



CONDITIONS FOR EFFECTIVE LEARNING IN TEACHING ENGINEERING GRAPHICS

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ABSTRACT

This article explores the challenges of facilitating a modern educational process aimed at developing students' graphic literacy skills and mastering new information technologies. The article describes the experience of creating a custom workbook for the course "Engineering Graphics."

One of the most important conditions for the successful development, rapid implementation, and rational use of new teaching techniques for the discipline "Engineering Graphics" is the ability of specialists to create and read drawings, sketches, diagrams, and other technical documentation. The discipline "Engineering Graphics" in the technical education system is one of the basic general professional disciplines. The competency-based approach also places its demands on other components of the educational process—content, methods, pedagogical technologies, and the organization of the pedagogical process [4]. Within the context of the modular- competency- based approach, a comprehensive acquisition of skills and knowledge is carried out within an individual module as part of the development of a specific competency that ensures the performance of a specific work function reflecting the demands of the labor market.

The implementation of modular technology requires the creation of a specific learning environment, which, on the one hand, should be close to the real conditions of professional activity, and on the other hand, should optimize the modular learning process as much as possible [3].

The final requirements include: availability of spaces for various forms of educational and cognitive activity (individual spaces, spaces for paired work, spaces for small group work, spaces for group work); ensuring the teacher's ability to perform all functions (ensuring free access to all learning spaces (network access in the classroom), good visibility of all spaces, etc.).

The curriculum for a given course serves as the basis for creating learning modules. A module typically corresponds to a topic or a set of related topics. The module assesses parameters such as student attendance, student performance during the learning process, and initial, midterm, and final assessments.

The purpose of creating each module is to achieve a pre-planned learning outcome.

The method of using modular learning elements is effective in that it allows for the activation of students' cognitive activity, ensuring high motivation of students in the educational process, increasing the effectiveness of classes, the quality of knowledge, and academic performance in a given subject.

The goal of studying the course "Engineering Graphics" is to develop an understanding of the Unified System for Design Documentation (ESKD) and the ability to prepare and produce design, technological, and other technical documentation. This course provides students with the necessary knowledge to successfully study other technical disciplines, as well as interdisciplinary courses included in professional modules.

Also, for more effective learning, elements of other technologies, such as gaming and group learning, should be incorporated into the teaching process. Graphic training is continuous for technical majors throughout the entire training period, and is not limited to the first, second, or third year of "Engineering Graphics." Coursework and diploma projects within professional modules play a significant role here. In today's environment, the integration of computer graphics programs into the educational process is becoming increasingly common. The Federal State Educational Standard for Secondary Vocational Education for technical majors places the ability to develop various drawings using information technology as a key task. Undoubtedly, teachers have encountered many challenges, ranging from students' lack of basic computer skills to the insufficient number of hours allocated for classes.

However, despite the difficulties, computer technology is a powerful tool in the implementation of geometric and graphic methods and allows the modeling of almost any structure.

Computer work at the college is structured so that students don't simply learn the KOMPAS-3D graphics package but also continue their study of engineering graphics. The learning process is organized in parallel, combining hand-drawn graphics with computer-based drawing. It's worth noting that students are very engaged in studying "Engineering Graphics," and even weaker students find these classes engaging. Our students then apply their acquired graphics skills in their interdisciplinary courses within professional modules.

Of course, modern information technology holds a great future, but developing students' spatial imagination is impossible using only a computer. Students complete some graphic work on paper and some on a computer. Working on paper is essential, as every technically literate professional must be proficient in drawing tools. To achieve professional creative thinking, training in traditional graphic sketching techniques is essential.

Graphic activities simultaneously implement cognitive processes such as sensation, perception, imagination, and thinking. Developing spatial thinking is particularly important, as the development of thinking, particularly visual-figurative and spatial thinking, is closely linked to human intelligence. Here we encounter the problem of school graduates, who spend very little time on the subject "Drawing" or none at all. To develop spatial imagination, so essential for creating drawings, models of parts, and spatial objects, the course "Construction and 3D Modeling," introduced for first-year students, plays a major role.

The academic discipline "3D Design and Modeling" is part of the general educational cycle of the main educational program, which, along with the academic disciplines of the

general educational cycle, ensures the formation of general competencies for further mastery of academic disciplines and professional modules.

Mental processes, and therefore learning success, are also influenced by a number of seemingly unrelated factors. These include aspects of a person's personality such as emotions, feelings, current mood, temperament, character, and others. Only if the task is accessible to the learner, and if the goals for solving it are clear, will they feel they are moving forward, generating positive emotions.

In the new educational environment, a large portion of the curriculum is devoted to independent study by students. This necessitates the development of teaching and learning tools that facilitate rapid and complete student acquisition of the curriculum and the development of graphic drawing skills. Visual handouts are useful at the initial stage of graphic instruction (assignment cards, work samples, models and worksheets).

However, there is a need to develop a manual that would concentrate both a brief presentation of the theoretical content and the necessary volume of practical work, and would also reduce the time spent on unnecessary graphic operations (redrawing), and would also be multi-variant, aimed at developing the creative interest of students, and would promote self-expression and self-realization.

A printed workbook became such a teaching tool. The workbook is an effective didactic teaching tool for students, helping to streamline the instructor's work and save time. The tasks included in the workbook are aimed at acquiring and developing students' skills in constructing images and developing spatial understanding. The order of the workbook's sections corresponds to their sequence in the curriculum. Each section consists of graphic exercises recommended for classroom use and homework. The workbook offers a simple and practical opportunity to implement the results of didactic and methodological research and is used for practical exercises after explaining new material.

An electronic textbook that includes all types of learning activities—lectures, graphic design projects, methodological instructions, and section-specific testing—is available. This resource for the course "Engineering Graphics" completely frees students from searching for information and increases their interest in the subject. This textbook greatly supports the instructor's work and provides broader teaching opportunities.

A key condition for effective learning is the availability of prompt feedback, which allows for assessment of successful mastery of a given topic. For this purpose, assessments are conducted, including written surveys, tests, and individual assignments. The results obtained allow both students and instructors to adjust their own actions. A specific feature of graphic arts instruction is the individualization of learning and the instructor's careful monitoring of each student's work [5].

Thus, the modern educational process is aimed at developing students not only graphic literacy but also mastering new information technologies. Our main areas of work in implementing the Federal State Educational Standard for Secondary Vocational Education are activating students' behavior and thinking, developing interest in the subject, engaging students in cognitive inquiry, the ability to independently find and process information, and developing individual abilities.

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