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Research Article

ELEMENTS OF STUDENT SPACE IMAGINATION IN THE TEACHING OF GRAPHIC SCIENCES AND METHODS OF USING IT

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ABSTRACT

The article describes the elements of the development of students' spatial imagination in teaching graphic sciences and methods of its use, in particular, the apparatus of spatial imagery for use in the science of descriptive geometry and methodological recommendations for its use.

KEYWORDS

Knowledge, skills, abilities, student, spatial imagination, ability, literacy, thinking, spatial imagination.

INTRODUCTION

Nowaday, in order to improve the quality of education, teachers use a variety of methods, teaching aids, analyze foreign literature. Particulary, when teaching the subjects of descriptive geometry, drawing, or engineering graphics, students often have problems with spatial imagination. Based on our many years of observation and experience in solving these problems, we have developed a device for the formation and development of students' spatial imagination. In this regard, scientists Sh.K.Murodov, I.T.Rakhmonov, P.O.Adilov, T.Rixsiboyev, R.Q.Ismatullayev, M.Sh.Isayeva, M.O.Mirdavidov, T.J.Azimov, E.I.Ruziyev, Sh.Abdurahmonov and others in their scientific work those who have been killed or expressed their views. In particular, T.Rixsiboyev has done a lot of research on this issue. In particular, as a result of a number of studies, we have tried to create small tasks that motivate students to increase their spatial imagination and use simple elements. It consists of a singleplane and a point or section or triangle or rectangle or circle or curve lying on it.To be closer to practice or textbooks, we called this plane the V plane. (Figure 1).

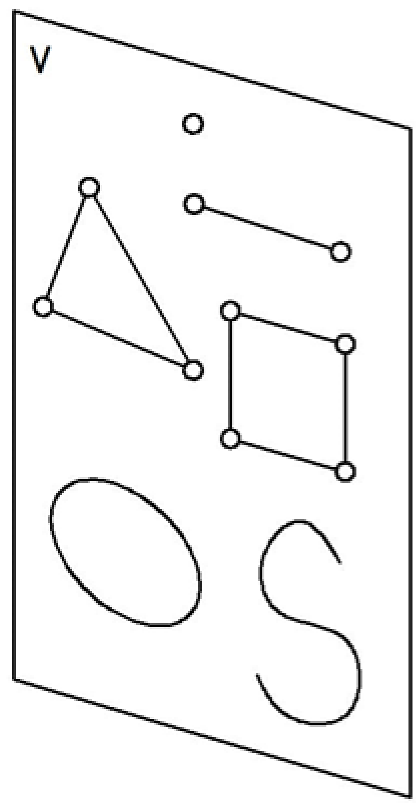

Figure 1

It is aimed at deforming and shaping the spatial imagination of students based on the design and imagining of geometric figures lying in a single projection light, plane or surface, that is, with the same appearance. we called. The aim is to activate their spatial thinking skills in a short period of time.

Let's take a look at how to use a spatial imager. As mentioned in part above, the figures in the spatial imaging apparatus are different in front of each other, but the projection is a point or cross-section or a straight figure or a curved line, i.e. the appearance is the same. The intended goal is achieved by the rapid design of flat and spatial geometric figures in space.

Gospar Monj, the founder of the science of graphic geometry, once said that "... if young people learn the basics of the science of graphic

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geometry from the point of view, they can easily and conveniently change geometric figures." That is why, we will first consider the development of students' spatial imagination in a short period of time using a point in the V-plane, which is given in the apparatus for the development of spatial thinking.

This process is based on interactive teaching methods. That is, modern teaching methods and financial assistance, such as question-and-answer sessions, heated debates, discussions, brainstorming, quick findings, creative research, and independent production and advice. Students will be given a handout, as shown in Figure 2, and they will sew it in their notebooks. Then, on an electronic slide, draw a Graph 2 or a Graph 2 projection device on the board, and ask the student questions to create a problem situation:

Question 1. Which geometric figure's projection in the V plane is like a point A or joins it?

This question motivates each student to think, reason, research and draw independent conclusions.

The teacher listens to the students answers and directs them to lively discussions, debates, brainstorming, quick findings, creative research, listening to and summarizing the opinions of each of them. That is, point A is the projection of point A in the space lying on the projecting light passing through it, as shown in the example in Figure 3, showing a slide or drawing on the board.Students copy the drawing on the board into handouts. The teacher then asks the next question.

