To Develop The Ability of Thinking Creatively of Students in The Process of Drawing

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Abstract  
In this article in the developed information technology environment, “Development of interest in drawing learning in pupils of secondary schools”, initially, it seemed that there were three ways to incorporate graphic exercises that could serve significantly in the learning process of the subject of drawing, which is currently dominating.

Key words: “Volumetric Trapezium”, geometry, designing, drafting, solutions.

Introduction  
First of all, it is the question of finding enough space and enough time to fit into the content of this material in this or that subject, every new teaching material in this or that subject, even if it is very important in our example, for the introduction of the drawing course of the general secondary school into the educational process, which is currently dominating.

In the developed information technology environment, “Development of interest in drawing learning in pupils of secondary schools”, initially, it seemed that there were three ways to incorporate graphic exercises that could serve significantly in the learning process of the subject of drawing, which is currently dominating:

1) Introduction of elements of interest in the composition of the assignment for each of the total 16 graphic works performed in the 8th and 9th grades on the "Drawing" (Drafting) course;

2) Development of a set of topics and assignments for graphic work on the control of creative activity of students, as indicated in the science program "Drawing" (Drafting);

3) To develop a set of assignments for the 5-th graphic work of 9th class, which is carried out within 2 hours of the 19th and 20th lessons on the topic “Solution of creative graphic issues with elements of design in the structure” and the content of theoretical knowledge used in their implementation.

After all the different feedback, we chose 3 of these ways.

After we came to this decision, it was made possible to accurately record our duties in the queue:

1. To review the types of graphic assignments that can be prepared under the theme “Designing” of the course “Drawing” (Drafting) within the framework of this dissertation work.

2. Introduction of levels of complexity to the tasks to be prepared for the subject of "Designing", depending on the place occupied by the content of the course “Drawing” (Drafting).

3. To develop the content of theoretical knowledge used in carrying out the prepared assignments.

Let's first take the image of ”Unlimited stairs” (figure 1.1.8, B). This image was done in the
so-called “Perspective” type of images where we took it. True, 9-graders have worked with this type of images many times in the lessons of “Art”, which are studied in the lower classes. But they did such work on the basis of the experience generated by observation. The secondary school drawing course program does not provide for the study of geometrical foundations of image formation. Perhaps this is not so necessary either. Because similar images to “Unlimited stairs” can be obtained even in the type of projection known as ”Isometry”, which is studied in the course of secondary school drawing.

Now, to the attention of readers, we refer to the isometric picture of the “Unlimited stairs“. The reason why the staircase seems to be infinite is that the elements (A and V, as well as S and D points), which are located far away from each other in space, are depicted very closely together in the drawing. In order for the image to have the same feature in the trackometric projection, the lines A and V and C and the lines passing through the points D in the planar should form a horizontal line with the angle 60° (Figure 1.2.2).

Assignment. By using the images of the blocks given in Figure 1.2.3 make the isometry “no end ladder” as in the picture 3.2.1.

![Figure 1.2.1. Isometric image of “Unlimited stairs“.

Figure 1.2.2. Plan of “Unlimited stairs“.

Figure 1.2.3. Blocks for assembling “Unlimited stairs“.

Note. Based on our previous example of the assignment, it is possible to develop different variants of it, either by increasing the number of stairs, their thickness, width and length by either increasing or decreasing the number of sides of the cages. The second type of tasks, which we are involved in pedagogical test-experimental work, is associated with “Volumetric Trapezium”, and the details of our work performed on its basis are as follows.

A 20-minute lecture on the first of two lessons on the topic “Solution of creative graphic issues with design elements in the structure“, which will be held in the 19th and 20th hours on the curriculum of the subject ”Drawing” (Drafting) of the 9th class:

There are scientific teachings developed by the theory of geometrical modeling in solving creative graphic problems. Geometrical modeling is considered one of the promising areas of practical geometry of the present time, where new geometrical images are created and their properties are studied, which can be attributed to engineering, architecture, design and various other areas.

As is typical for all areas of creativity, in the search for new solutions, the methods of thinking in a non-standard way are often used in the case of geometric modeling. Let’s see examples.

