TEACHING MATHEMATICS USING THE GEOGEBRA SOFTWARE TOOL IN AN E-LEARNING ENVIRONMENT

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Abstract: The problems of mathematical education in secondary school are considered. The program of the elective course for senior schoolchildren on the topic "Construction of sections" with the use of interactive technologies is proposed.

Keywords: elective course, cross section of a polyhedron, teaching of mathematics, interactive environment GeoGebra.

Modern school education involves the use of various pedagogical technologies, but preference is given to those that ensure the active participation of students in the learning process, an individual approach, and visibility in the presentation of information.

Improving the teaching of mathematics to students using visual teaching aids associated with computer programs allows you to consistently develop and deepen your interest in mathematics.

When studying stereometry in grades 10-11 of a general education school, it is necessary to depict various spatial figures on a plane, to build sections. Each task in the solution requires a certain skill on the part of the student in building a "readable" drawing. For many high school students, building and "reading" drawings in space, building sections is difficult. As a result, stereometry for schoolchildren remains one of the most difficult sections of geometry.

One way to solve the problem is to use various interactive programs. One such program is GeoGebra (http://www.geogebra.org/cms/), a dynamic geometry software. Mathematical packages, including a dynamic geometric environment, combine both multimedia and programming tools, provide informatization of the

educational process. GeoGebra is suitable for studying and learning at any stage of education, it facilitates the creation of mathematical constructions and models by students, which allow interactive research when moving objects and changing parameters.

Working with an interactive environment seems to be more attractive to a student than working with textbooks. The geometric environment allows you to build drawings, create visual models of geometric objects that can be modified according to the algorithms laid down in their construction.

We have developed an elective course "Construction of sections" for students in grades 10-11 of educational and specialized schools.

Lectures, seminars, workshops on problem solving are used to implement the elective program. One of the key goals of the course is to expand and deepen the practical and theoretical knowledge and skills acquired in the study of the geometry course. For a visual representation, it is recommended to use the interactive geometric environment GeoGebra.

During the course, such sections as: "The method of constructing sections (Method of traces, the method of internal design, the method of auxiliary sections)", "Finding the area of the section" are considered.

Let's consider some tasks, for the solution of which the capabilities of the dynamic environment are used.

Task. Construct a section of the pyramid by the plane PQR, if the point P lies on the line SA, the point Q lies on the line SB, the point R lies on the line SC.

Solution. Let's consider two cases. Case 1. Let the point P belong to the edge SA.

1) Mark arbitrary points A, B, C, D with the "Point" tool. Right-click on point D, select "Rename". Rename D to S and set the position of this point as shown in Figure 1.

2) Using the tool "Segment by two points" we will construct the segments SA, SB, SC, AB, AC, BC.

3) Right-click on the segment AB and select "Properties" - "Style". Set up a dotted line.

4) Mark the points P, Q, R on the segments SA, SB, CS.

5) Using the tool "Line by two points" we will construct a line PQ.

6) Consider the line PQ and the point R. Question for students: How many planes pass through the line PQ and the point R? Justify the answer. (Answer. A plane passes through a straight line and a point not lying on it, and moreover, only one).

7) We build direct PR and QR.

8) Select the Polygon tool and click on the PQRP points one by one.

9) Using the "Move" tool, we change the position of the points and observe the changes in the section.
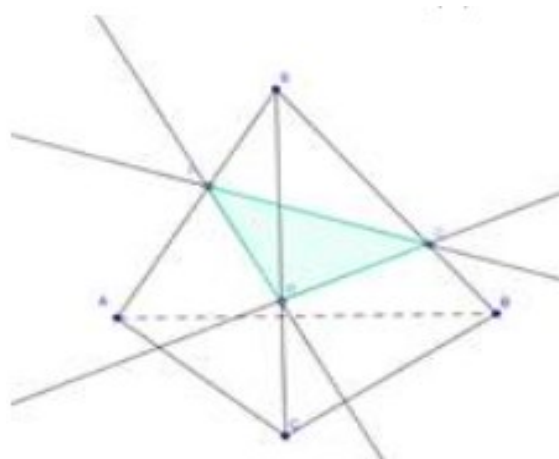
Fig 1. Building a section

10) Right-click on the polygon and select "Properties" - "Color". Fill the polygon with some color.

11) On the object panel, click on the markers and hide the lines.

Case 2. The point P lies on the line SA. To consider the solution of the problem for this case, you can use the drawing of the previous problem. Let's hide only the polygon and the point P.

1) Using the tool "Line by two points" we will construct a straight line SA.