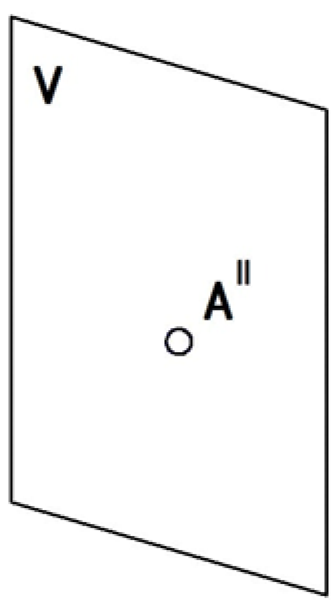
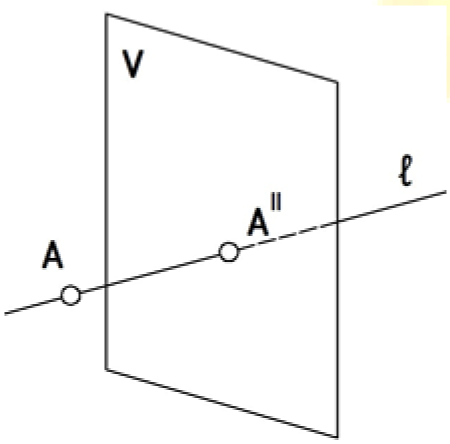


Figure 2

Question 2. Could there be any points other than point A whose projection overlaps point A? If possible, the second question is how such points are positioned relative to plane V.

After a few minutes, the students' responses are summarized as follows, with a lively discussion and debate during the problem situation, explaining their correct or incorrect answers as follows:

"There are so many types it's hard to say. Such points in space lie in the projecting ℓ ray, in front of point A (such as point A1), between point A and plane V (such as points A2, A3), in plane V, overlapping point A "(like point A4) and V can be located behind the plane (such as points A5, A6,..., and A8) so that the teacher deforms the spatial imagination and logical thinking abilities of the students along the projection ℓ beam (Figure 4).



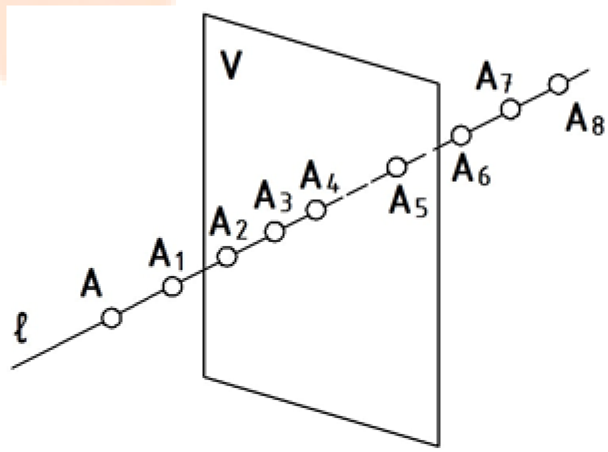


Figure 3 Figure 4

Their whole attention is drawn to the fact that there are an infinite number of points lying in the ℓ-ray projecting in different positions relative to the V-plane, and encouraging them to keep such points sealed in their minds. The teacher then asks the next third question.

Question 3. Will the projection of geometric figures other than a point on the V plane be a point like A"?

This question motivates each student to think more deeply, to explore their knowledge more intensively, and to draw positive conclusions. After a while, the teacher listens to the students' answers and encourages them to engage in lively discussions, debates, brainstorming, quick findings, creative research, and encourages them to listen to and summarize the ideas of each student in the class.

That is, point A "is the projection of the cross section m in the space lying on the projecting ℓ beam passing through it, as shown in the example shown in Figure 5. The image in Figure 5 is distributed to students as handouts and sewn to their notebooks. It is recommended.That is, point A "is the projection of the cross section m in the space lying on the projecting ℓ beam passing through it, as shown in the example shown in Figure 5. The image in Figure 5 is distributed to students as handouts and sewn to their notebooks. It is recommended.

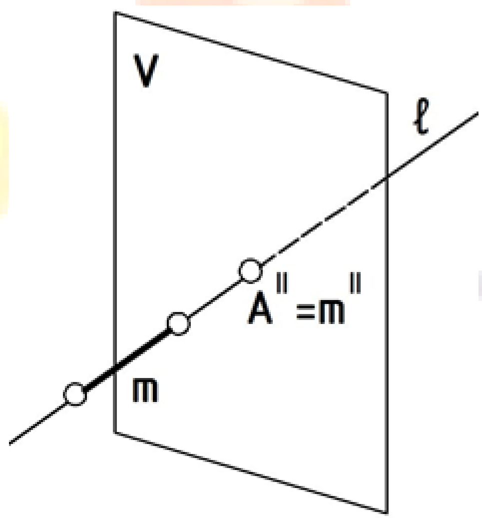


Figure 5

Question 4. Is it possible to have straight line sections whose projections overlap with points A and m? If possible, ask how such sections intersect with respect to plane V.

