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RESEARCH ARTICLE OPEN ACCESS

The Role Of Engineering Graphics In The Training Of Future Professional Engineers

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ABSTRACT

The article analyzes the development of new science-intensive forms of organizing the educational process in the system of higher professional education "Engineering and Computer Graphics," as well as the goals, structure, and interdependence of the educational system.

Keywords: Spatial imagination, psychological adaptation, abilities, interdependence, design, competence, intellectual, integration, creativity, cognitive, efficiency.

INTRODUCTION

Training highly qualified and competitive personnel in the higher-education system is one of the most important tasks of our time. How effectively is this task being addressed? The educational reforms being implemented in our country are aimed at ensuring a high level of quality in education and upbringing, and the President of the Republic of Uzbekistan, Sh. M. Mirziyoyev, stated that "it is extremely important to solve another problem." This is the professional level of teachers and academic staff, and their specialized knowledge. In this regard, it is necessary to create an environment that actively supports the processes of education, spiritual and moral maturation, and the formation of true values," as reflected in his views [1].

Problem statement. In the development of the professional competence of future engineers, engineering graphics is a fundamental subject: on the basis of the knowledge and skills acquired in this field, such qualities as spatial imagination, technical thinking, and the creative abilities of an engineer are developed. The academic discipline "Engineering Graphics" is regarded as the foundation for developing students' graphic knowledge, skills, and abilities and opens the way for the manifestation of their creative potential. It expands their spatial imagination and provides graphic-literacy skills such as reading and producing drawings, which underlie design, creating sketches and working drawings of objects, and constructing perspective images. In the course of studying general engineering and specialized disciplines, the level of graphic literacy develops, and course papers are completed in specialized subjects. Using the knowledge and skills acquired while completing course projects, students fully demonstrate their graphic and creative abilities within the framework of the final qualifying work.

METHODS

It has been confirmed that the content, forms, and methods of teaching in higher education must be oriented toward modern professional tasks in this field of knowledge as a system that prepares students for active professional activity. Therefore, the composition and structure of any discipline in higher educational institutions must be considered from the standpoint of developing the knowledge and skills necessary to solve professional problems [2–3]. In our view, such an approach to the structure of the discipline makes it possible to: ensure interaction between the basic and specialized sections of engineering graphics; promote the development of knowledge, skills, and abilities as well as the mastery of specialized subjects taught in higher educational institutions; and, through active influence on the future engineer's work in solving practical tasks, stimulate

interest in the profession.

Orientation toward the scientific field, enabling a student to meet the level of professional tasks of modern practice, can be achieved through the systematic organization of specialized disciplines in higher educational institutions that train engineers. However, specialized subjects are studied only in semesters 5–8 at specialized faculties, whereas the need to engage students in their future profession arises already in the first semester, because, as emphasized by earlier researchers, the process of developing professional interest must be continuous across all stages of "school – vocational – higher education." A. B. Kaganov emphasizes that the outcomes of students' initial professional training are largely determined by their achievements in psychological adaptation to the new conditions of a higher educational institution.

To determine the role, place, and influence of engineering graphics in the training of future engineers, we will conduct a series of theoretical studies. The effect of embodying engineering ideas in invisible, complex, pristine imagination is sometimes all the stronger the better the author has mastered the concept of three-dimensional space on a plane. The stronger the connection with technical disciplines during training in higher educational institutions that prepare engineers, the more actively interest in the profession develops [2–4]. This indicates the importance of engineering graphics for training future highly qualified specialists.

When studying engineering graphics, a future engineer should:

- possess the theory of forming images (of points, straight lines, and planes);
- know the algorithm for solving problems of plane intersections, and be able to determine the true sizes of certain geometric figures;
- know methods for creating images of objects (knowledge of standards);
- be able to read geometric shapes from parts of drawings and produce these images (drawing from life and in general);
- create drawings of various forms from combinations of the most common parts in the given specialty;
- be able to read drawings and prepare assembly-unit schemes.

Mastery of drawing skills as a means of expressing technical thought and as a production document must be developed throughout the entire period of study at a higher educational institution. This process begins with the study of engineering graphics and then develops and strengthens through a number of general engineering and specialized disciplines. Drawing and reading skills are among the key components of an engineer's career. The ability to read drawings enables a student to study an engineer's professional activity in depth, brings satisfaction from this activity, and consequently contributes to the activation of a person's professional interests. The knowledge and skills acquired in the study of engineering graphics are necessary for mastering general engineering and specialized disciplines, as well as for further professional activity.

An analysis of qualification requirements, curricula, and programs approved annually revealed the presence of entire sections that are not presented to students, and there is a serious need to study them. We concluded that intensive specialist training cannot be based exclusively on the traditional program documents we use.

We attempted to conduct a sociological study to determine the place and role of engineering graphics in engineering education. Sociological research provides broad opportunities to update the content and increase the level of activity. Along with other studies, it makes it possible to carry out a clear, in-depth, and comprehensive analysis of the current state of the process and development trends. Such studies can rightly be called one of the universal sources of information, since they not only identify various problems but also propose effective ways to solve them [5–6].

From 2023 to 2025, we collected anonymous questionnaires from 3rd- and 4th-year students in various specialties in order to obtain accurate and reliable information. A specific group of students was selected to participate in the anonymous survey—those who had completed training in practically all general technical and specialized disciplines included in the curriculum (course paper, course projects, diploma work). We offered them a subjective or objective assessment of the content of the educational material. They assessed the place and role of

engineering graphics in the process of studying specialized disciplines and helped to identify general perceptions of their future professional activity. The survey results confirmed our conclusions. Which subjects in the curriculum played a decisive role in your professional development? [3–5] Among the 10 subjects mentioned in the question, the connection with engineering graphics was lost. Engineering graphics, along with other disciplines of the program, is a priority area in improving a specialist's qualifications. The survey data are presented in Table 1.

The current stage of economic development, the level of technical equipment of production, and the introduction of integrated technologies have a significant impact on the personality of a young specialist and their qualifications; the demand for skills and organizational abilities has increased markedly.

The role and significance of engineering graphics in the professional development of a specialist.

Questionnaire Response number		3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Year of survey	2023	7	6	25	9	4	3	27	12	25	28
	2024	8	9	29	11	1	4	30	17	30	30
	2025	11	4	27	7	4	6	31	23	29	15
2023-2025		7,2	6,0	27,8	9,2	4,0	5,5	27,5	15,5	28,2	24,7

In this regard, in addition to questionnaires, we considered it necessary to use an equally effective method of collecting sociological data—the interview method. As data sources, second-, third-, and fourth-year students of mechanical engineering, road construction, and all specialties, as well as young specialists, enterprise managers, and department heads were selected. At different times (from 2018 to 2021), we personally and indirectly assessed the level of teaching engineering graphics, as well as the level of application of knowledge in this discipline in other fields when completing course and diploma projects. At this stage, the content of the curriculum and diploma projects in these specialties was also studied. At the same time, the conditions and factors that directly and indirectly influence the degree of interrelation of engineering graphics with other subjects of the curriculum were analyzed [6–7].

CONCLUSION

In conclusion, the following can be stated:

1. The research results serve as a basis for revising the curriculum of the course "Engineering Graphics."

2. Greater attention should be paid to studying the following issues:

– improving the skills of students performing tasks on the following topics: preparation and mastery of assembly drawings with elements of detailing and specialization;

3. Focusing on specialization, instruction, and the development of didactic teaching materials and their more active use.

4. When organizing the educational process, measures should be planned to ensure the connection of engineering graphics with disciplines that include a graphical component.

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