems in various ways gives the following opportunities:

- to instill interest in the subject, encourage students to think more carefully about geometry;
- develop critical and mathematical thinking;
- more fully explore the properties of geometric shapes;
- note the property, which is not mentioned in the problem;
- obtain an interesting generalization of the problem.

It is also important that, having come in different ways to the same result, students are assured of the correctness of the decision.

Such methods of educational work as: the allocation of support tasks, the solution and use in solving complex problems, the study of the structure of the solution of problems, the formulation of tasks, the solution of the same problem in different ways, the choice of an effective method of solving, form the ability of students to calculate the volume of geometric bodies.

Not all students can immediately make up their own plan for solving the problem. Such a student at the first stage can be given to solve problems with omissions. Practical work, which reflects a brief reference material, the basic formulas necessary for the performance of work, tasks, control questions, contributes to the formation of skills to calculate the volume of geometric bodies [3].

When forming the students' skills in calculating the volumes of geometric bodies, it is necessary to use the following:

1. Drawing up a cluster on the subject «Square of figures» and «Volumes of geometric bodies». Graphic organization of the material will allow students to freely and openly think about a topic, see the structure of the material being studied. The cluster activates the activities of students, summarizes and systematizes all the material that has been passed, which helps students form skills in calculating the volumes of geometric bodies.

2. To develop cognitive interest, use:

a) historical information;

b) application of mathematical knowledge in the economic activity of a person, by the example of solving problems;

c) inform the students that after completing the topic, an extra-curricular activity will be held, a game on the subject «Volumes of geometric bodies». The game will support and strengthen students' interest in the topic. The game is not the goal itself, but a means of training and education. In the process of playing, the wonderful world of childhood will unite with the wonderful world of science, into which the students enter. In games different knowledge, skills are formed freely.

An effective technique for forming the ability to calculate the volume of geometric bodies is to take a study of the structure of the solution of the problem after the design of its solution. This method is designed to understand the general nature of the solution of the problem so that the basic ideas and facts of its solution could be used to solve other problems. Therefore, all questions and tasks are taken from those that were worked out in the lesson, at home, during the control and practical work, that is, the method of studying the structure of the solution of problems after the decision is applied.

3. Reception of the «Cube-Bloom». There are two ways to use this technique:

– the teacher asks relevant questions, tasks;

– the student formulates questions, tasks.

4. Solve algorithmic tasks for finished drawings. When solving problems for calculating the volumes of geometric bodies, we use the method of specifying an algorithm-a formula. Learning to learn how to work with a drawing is facilitated by exercises on ready drawings that provide invaluable assistance in mastering and fixing new concepts and theorems. It is possible to assimilate and repeat a much larger amount of material within a minimum of time, thereby increasing the pace of work in the lessons.

In addition, these exercises contribute to the activation of the thinking activity of students, teach the ability to competently argue, find common ground and make differences, compare and contrast, draw the right conclusions. Most of these tasks are rationally used as oral exercises. Tasks on ready drawings prepare students to memorize and independently solve problems for which these exercises are elements.

5. Training in drawing up a plan and solving tasks according to the plan.

At this stage, you apply the work with the support tasks. This technique is aimed at developing students' thinking abilities, developing skills to independently actualize knowledge and experience, combining algorithmic and heuristic activities, highlighting the essential links between the elements of the task, transferring knowledge to new situations, reformulating the problem, and performing thought tests to solve it.

When solving basic problems, it is necessary to use the method of studying the structure of the solution of the problem after the design of its solution. Effectively at the final stage of solving the problem, students are asked to compose from simple complex tasks. Known is also the decision of the solution of the same problem in different ways. This contributes to a deeper assimilation by schoolchildren of each method of solving problems and a systematic repetition of the students' traversed material. In addition, learning to solve the same problem in different ways prepares students for a transition to a higher level in solving problems, choosing the most effective way to solve the problem.