After a few minutes, the students' responses are summarised as follows, with a lively discussion and discussion of the above problem situation, explaining their correct or incorrect answers:

There are so many types it's hard to say. Such cross-sections in space lie in the projecting ℓ beam, and m can be located in front of V as a cross-section, one end in front of the plane V and the other end between it (like the cross-section n), behind the plane V (like the cross-section k). projection of spatial imagination and logical thinking skills ℓ once again deforms along the beam (Fig. 6). Students are taught to memorize such intersections by telling them that there are an infinite number of intersections that lie in the projected beam and are in different positions relative to the V plane.

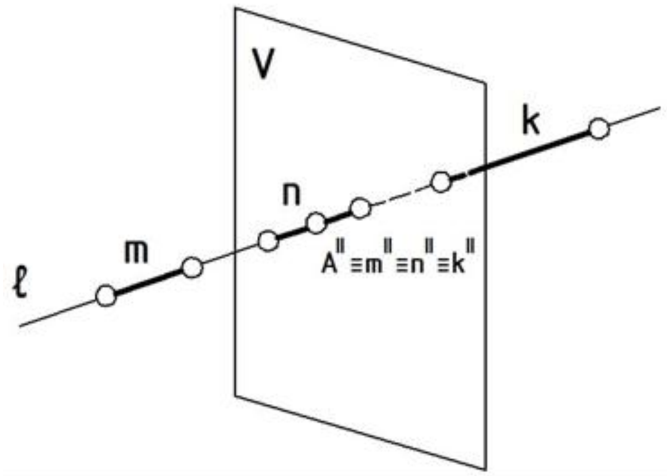


Figure 6

The teacher then draws the sections n and k in Figure 6 on the second handout sewn into the student's notebook and draws the following conclusion based on the students' active participation:

There are an infinite number of intersections in space that satisfy the condition of the problem, and they are in different positions with respect to the plane V of the projection along the projection beam passing through point A of the spatial imaging apparatus.

Thus, it is possible to improve students' spatial imagination and logical thinking skills with the help of the proposed spatial imaging device and the method of using it. They reinforce it by listening and looking at the visual aids presented above, and by drawing the diagrams in Figures 4 and 6 on handouts to form their spatial imaginations.

Students not only consolidate their knowledge formed during the use of spatial imagery in the classroom, but also develop their spatial imagination by listening to the conclusions, viewing the visual aids presented, and making drawings in the handouts.

In doing so, we ask the ancient peoples of the East to hear and see events and realities, to understand and comprehend them, and to

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acquire skills and abilities. I will never forget hearing, seeing and participating. "

Now let's look at how the second element, "Cross-Plane", can expand and enhance students' spatial imagination, Figure 7.

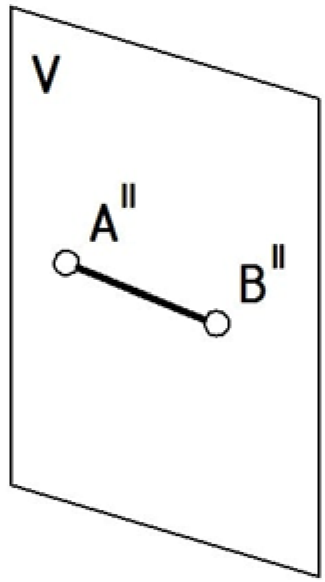

Figure 7

To do this, special questions are asked, such as the initial element of the apparatus used in the process of using the "point-plane", a problem situation is created on the basis of interactive methods of teaching. , independent thinking and reasoning skills are formed.

Students will begiven a handout as shown in Figure 7 and will be asked the following questions to create a problem situation:

Question 1. Which geometric shapes are projected onto the plane V as a cross section A "B" or merge with it?

Take some time to think. This question engages each student in thinking, researching, and drawing positive conclusions.

After the allotted time, the teacher listens to the students' answers, has a lively discussion with them, directs them to creative research, and listens and summarizes the opinions of each of them. That is, the cross-section A "B" shows from the example given in Figure 8 that AB is the projection of a straight line in space lying in the plane of the projected rays passing through it. The next asks the second question.

