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THE FORMATION AND DEVELOPMENT OF A CONCEPT OF SPACE GEOMETRY OF STUDENTS IN 5-6 GRADES WHILE STUDYING THE PRINCIPLES OF GEOMETRY

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Abstract

The high school math program points out the importance of developing students spatiauniqueness of the reflection of the laws of reality by mathematics, the peculiarities of the application of mathematics to the study of the real world, the importance of the formation of skills and abilities necessary in life and in the workplace.

The article describes the methods for the formation and development of concept of Space geometry of students of grades 5-6 while studying the principles of geometry, based on a system

of expediently selected exercises. There are eight basic techniques that can help to understand and to construct the main formation of Space Geometry and the methods for its implementation in the study of mathematics of students of 5-6 grades. Also there are given special tasks which can be used while studying the bases of space geometry at 5-6 grades.

Keywords: formation of concept of Space geometry, spatial representations, system of expediently selected exercises, School mathematics course

The formation and development of a concept of Space geometry of students in 5-6 grades while studying the principles of geometry.

Teaching mathematics should provide a solid and conscious assimilation of the basics of mathematical knowledge, the formation of skills and abilities necessary for the overall mental development of students, for successful study at the appropriate level of both mathematics itself and related disciplines. The knowledge gained in teaching mathematics should help students in their subsequent adaptation to the rapidly changing conditions of industrial activity. The achievement of deep and solid knowledge is impossible without the skillful organization of students mental activity.

The high school math program points out the importance of developing students spatial representations, imagination, and creative thinking. It emphasizes the need to explain to students, using concrete examples, the uniqueness of the reflection of the laws of reality by mathematics, the peculiarities of the application of mathematics to the study of the real world, the importance of the formation of skills and abilities necessary in life and in the workplace.

A qualitative study of geometry as a science “about spatial forms and spatial relations of the real world” is not possible without a well-developed spatial imagination and a significant stock of spatial representations. The ability to mentally imagine and perform the necessary operations on geometric images is necessary not only for the assimilation of theoretical information from geometry, but also for practical activity in many fields of science, technology and production.

Theoretical Part

In this regard, there stands an important task of preparing students in grades 5-6 on the development of concept of space geometry and spatial representations. The State Standard of

Education in Mathematics from the first grade is supposed to study a number of issues that contribute to solving this problem. In the initial stage of training, students get acquainted with some spatial figures (a cube, a rectangular parallelepiped, etc.), learn to see these figures in the surrounding objects. Plotting segments of different length, rectangles, squares, and other geometric shapes contribute to the formation of the concept of extension, distance, and direction. Gradually, students form general ideas about the geometric shape. Ideas do not arise instantly and not in a complete form, but are formed, gradually improved and changed under the influence of new perceptions, sensations, the process of thinking and personal experience. The term "spatial representations" includes representations of shape, position, and magnitude, i.e., spatial relationships and relationships. However, the current curriculum and textbooks do not fully use all the available opportunities for the development of students' spatial representations. In this regard, the task arises to explore all possible and accessible ways and means for students of grades 5-6 that contribute to the development of students ' spatial representations. Data from a number of studies in this area indicate a relatively high level and potential of spatial representations of students. Based on their life experience, by the age of 12-13, they accumulate a significant amount of experience, a stock of spatial images. All this leads to the fact that already in grades 5-6, it is possible to use spatial figures much more widely when studying the principles of geometry.

A special place in the formation of representations is given to reading and building graphic images. When constructing a graphic image, the main task is to translate the representation of an object into a planar image of it, while reading solves the opposite problem like: based on the perception of a planar image the form, dimension, position of the object is mentally reproduced in the imagination, and the necessary information and relationships are clarified.

The main techniques that contribute to the formation and development of spatial representations are:

1) the ability to see geometric shapes in the surrounding environment, their location in space and extent;

2) the use of models of geometric shapes in combination with objects of the surrounding environment;

3) the use of three-dimensional bodies in the study of planimetry;

4) the ability of students to perform the necessary actions with visual material so that

visual, musculoskeletal, tactile and other analyzers are used in the perception of spatial components;

5) production of visual aids by students;

6) carrying out measurement work;

7) the ability to depict three-dimensional objects on a plane;

8) ocular estimation of geometric quantities with subsequent control by direct measurements.

Based on the above, our study considered the question of possible means of implementing the planned ways of developing students spatial representation. We have chosen the "system of appropriately selected exercises" as the main such tool. It is designed in such a way that, along with other functions (to facilitate the introduction to concepts, their formation, to ensure the consolidation, repetition, application of what has been learned in practice, to promote the development of logical thinking, graphic skills, etc.), it contains exercises on the formation of the following concepts:-formation and development of spatial representations of schoolchildren.

The following types of tasks are considered in the system of exercises:

1. Working with models of geometric bodies.

2. Building the scans of these bodies.

3. Performing the construction of some three-dimensional shapes on the plane.

4. Construction of sections of a cube, a rectangular parallelepiped.

5. Image of projections of points, segments.

6. Exercises for studying sets of points that have a certain

property.