2) Mark a point P1 on the line SA, as shown in figure 2.

3) Draw a line P1Q.

4) Select the tool "Intersection of two objects" and left-click on the lines AB and P1 Q. Find the point of their intersection K.

5) Let's draw a line P1R. Find the point of intersection M of this line with the line AC.

6) Let's draw direct KM and QR.

7) Let's construct a polygon QRKMQ. Fill with color and hide the auxiliary lines.
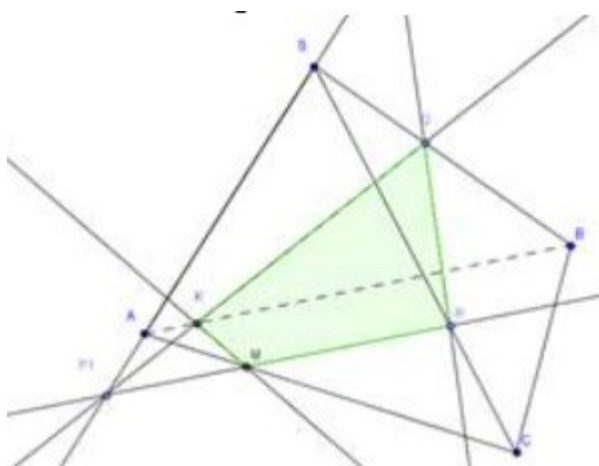

Fig 2. Desired section

Problem 2. Construct a section of the pyramid by the plane PQR, if the point P lies on the line SA, the point Q lies on the line SB, the point R lies on the line SC.

Consider the case when the point P lies on the line SA outside the polygon. To consider the solution of the problem for this case, you can use the drawing of the previous problem. Let's hide the point R.

-    Use the tool "Line by two points" to construct a straight line SA.

-    Mark a point P on the line SA.

Let's draw a straight line PQ.

-    Select the tool "Intersection of two objects" and left-click on the lines AB and P Q. Find the point of their intersection K, as shown in Figure 3.
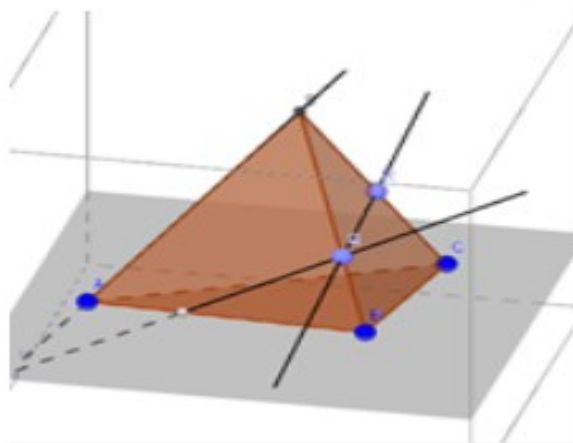
Fig 3. Finding the point of intersection of lines

- We will conduct a direct PR. Find the point of intersection M of this line with the line AC, as shown in Figure 11.

- Let's draw direct KM and QR.

- Let's construct a polygon QRKMQ. Fill the resulting section with color, as shown in Figure 4.
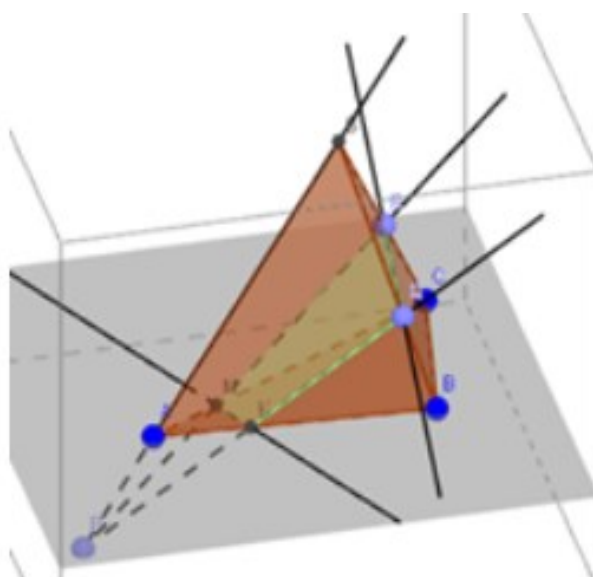
Fig 4. Building a section

Thus, the GeoGebra dynamic mathematics software makes it possible to more clearly demonstrate the presentation of material for schoolchildren, which, in our opinion, can improve the understanding of the material being studied.

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