You have already solved a lot of questions on how to make a drawing (epure), consisting of
two or three proxies of different geometrical elements, shapes and bodies, and then during several lessons on the topic “General concept of Octant and epure” on drawing in the 8th grade, and then in several lessons.

Three located mutually perpendicular: let us recall the image of the transmission of the geometrical space by means of $H$, $V$ and $W$ planes into 8 octets (fig. 3.2.4). Here it is only necessary to note that in the picture we are now seeing, the projection planes are much thicker, that is, it is described as “voluminous”. A “volumetric straight line”, denoting the $x$, $y$ and $z$ coordinate arrows formed by their intersections, has the appearance of a four-sided prism. As a result, each of the three projections of the “volumetric point” in the image of the sphere remains a cylindrical image. The sphere here will have the form of a parallelepiped” volumetric points”, representing the coordinates of the ”volumetric point“ on the $x$, $y$ and $z$ arrows, and the ”volumetric point” on the head of the coordinates will have the appearance of a cube.

Is it possible to draw some useful conclusions from this that can be used for creative purposes? Possible.

Since the “volumetric points” in space have the appearance of a parallelepiped, the points of the sphere, the “volumetric points” of the “volumetric planes” are cylindrical and the “volumetric straight lines”. ”Volumetric straight lines” consist of a series of parallelepiped points (Fig.1.2.5, a), ”volumetric straight curved lines” series of cylindrical points (Fig.1.2.5, b), ”volumetric space curved lines” sphere series of points (Fig.1.2.5, v).

Similarly, a parallelepiped serves to model the “volume plane”, which is limited to any straight “volume closed broken line” from the “area of the points with a thickness” (Fig.1.2.6, a), cylinder-any flat from the “area of the points having a thickness” to “volume”, bounded by a closed broken line “volumetric plane” (Fig.1.2.6, b), sphere points “area with a thickness” on the desired curvature “surface with a thickness” (Fig.1.2.6, v).
Rule. Where two “volumetric lines”, consisting of a series of “volumetric points” of the same name, that is, there will be two “volumetric points”, which are located not in one but in the other (Fig.1.2.7). The refractive points of the spatial “volumetric fracture line” formed by a series of cube-points are “double points” (Fig.1.2.8).

Assignment for graphic work 5. Determine the graphic error allowed in the given drawing. Describe the solution along with its secondary projection on the plane V or W.

We get Fig. 1.2.9 (a) drawing as a given drawing without drawing with a graphic error. For a clear and understandable passage of the task execution process, we imagine that the object described in this drawing is made on the account of the sequencing of 21 cubes. We mark each cube with a certain number (Fig.1.2.4, b).

Instructions. The error allowed in the drawing in Figure 1.2.9 (a) is eliminated on account of the removal of three consecutive cubes from the image composition, forming an object image in the graphic work 5. The isometry of the formed object is described along with its secondary projection in the plane V or W.

In the Fig.1.2.10 a table is being drawn in which variant the reader removes own solution exactly the sequence of which trial cubes.

<table>
<thead>
<tr>
<th>Variation</th>
<th>Cubes</th>
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<th>Variation</th>
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<td>8, 9, 10</td>
<td>15</td>
<td>15, 16, 17</td>
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<td>2, 3, 4</td>
<td>9</td>
<td>9, 10, 11</td>
<td>16</td>
<td>16, 17, 18</td>
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<tr>
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<td>3, 4, 5</td>
<td>10</td>
<td>10, 11,12</td>
<td>17</td>
<td>17, 18,19</td>
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<tr>
<td>4</td>
<td>4, 5, 6</td>
<td>11</td>
<td>11, 12,13</td>
<td>18</td>
<td>18, 19,20</td>
</tr>
</tbody>
</table>
Fig.1.2.10. On 9th class drawing options for performing the graphic work 5.

After the assignments are distributed to the students of the class on the basis of this table, without pressing the pen, they begin to look for their own solutions in the sketch of their options on their paper specially folded, which consists of small equilateral triangles.