A significant place in the system is occupied by graphic dictation and work with ready-made geometric drawings.

Let's explain each of these types of tasks. When working with geometric shapes, students are offered exercises to recognize spatial images in the surrounding objects that correspond to the considered geometric bodies. For this purpose, drawings, pre-selected paintings, fragments from filmstrips are used. Thus, students are introduced to a rectangular parallelepipe-a house, a cube, a pyramid, a cone, a cylinder, a ball. Stronger assimilation the image of a geometric figure occurs when they construct some of them on paper: a rectangular parallelepiped, a cube, a regular quadrangular pyramid.

One of the great important exercises that are being used for the development of spatial representation are exercises for building unfoldings of geometric shapes and reverse tasks: to represent the view of a geometric body according to a given unfolding. Performing the construction of the unfolds, the student has to mentally "unbend" the adjacent faces of the geometric figure until the two planes that these faces belong to are combined into one. Such mental actions contribute to the development of the ability to operate with geometric images, and not the figures themselves.

Exercises for finding sets of points on the plane with the same number of properties in a space, require students to exert the greatest effort of their mental abilities in order to represent the considered set of points and be able to combine them into one geometric image.

Graphic dictation aims to develop the students' ability to perform the appropriate constructions according to the verbal description, visually represent the mutual position of the various parts of the spatial figure, and on the basis of the mental image to answer the question posed by the teacher. When performing exercises on ready-made geometric drawings, students develop the ability to “read” drawings, diagrams, and determine the missing ones based on the available dimensions in the drawing.

Exercises for formation and development of a concept of space geometry

Here are some tasks that contribute to solving the problem of handicap-formation and development of spatial representations by students in the study of the principles of geometry. In some experiment, these exercises were performed at the stage of fixing and repeating the main program material.

When studying the first information on geometry: about a point and a segment, about a straight line and a ray, you can consider the following exercises.

1. a) (on the model). The cube is bounded by squares, which are called the faces of the cube. How many faces does a cube have? b) Which geometric shape is the common part of two adjacent faces of the cube? c) What is the common part of the three adjacent faces of the cube? These points are called the vertices of the cube. How many vertexes does a cube have?

2. Draw a cube (Fig. 1). d). Mark its vertices with letters. Which segments do not have common points with the MK segment?

3. Figure 2 shows the scan of the cube. Make this drawing on a piece of paper, cut out the

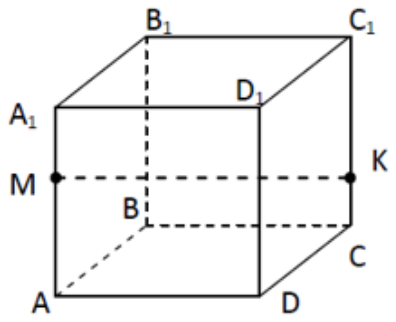

Fig.1

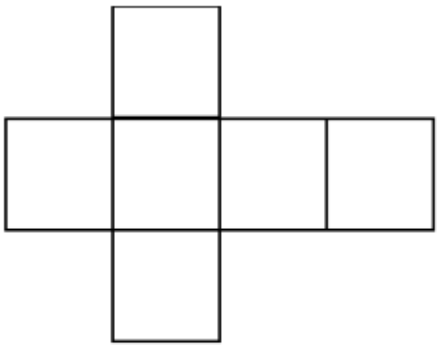

Fig.2

resulting shape and glue the cube model from it. Draw other scans of the cube.

4. (On the completed drawing). Figure 3 shows the pyramid. Write down all the segments that do not have common points with the segment CD.

5. (Graphic dictation). 1) Will a horizontal straight line and a ray directed vertically upwards intersect if: a) the beginning of the ray is located above the straight line; b) the beginning of the ray is located under the straight line? 2) Will a straight line drawn from top to bottom and a ray directed from left to right intersect if: a) the beginning of the ray located at the left of straight line b) the beginning of the ray is located at the right of the straight line?

6. The plane can be drawn as shown in Fig. 4. The straight line AB intersects this plane at point K. How many points do this plane and the straight line AB have in common?

7. How many lines can be drawn through two different points? How many planes can be drawn through such two points? Explain your answer.

8. (On the cube model). How many segments pass through two adjacent vertexes of the cube? How many faces have the same vertices in common?