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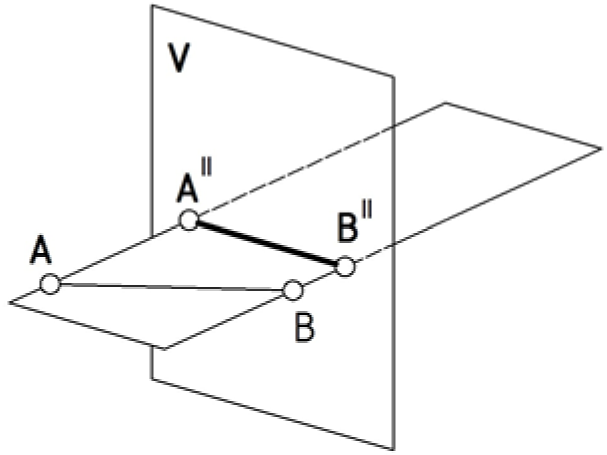

Figure 8

Question 2. Could there be another straight line whose projection A overlaps with section B? If so, how are these points relative to the V plane? he asks.

After a few minutes, summarize the students' answers as follows:

"There are so many types it's hard to say. Such intersections in space lie in the projection plane Q, such as the section m in front of V or the section AB lying on top of the section A "B", or one end in front of the plane V and the other end behind it. as the teacher deforms and forms once again along the plane Q of the rays projecting the spatial imagination and logical thinking abilities of the students (Figure 9).

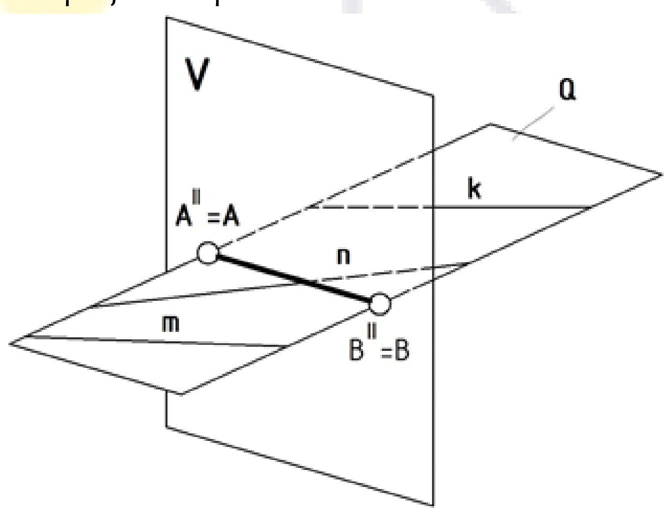

Figure 9

Question 3. Is the projection of geometric figures in the V plane other than the cross section A cross section like B"? Or what other geometric shapes are projected onto the plane V as a cross section A"B"?

This question encourages each student to think more deeply, focus their attention, and draw independent positive conclusions. .

After a while, the teacher listens to the students' answers, and after a lively discussion with them, listens to each student's comments, notes them, and announces the summary answer. That is, the cross-section A"B" shows examples from Figure 10 that the plane of projection rays passing through it can also be a projection of arbitrary straight shapes and curves in space lying in Q. In the handout, students write a summary and draw diagrams (flat shapes) accordingly.

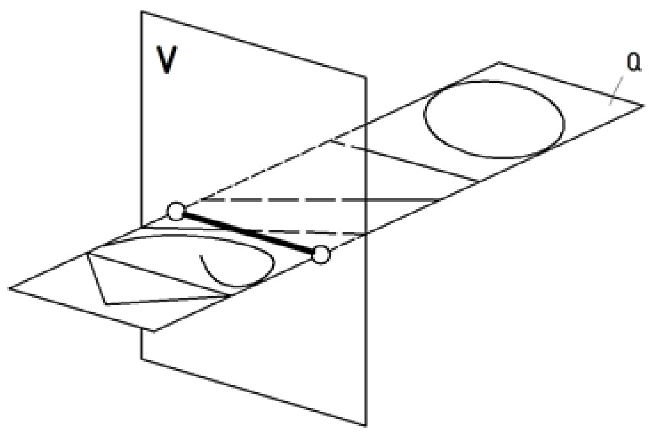

Figure 10

It is recommended to use this element of the apparatus in teaching the subject of descriptive geometry, such as "representation of straight lines and planes".

