

SPATIAL AND GEOMETRIC IMAGINATION.

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Abstract: *Graphical geometry is a part of general geometry that studies solving positional and metric problems related to the shapes, sizes, and relative positions of objects using methods of representing them.*

Keywords: *Drawing, ability, imagination, spatial visualization, perception, modeling, activity.*

In higher education institutions of developed countries of the world, it is becoming increasingly important to expand the opportunities for students to form their motivation for independent distance learning, develop spatial imagination and graphic thinking, and creative thinking skills through the introduction of multimedia educational technologies and virtual modeling methods. Spatial abilities are the ability to understand, discuss, and remember spatial relationships between objects and space. In a broad sense, spatial abilities include the processes of perception, memory, and processes associated with changes in spatial relationships between objects, as well as the ability to imagine changes in object relationships as a result of changes in perspective and other manipulations. Spatial abilities are a predictor of academic achievement in mathematics, science, technology, and architecture. Psychometric studies have identified the components of spatial abilities as spatial visualization (Lockman, 1979), spatial orientation (Hegarty, Waller, 2004), spatial imagination (Jansen, 2009), mental imagery (Shepard, Metzler, 1971), and spatial relations (Lockman, 1987).

The need for images began to appear in the era of primitive society. This is evidenced by the ornaments used on the tools and objects of primitive people that have survived to our time, as well as numerous images carved on rocks. Later, each people built high walls, ramparts and fortifications to protect itself from external enemies. Before building a fortification, of course, its image (plan) was drawn. Architecture in Central Asia has long been very well developed, and before the construction of each building, specific drawings were made. Of these, drawings of some decorative parts of buildings have survived to this day.

In the works of Central Asian thinkers such as Ibn Sina, Beruni, al-Khwarizmi, Ali Kushchi, similar drawings were widely used today. The development of human production activity began to set the task of more accurately reflecting objects on a plane. At the end of the 18th century, the French geometer Gaspar Monge, having studied the scientific work of scientists who had lived before him on geometry, wrote a book on depiction and called it “Geometrie descriptive” (“Descriptive geometry”, that is, “Drawing geometry”). This book was published in 1798, soon spread throughout Europe and began to be widely used in technology. G. Monge is considered the founder of projection at right angles onto two mutually perpendicular planes, and this method is still called the “Monge method”.

The problem of human orientation in space is broad and multifaceted. Spatial differentiation and spatial perception, spatial representations, and various spatial relationships, such as the shape, size, spatial orientation, location in space, volume, length, width, and height of objects, are all different spatial categories.

Their perception and imagination are spatial perception and imagination. According to the description of Professor V.S. Sverdlov, aiming in space is “a seminal expression of spatial perception and imagination”. Aiming in space is carried out on the basis of direct perception of space and knowledge of the above categories. The participation of attention, memory, and thinking is mandatory in this. That is why, when determining the content of the concept of “aiming in space”, some authors believe that it includes the positions of surrounding objects, their mutual distances, sizes, shapes, mutual locations, and their positions relative to the object being aimed at.

In a somewhat narrower sense, the expression “to aim in space” means to aim in place, which means:

- a) “Speech of position”, that is, to determine the location of the subject in relation to the objects surrounding him. For example, I am standing to the right of the house, etc.
- b) to isolate the surrounding objects in relation to the person aiming in space. For example, the shelf is to the right of me, and the door is to the left of me;
- c) to determine the location of objects in space relative to each other, in other words, the spatial relationships between them.

Active movement is a necessary component of spatial orientation, since a person aims in space “to successfully move from one point of the space to another”. Therefore, spatial orientation in practice always depends on the following three tasks: choosing a direction of movement; adhering to it (maintaining the direction); determining the goal (target) at the end of the movement. It can be seen from this that the coordination of movements and the acquisition of a clear spatial orientation are important components and, at the same time, an indicator of the mastery of spatial orientation by a person. Let's consider the main directions of the content and methodology of working with children at different age stages.

The section “Landmarking in Space” of the “Kindergarten Education and Training Program” is given from the second year of life. However, in our opinion, purposeful work on the development of spatial perception and elementary imagination in children should begin at an early age. Children under three years of age are very interested in the surrounding environment (home conditions, group “mother”, usual locations of objects, toys) and are interested in the workshop, which is a period of accumulating various experiences in landmarking. Therefore, an adult should teach a child to freely orient in the spatial location of rooms (group room, bedroom, bathroom, toilet), objects, things, toys.

From the beginning of the second year of life, children begin to imagine a familiar space (a room or part of it) more clearly, they can easily notice some changes in the location of familiar objects. From the age of two, children begin to form the first elementary ideas about how to move in a familiar limited space, and these ideas are improved in life activities.

Analysis of studies shows that spatial abilities have a number of interconnected components. However, there are different points of view on the number of components

included in this structure. One study emphasizes only two components: spatial relations and spatial visualization. Spatial relations are one-stage mental representations of two-dimensional and three-dimensional objects. Spatial visualization involves a set of sequential (more than one stage) mental manipulations in the arrangement and scattering of object parts. At the same time, spatial orientation is presented as an independent component, but the isolation of this component is complicated by the lack of tests that determine only spatial orientation.

Graphical geometry is a branch of geometry that studies the methods of depicting spatial figures on a plane and solving spatial problems with their help. Graphical geometry gradually emerged in the practical activities of mankind; it was used in the design of structures and machines, in the visual arts, and in other areas. Central Asian architects also used geometric shapes in the design of domed buildings and bridges. Even now, the methods of graphic geometry are widely used in the construction of buildings and structures of various geometric shapes.

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