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THE ROLE OF DESCRIPTIVE GEOMETRY IN THE FIELD OF ENGINEERING GRAPHICS

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ABSTRACT:

Innovative approaches to simplifying engineering graphics and drawings through the use of software such as “AutoCAD” and “Ascon Compass” are being widely implemented in practice. Research is being conducted to enhance the methodological systems for using automated 3D digital technologies in the creation of complex product drawings, fostering creativity in future professionals based on international experiences.

Keywords: Spatial imagination, spatial structure, problem-solving through spatial visualization, object, drawing, product, detail.

INTRODUCTION

From the earliest periods of human history to the Renaissance, humans communicated thoughts through gestures, facial expressions, symbols, words, and drawings. These methods evolved and developed alongside human progress. Initially, drawings were created in two dimensions and later in three dimensions.

In ancient times, there was a significant need for maps depicting caravan routes with conditional symbols representing objects such as large trees, rocks, streams, deserts, and water sources to avoid losing direction. These drawings were tools for communication and survival.

Over millennia, humanity's intellectual and creative development allowed people to create more detailed and explicit representations of objects. These drawings provided insights into the parts, structure, functionality, and dimensions of objects. However, as objects became more complex, explicit representations could not fully convey their internal and external structures.

Flat drawings evolved into more sophisticated two- and three-dimensional representations. Although the exact origins of explicit representations and axonometric projections remain unclear, they were widely used by craftsmen and artists in many countries.

Descriptive geometry serves as the foundation of engineering graphics and is taught as a core subject. While geometry theoretically studies planar and spatial figures from a mathematical perspective, descriptive geometry focuses on practically representing these figures through

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drawing. This dual approach-first gaining theoretical knowledge and then applying it practically by creating drawings-is considered effective for understanding geometric figures.

Every designer, in the process of creating a product, employs their creative thinking to arrive at optimal decisions, using geometric knowledge to address technical, technological, and economic considerations. The design process involves creating various drawings of the product, analyzing its strength and durability through mathematical modeling, and conducting tests. Therefore, students must first master descriptive geometry and then continue to advance their skills in drawing and engineering graphics.

From primary school onwards, students encounter various types of drawings and graphical representations in their studies. For example, in labor classes, students create drawings of objects they will construct. This practice extends beyond schools to vocational colleges and other educational institutions, where drawing remains a fundamental subject. Drawings are part of everyday life, used for design, modifications, and planning. Spatial imagination lies at the heart of this process, leading to creative design work.

The tasks assigned to students during design and construction exercises should account for their knowledge, skills, and abilities. These tasks may include:

1. Choosing students with well-developed spatial imagination.
2. Creating engineering drawings that meet industry standards.
3. Understanding and combining interchangeable parts commonly used in modern mechanical engineering.
4. Applying methods to transform and refine mechanisms and transmissions.
5. Understanding advanced technological processes in modern mechanical engineering.
6. Knowing the basics of part strength (durability of structures, smooth operation during use, etc.).

Creative design in drawing involves addressing both technical and technological challenges, such as:

- Designing a part’s construction according to given conditions in axonometric projection.
- Transitioning from one construction to another.
- Completing or redesigning incomplete product structures.
- Improving designs.
- Designing mechanisms in axonometric projection.

Technological challenges include:

- Developing manufacturing processes for parts.
- Optimizing technological processes during assembly.
- Enhancing marking methods for raw materials.

Scientific and pedagogical literature highlights the components of creativity in axonometric projections as follows:

Motivational-value component: Personal qualities defining the individual's role in and orientation toward the activity.

Cognitive component: The presence of theoretical knowledge enabling conscious activity.

Practical-activity component: Skills and knowledge tested and deemed effective in practice.

Reflective-evaluation component: Independence, creativity, and self-assessment during design activities.

As students' cognitive activities expand, the role of the teacher evolves. Teachers are no longer mere conveyors of subject knowledge but act as "pilots" in the sea of information, helping students select, comprehend, and effectively use relevant information in their professional activities, aligning with modern educational competency principles.

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