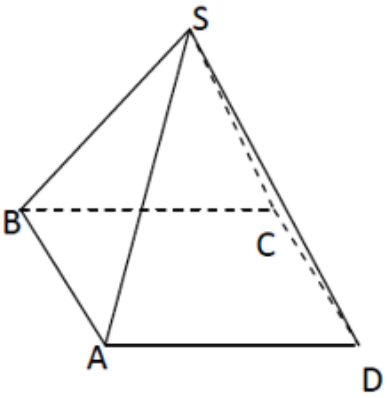

Fig.3

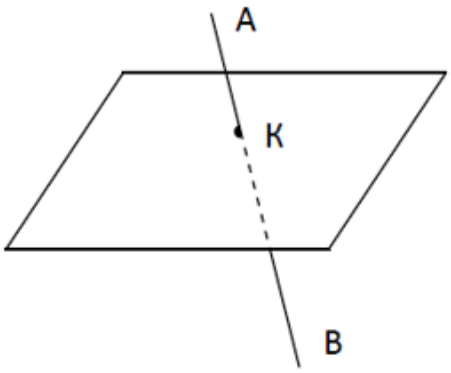

Fig.4

When studying such questions as "Comparison of segments", "Polyline", "Angle", "Equal shapes" with the student, it is possible to consider the following exercises:

9. Figure 5 shows a cube. Compare the length of the segments KF and EC. What other equal segments do you see in this drawing? Are the segments AB and BD equal?

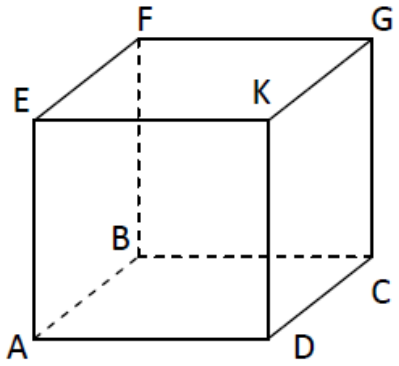

Fig.5

10. Draw a plane. Draw a polyline consisting of three links so that it intersects this plane at three points.

11. (Graphic dictation).1) Two rays are drawn inside the corner from the vertex. How many corners were formed? 2) How to draw a straight line so that it has only one common point with the angle? Make a drawing.

12. (On the pyramid model). How many angles does each face of a quadrangular pyramid have? How many such angles are there on the surface of the pyramid?

13. (On the model of a quadrangular pyramid). What figure will you get, whether to connect the top of the pyramid with the ends of the diagonal base. Show another shape on the model that is equal to the one obtained (Fig. 6).

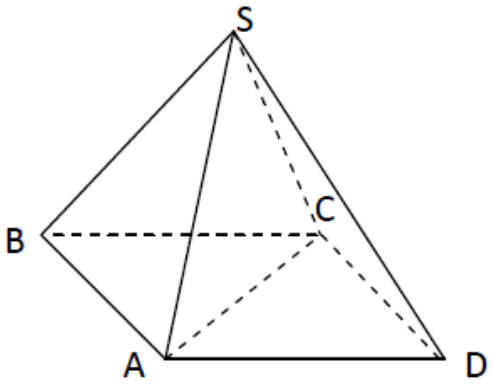

Fig.6

By studying a rectangular parallelepiped, you can analyze the following tasks performed using ready - made drawings.

14. Is the drawing of a rectangular parallelepiped made correctly (Fig. 7)? Explain the mistakes made.

15. Some dimensions of the sweep of a rectangular parallelepiped are shown in Fig. 8. What are the sides of the base equal to? What is the height? Make a scan of these dimensions on a separate sheet of paper, cut it out, and glue the model of a rectangular parallelepiped.

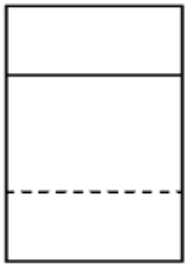

Fig.7

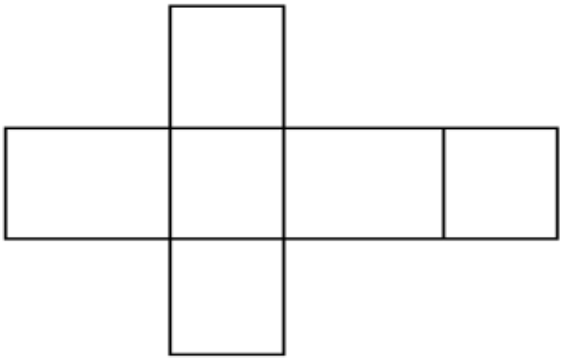

Fig.8

When studying other topics, students can be offered a similar system of appropriately selected exercises, adhering to the above-mentioned methodology.

Conclusion

To conclude at the 5-6 grades students the main purpose is not a broader consideration of the stereometric material. Because, first of all the most important for children is the means of effective development of geometric intuition, the formation of skills to see spatial geometric images in the surrounding environment. The close connection between the study of planimetry and the elements of stereometry contributes to a deeper assimilation of the properties of plane figures, expands the scope of application of the facts from planimetry in three-dimensional space. Considering age opportunities of students of grades 5-6, the use of elements of stereometry is possible only if they are closely connected with the educational material which they study, that is, with the elements of planimetry considered in these classes. For that reason it is important for teachers to use and give special selected tasks like which were given in this article within the material which they study in order to prepare students for deeper investigation of a huge world of Space geometry.

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