Obviously, drawings will be prepared by the teacher, which will be presented earlier by the owners of various options as the right solution. But they are not shown to pupils.

Now let's analyze the solutions offered by students on the topic of the lesson.

We can say according to the drawing of the Figure 1.2.9 (b), despite the fact that the holistic standing “volumetric trapeze” consists of a total of 21 Cube images in the task we have compiled, they are described in the drawing, consisting of a series of 17 cubes. That is, the image of 4 cubes in 4 corners of the “trapezium” is considered a "double" image, the image of one of the cubes on this earth is superimposed with the other. They are: Images of the 1st and 2nd cubes, 6th and 7th cubes, 10th and 11th cubes also 18th and 19th cubes. Thus, the drawing of “volume trapezium” consists of 17 image rows of 21 cubes in total. According to this situation, in the process of removing every three from cubes, in a row, respectively, we face different situations. Such cases can be divided into two.

Situation 1. Solutions of consisting of 14 cubes located in a row. The solution of the task 3 variation (Fig.1.2.11) and the solutions of the 12th, 13th, 14th, 15th variations (Fig.1.2.12) enter so solutions. In the formation of these images “the double” images of cubes in the corners of the trapezium are not involved.

Fig.1.2.12. The solutions of the 12th, 13th, 14th, 15th variations.
Situation 2. Solutions of consisting of images of 15 cubes located in a row. These cases can be analyzed by dividing them into 3 different cases.

Position 2.1. In the formation of solutions related to this case, both sides of the image of the "double" cubes located in the corner belonging to it in the composition of the triplet of cubes, which must be removed from the picture "Trapezium", will be equally involved. So situations include solutions of tasks of the 1st, 5th, 6th and 9th options (Fig.3.2.13) and solutions of tasks of the 10th, 17th, 18th and 21st (Fig.3.2.14).

Fig.1.2.13. Solutions of tasks of the 1st, 5th, 6th and 9th options.

Position 2.2. In this case, only one of the images of the “double” cubes, which is located in the appropriate corner of it, will be involved in the composition of the triangles, which will be removed from the image of the “trapezium” in the formation of the corresponding solutions. These include solutions to the tasks of the 2nd, 4th, 11th and 16th variations (Fig.1.2.15).

Fig.1.2.14. Solutions of tasks of the 10th, 17th, 18th and 21st variations.
Position 2.3. For finding solutions of the following only one of the images of the “double” cubes, which is located in the appropriate corner of it, will be involved in the composition of the triangles, which will be removed from the image of the “trapezium” in the formation of the corresponding solutions. But here the solutions of the two options will remain exactly the same shape: These include solutions to the tasks of the 7th and 8th, 19th and 20th variations (Fig.1.2.16).

An example of the situation after the execution of the task is given in Fig.1.2.17.

According to the working program on drawing of the 9th class, during the 19th and 20th lessons on “Solving creative graphic issues with elements of design in the structure” is held for 2 hours, and the details of the above-mentioned lessons were of great interest to us, after these two lessons, the students of the class developed sharply to engage in drawing for 2 weeks. Every day after the lesson, 4-5 students come to our presence and tell us the curiosities faced in creating a solution according to their own options, even after the solution was found, they remained in anticipation of the binaries again, saying that the next day they would come again and ask what they were asking for.
Fig. 1.2.17. Here is an example of the execution of graphic work 5 on the drawing of the 9th class.

During the break, I saw several times that three or four students in front of the blackboard of the class had a heated argument over the assignment drawing. Even the students who had been quietly mastering addressed to advanced students in handling their issues, they were helping with such appeals. Some of the students had been starting to study exactly what changes could have occurred on the account of increasing or decreasing the number of cubes in total that formed the "Penrouz triangle" or "volumetric Trapezium", or the number of certain cubes that were removed from their composition.

Also, pupils of the 9th grade also gave interesting graphic puzzles that existed to the pupils of the lower class, who were also actively involved in the solution of these category issues. Among the abandoned papers, which the school scavengers collected, also tried to solve interesting graphic tasks, but the drafts that were thrown out because the solution did not come out.

**Used literature**