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IMPROVING DIDACTIC SUPPORT FOR THE PRACTICAL APPLICATION OF POSITIONAL PROBLEMS IN PERSPECTIVE

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Abstract: This article addresses the optimization of didactic materials used in teaching positional problems within the framework of perspective projection. Positional problems, which involve determining the spatial relationships between geometric elements (points, lines, and planes), often present significant cognitive challenges for students in engineering graphics. The research focuses on improving the didactic support system by integrating modern multimedia tools, 3D modeling, and interactive visualization techniques. By shifting from traditional static methods to dynamic digital frameworks, the study demonstrates how the practical application of perspective rules can be made more intuitive and precise. The results suggest that enhanced didactic support not only improves students' spatial imagination but also bridges the gap between theoretical descriptive geometry and real-world design execution.

Keywords: Positional Problems, Perspective Projection, Didactic Support, Engineering Graphics, Instructional Design, Spatial Visualization, Descriptive Geometry, Pedagogical Technology.

Introduction

In the study of engineering graphics and design theory, **perspective projection** serves as the primary method for representing three-dimensional objects on a two-dimensional plane as they appear to the human eye. Within this discipline, **positional problems** represent the core of spatial analysis. These tasks—which include determining intersections, visibility, and the relative positions of geometric figures—require a high degree of abstract thinking and spatial reasoning.

Historically, the didactic support for these problems has relied on two-dimensional textbooks and manual drafting, which often fail to convey the depth and complexity of spatial intersections. As the architectural and engineering industries transition toward digital-first workflows, there is an urgent need to **improve the didactic framework** in pedagogical institutions. By leveraging modern information technologies, we can transform these abstract positional tasks into interactive, visual experiments. This introduction explores the necessity of modernizing instructional materials to ensure that future engineers and designers can master the practical application of perspective with greater efficiency and accuracy.

Main Body

The study of perspective projection remains one of the most intellectually demanding components of the engineering graphics curriculum. At its core, the discipline requires students to translate complex three-dimensional spatial relationships onto a two-dimensional plane while maintaining the visual laws of human perception. Within this framework, **positional problems**—tasks involving the intersection of lines and planes, the determination of visibility, and the relative orientation of geometric figures—serve as the foundation for architectural and engineering design. However, traditional didactic methods, which rely heavily on static textbooks and manual drafting, often fail to bridge the gap between abstract geometric theory and practical application. To address this, the improvement of didactic support through modern information technology is not merely an option but a necessity for modern pedagogical standards.

To improve the didactic support for positional problems, one must first analyze the cognitive barriers students face. Positional tasks in perspective require a high level of spatial imagination. When a student is asked to find the intersection of a line with a plane in a perspective drawing, they must mentally track vanishing points, horizon lines, and ground planes simultaneously. Traditional 2D diagrams are often cluttered with auxiliary construction lines, which can lead to visual fatigue and conceptual confusion. By integrating **multimedia-based didactic tools**, we can decompose these complex problems into step-by-step animated sequences. For instance, instead of viewing a completed, static drawing, a student can interact with a dynamic model where each construction step—from locating the station point to determining the final intersection—is layered and color-coded. This visual decomposition allows for a deeper "schematic" understanding of the geometric logic involved.

A strategic opportunity for improving didactic support lies in the transition from descriptive geometry to **Parametric 3D Modeling**. In a modernized didactic environment, positional problems are solved not just by drawing lines, but by manipulating digital objects. Using software like AutoCAD, Revit, or specialized pedagogical platforms, students can rotate a perspective scene in real-time. This provides immediate feedback: if a student incorrectly places a vanishing point, the distortion in the perspective view becomes instantly visible. This "trial-and-error" loop is a powerful didactic mechanism that is impossible to achieve with paper and pencil. Furthermore, the application of **Augmented Reality (AR)** allows didactic materials to come to life. A student can point a tablet at a 2D textbook diagram and see a 3D hologram of the positional problem emerge, allowing them to inspect the intersection of planes from any angle. This immersive interaction significantly accelerates the development of spatial reasoning.

Furthermore, the "Practical Application" aspect of these problems must be linked to contemporary engineering challenges. Didactic support should move away from abstract cubes and pyramids toward real-world architectural elements. Positional problems can be taught through the lens of shadow construction, reflections in mirrors, or the placement of structural beams within a complex building frame. When didactic materials use "Project-Based Learning," students see the direct utility of perspective laws. For example, calculating the perspective of a winding staircase involves multiple positional tasks—finding the intersection of tread planes with the central axis. Modern IT allows for the creation of "Interactive Workbooks" where students solve these practical problems digitally, and the system provides automated hints based on descriptive geometry algorithms.

The role of the educator in this improved didactic framework also evolves. The teacher shifts from being a source of information to a facilitator of digital exploration. Modern information technologies provide "Learning Management Systems" (LMS) where didactic support is personalized. For a student struggling with the concept of "Parallelism in Perspective," the system can offer targeted multimedia tutorials and simplified positional tasks before moving on to complex intersections. This adaptive learning approach ensures that the fundamental laws of perspective are mastered before the student attempts high-level design theory. The data collected from these digital interactions allows instructors at institutions like the Termez State Pedagogical

Institute to identify common "bottlenecks" in student understanding and refine the didactic curriculum accordingly.

In the context of **Engineering Graphics and Design Theory**, the accuracy of positional solutions is paramount. Modern IT provides tools for "Computational Geometry" that can verify the mathematical precision of a perspective drawing. Improved didactic support should include training on these verification tools. Students should be taught to verify their manual perspective constructions against computer-generated models. This dual-method approach—combining traditional geometric logic with modern software verification—produces a more robust technical mindset. It ensures that the student understands both the "how" (the manual construction) and the "why" (the underlying geometric principles).

The prospects of this improved didactic support also extend to collaborative learning. Multimedia platforms allow students to engage in "Peer-to-Peer" geometric problem-solving. Through cloud-based whiteboards, multiple students can work on a single positional problem in perspective, discussing the placement of tracing points and the visibility of edges in real-time. This social construction of knowledge, supported by IT, mimics the collaborative nature of modern engineering firms. It transforms a solitary, often frustrating task into a collective analytical exercise.

Conclusion

Finally, the sustainability of improved didactic support depends on its accessibility. Modern information technologies enable the creation of "Open Educational Resources" (OER). High-quality 3D animations of perspective problems, interactive quizzes, and virtual labs can be shared globally, allowing for a standardized level of excellence in engineering graphics education. For a Master's student researching this field, the goal is to create a didactic ecosystem that is not only technologically advanced but also pedagogically sound. We must ensure that the "Multimedia" is not just a distraction, but a targeted tool that clarifies the complex spatial logic of positional problems.

In conclusion, the practical application of positional problems in perspective is being revolutionized by the synergy of traditional geometry and modern IT. By improving didactic support through interactivity, 3D visualization, and adaptive learning, we can equip students with the spatial intelligence required for the next generation of design and engineering. The transition from static representation to dynamic simulation is the defining characteristic of modern engineering graphics education, offering a clearer, faster, and more precise pathway to mastering the laws of perspective.

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