Consider the use of a triangle as a third element of the spatial imagery.

Students will be given a handout during the lesson as shown in Figure 11. Students will then be asked questions that create a problem situation.

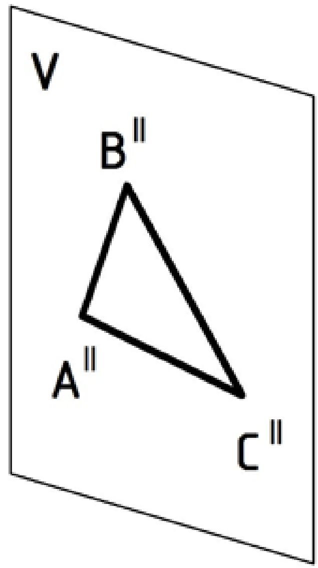

Figure 11

Question 1. Which geometric shapes are projected onto plane V as a triangle A "B" C? Or which geometric shapes are projected onto plane V with triangle A "B" C "?

Students will be given time to think, and their brainstorming responses will be explored using the Brainstorming method. After the discussion, the teacher shows the diagram in Figure 12 and summarizes the correct answer to the question, i.e., the planes of projection rays passing through the sides of the triangle A "B" C "in the V plane. will be the projection of the triangle (ABC) lying on the surface of the prism.

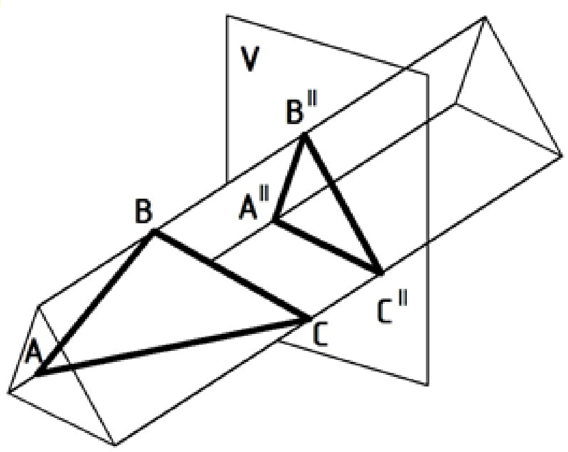

Figure 12

Students will then be asked another question.

Question 2. Can the projections of triangles other than triangle ABC be projected onto plane V as triangles A "B" C? If possible, in what position should they be in relation to plane V?

After analyzing the students' thoughts and comments, the teacher concludes the discussion with the following answer: The various triangles in an arbitrary position with respect to the plane V are also projected as triangles A"B" C". Must satisfy the condition of lying on the edges of the formed prism.

Question 3. Apart from the triangle, what other geometric shapes are projected onto the V plane as a triangle A"B" C"?

Students are given time to think. Then, as much as possible, listen to each student's feedback, have a discussion and debate between them, summarize all the answers, the teacher gives a concluding answer and show examples from the examples given in Figure 13.

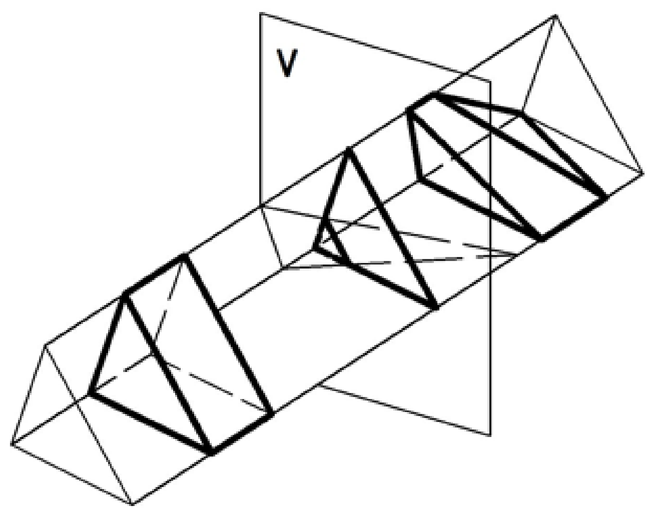

Figure 13

The answer is: A triangle A"B" C in the plane V is a prism passing through the edges of the projection beam passing through it, a curved prism, a truncated prism, a pyramid, a curved pyramid, triangles lying in a different position, and a line may be the projection of the surfaces.

From the above, it can be concluded that the use of such devices in the teaching of graphics helps to increase the spatial imagination of students, to work consciously on the problems.

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