6. Not all students can immediately make up their own plan for solving the problem. Such a student at the first stage can propose to solve problems with omissions.

7. Practical work, which reflects the short reference material, basic formulas necessary for the performance of work, tasks, control questions.

The use of various methods by the teacher in educational activities allows students to develop skills in calculating the volumes of geometric bodies [4].

Formation of skills and computing skills contributes to the formation of spatial representations and spatial imagination of students, and this is one of the most important goals of schooling. Taking into account all of the above, a mathematics teacher needs to develop the ability of students to calculate the volumes of geo-

metric bodies. To teach them to learn independently and creatively, one must include them in a specially organized activity. On the basis of sounded methods of learning activities, necessary skills are formed. They help students to learn the material better, systematize knowledge, help in solving problems.

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Геометриялық денелердің көлемін есептеуде біліктіліктерді қалыптастыру

Мақала геометриялық денелердің көлемін есептеуде оқушылардың біліктіліктерін қалыптастыру сұрақтарын зерттеуге арналған. Өртүрлі есептерді шешудің соңғы кезеңінде оқушылардың оқу-танымдық жұмысын ұйымдастыруда тиімді болатын тәсіл ұсынылды. Сонымен қоса авторлар сол мәселені шешудің әртүрлі жолдарымен таныстырады, бұл есептерді шешуде ең жоғары деңгейге өтуге, шешудің ең тиімді әдісін таңдауға өте көмектеседі. Авторлар отандық және шетелдік зерттеушілердің материалдарын жақсы меңгеруге, білімдерді жүйелендіруге, проблемаларды шешуге көмектесетін оқу іс-әрекеттерінің әдістеріне талдау жасады. Ерекше назар аударылатын басты мәселелердің бірі — оқушыларды өзіндік және шығармашылық тұрғыдан оқуға үйрету, сонымен қоса оларды айтылған білім беру шаралары негізінде арнайы ұйымдастырылған іс-шараларға қосу болады. Өзіндік жұмыстарды орындау үдерісінде оқушы және оқытушының ерекше рөлдері, есептерді шешу жоспарын жасау алгоритмі көрсетілген. Оқу жұмысының көптеген тәсілдері қажетті біліктіліктер мен дағдыларды қалыптастырады. Осылар оқушыларға оқу материалдарды жақсы меңгеруге, білімдерді жүйелеуге, есептерді шешуге көмектесті.

Кілт сөздер: есептеу, мәселе, шешім, алгоритм, әдіс, формула, білім, мәселені шешу, деңгей, жүйелеу.

Р.Ж. Төлеуханова, А.С. Шульгина-Тарашук, М.В. Ардашева, К.Л. Полупан

Формирование умений по вычислению объёмов геометрических тел

Статья посвящена формированию у учащихся умений по вычислению объёмов геометрических тел. Предложен эффективный приём учебной работы учащихся на заключительном этапе решения задачи. Помимо этого, авторы предлагают ознакомиться с обучением решения одной и той же задачи различными способами, что способствует переходу учащихся на более высокий уровень в решении задач, выбору наиболее эффективного способа их решения. Авторами проанализированы труды отечественных и зарубежных исследователей относительно приёмов учебной деятельности, которые способствуют лучшему усвоению учащимися учебного материала, систематизируют знания, помогают при решении задач. Уделено особое внимание одному из основных моментов обучения учащихся — самостоятельно и творчески учиться, чтобы включать их в специально организованную деятельность на основе озвученных приёмов учебной деятельности. В статье также выделена роль обучающегося и преподавателя в процессе выполнения самостоятельной работы. Показан алгоритм составления плана при решении задач. Отмечено, что большинство приёмов учебной деятельности формируют необходимые умения. Формирование умений у учащихся на основе данных приемов помогает лучше усваивать учебный материал, систематизирует знания, особенно при решении задач.

Ключевые слова: вычисление, задача, решение, алгоритм, метод, формула, знание, структура решения задачи, уровень, систематизация.

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