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Teaching Methodology Topics Orthogonal Projections Of A Point Using Engineering Graphics

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Enter. Engineering graphics is an integral part of engineering and technology education. It plays an important role in the training of specialists engaged in the design, construction and production of various products and systems. Engineering graphics allows students to develop the spatial visualization, analysis, and communication skills necessary for success in engineering [1].

One of the main topics studied in engineering graphics is "Orthogonal projections of a point". This topic allows students to learn how to represent three-dimensional objects on a plane using projection techniques. Orthogonal point projections allow viewing objects from different sides and angles, which is important for analyzing and understanding their shape and construction [2].

Also mention that learning the method of teaching "Orthogonal projections of a point" will help students develop skills in working with graphic tools such as drawing tools, rulers, triangles, and computer programs for 2D and 3D modeling. We consider it important. These skills will be useful to students not only during their studies, but also in their professional careers. It may also be noted that orthogonal projections of a point are used in various fields of engineering, such as architecture, mechanical engineering, electrical engineering, and others. Knowledge and understanding of this topic will help students successfully solve engineering problems and create high-quality technical drawings.

Research materials and method. One of the ways to arouse students' interest in engineering graphics while teaching the topic "Orthogonal projections of a point" is to give real examples of this practice. For example, one can mention how engineers use orthogonal projections of a point to design buildings, machines, or electrical circuits. It will be necessary to explain how the accuracy and correctness of orthogonal projections affect the safety and efficiency of the objects created.

It should be noted that there are examples from history where incorrect orthogonal projections of a point have led to serious errors or failures in engineering projects. This helps students to understand the importance of this topic and motivates them to learn.

One example of incorrect implementation of orthogonal point projections leading to serious errors is the accident at the Chernobyl nuclear power plant in 1986. During the development and construction of the reactor, mistakes were made in the design and construction of the safety system. One of the reasons for this is the incorrect implementation of orthogonal projections, which has led to incorrect understanding and interpretation of data in the design of the security system.

Another example is the 1986 space shuttle Challenger disaster. When analyzing the causes of the disaster, it was found that the engineers made incorrect orthogonal projections when designing compression rings in rocket engines. This caused compression rings to fail during flight and eventually crash the rocket.

Both of these examples show how incorrect execution of point orthogonal projections can have serious consequences in engineering projects.

Orthogonal projection of a point is a method of representing a three-dimensional object in a plane. It is based on the use of perpendicular lines passing through a point and perpendicular to the plane of projections, called projection lines [3].

The correct execution of orthogonal projections of a point is extremely important, because the accuracy and correctness of the created drawings and plans depend on them. Failure to correctly perform projections can lead to measurement errors, incorrect location of objects and, ultimately, the wrong execution of the project. Therefore, the ability to understand and correctly perform orthogonal projections of a point is an integral part of education in technical specialties.

Examples of using orthogonal point projections in engineering and architecture:

1. Creating drawings of buildings and structures: orthogonal projections of points are used to represent various building elements such as walls, windows, doors and roofs on a plane. It allows architects and engineers to create accurate plans and diagrams of buildings.

2. Design of machinery and equipment: Orthogonal projections of points are used to represent various parts of machinery and equipment in a plane. It helps engineers develop accurate drawings and models for manufacturing and assembly.

3. Urban infrastructure planning: orthogonal point projections are used to show different elements of urban infrastructure (such as roads, sidewalks, buildings and parks) on a plane. This allows city planners and engineers to make accurate plans for the development of cities.

4. Interior design: orthogonal point projections are used to depict various interior elements such as furniture, lighting and decorative elements in a plane. It helps designers to create clear plans for interior design and harmony of interior furnishings of the room.

5. Design of engineering systems: orthogonal projections of points are used to represent various engineering systems on a plane, such as electrical wiring, water pipes, and ventilation systems. It helps engineers develop accurate drawings and schematics to install and maintain systems.

These are some examples of the use of orthogonal projections of a point, and their application can be found in many other areas where accurate representation of three-dimensional objects in a plane is required.

Another way to arouse students' interest in science is to use interactive teaching methods. For example, a short hands-on experiment can be conducted in which students themselves create orthogonal projections of a point and they see the result of their work. This helps them understand how these projections work in practice and how they can be useful in engineering [5].

The following interactive methods can be used to teach orthogonal projections of points:

1.Virtual trainers and simulators: virtual environments should be created where students can practice creating orthogonal projections of points on a plane. This allows them to gain the practical experience and skills needed to work with orthogonal projections.

2. Interactive textbooks and online courses: develop interactive learning materials that allow students to interact with the material and complete tasks to create orthogonal projections of points. This may include video lessons, interactive demonstrations, and practical assignments.

3. Virtual Reality (VR): Using VR technology to create an immersive environment where students can interact with 3D objects in real time and create orthogonal projections of points. This allows them to build orthogonal projections and gain a deeper understanding of their application.

4. Computer programs and applications: Using special programs and applications that allow students to create orthogonal projections of points on a computer or mobile device. This may include 3D object modeling programs or CAD systems.

5. Group Projects and Assignments: Organize group projects and assignments where students can create orthogonal projections of points together. This allows them to learn to communicate and cooperate with each other, as well as to receive feedback from their peers and

teachers.

These interactive teaching methods help students better understand and apply orthogonal point projections in engineering and architecture.

Summary. Visual materials such as videos or presentations can also be used to show students real-life examples of orthogonal point projections and their applications in various areas of engineering. This helps them better understand how the topic relates to real-life problems and projects.

It should also be noted that orthogonal projections of a point are the basis for further study of engineering graphics and other technical sciences. Showing students how to apply these knowledge and skills during their studies and in their future careers can be a good motivation factor.

List of used literature

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