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PROBLEMS AND PROSPECTS OF GEOMETRIC AND GRAPHIC EDUCATION AT A TECHNICAL UNIVERSITY

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Abstract:

This article discusses the problems and prospects of graphic education at a technical university.

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Analysis of trends in the development of higher education has shown that the principle of system integration is of particular importance in the process of training future graduates of a technical university. This is due to the fact that the professional activity of a specialist is always integrative, and integration is one of the main activities of all spheres of modern society: management, economics, science, education. At the same time, it should be borne in mind that the essence of system integration, in a broad sense, is to determine the theoretical foundations of the intensification of creativity in vocational education, clarity, first of all, of a universal basis that takes into account the properties of the main components of non-standard situations of professional activity, namely, the properties of creative tasks and methods used to solve them.

Currently, a paradoxical situation has begun to develop in higher technical vocational education, when in order to achieve high-quality professionally-oriented training, general technical training, which includes a cycle of geometric and graphic disciplines, is being infringed. Geometric and graphic disciplines create a basis for training a specialist capable of professional growth not only in one narrowly chosen field, but also in related fields; they have a great influence on the professional development of future specialists (the development of logic, thinking, projective vision and intelligence), determining the universal abilities of a specialist.

It should be noted that the versatility of a specialist is the most important factor in the development of production in a market economy. The study of geometric and graphic disciplines lays the foundations of knowledge and skills necessary for the successful development of other general technical and special disciplines of the technical university, since the production of any structure, including technical products, construction objects and structures, etc., is impossible without preliminary development and execution of design and other technical documentation (sketches, plans, drawings, etc.).

To teach students to carry out such documentation (i.e., to use a visual-figurative language), to equip them with knowledge, techniques and methods of modeling, technical drawing and drawing, skills of using the acquired knowledge and skills in design practice when performing various images, where a set of tasks with extensive use of computer graphics tools is considered, is one of the goals of geometricgraphic education of future competitive specialists, as well as a necessary condition for their further successful professional activity and career growth.

The crisis in the field of geometric and graphic disciplines is largely due to narrowly pragmatic attitudes, orientation to a narrowly disciplinary approach, strict differentiation of disciplines studied at a technical university. The complexity of building geometric and graphic training at a technical university, which is based on descriptive geometry, is that descriptive geometry (and engineering graphics in general) occupies a dual position. On the one hand, it acts as a special general education discipline, because the knowledge gained in this discipline is the foundation for the study of other general education disciplines, general engineering and special disciplines. On the other hand, for most specialties of the technical university, descriptive geometry is not a major discipline, and students perceive it only as a kind of secondary discipline.

To change this situation, it is necessary to constantly link descriptive geometry with the solution of professional problems chosen by students of the direction, since junior students do not yet have sufficient knowledge of special subjects and cannot assess the importance of knowledge and application of geometric and graphic methods to solving professional problems. This indicates the need for systematic integration of geometric and graphic disciplines with general engineering and special.

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By geometric and graphic education we will understand the process of education and upbringing carried out during the study of geometric and graphic academic disciplines in the system of higher professional technical education, in which, along with the formation of a certain set of geometric and graphic knowledge, skills, skills and competencies, the development of visual and imaginative thinking of students, the formation of their professional competencies and geometric graphic culture.

The geometric and graphic disciplines that represent the basic geometric and graphic training at the technical University include: descriptive geometry, engineering graphics and computer graphics. Descriptive geometry, being the theoretical core of these disciplines, provides teaching of a number of courses in technical education. Being an integral part of engineering geometry and computer graphics, it determines the development of the theoretical foundations of computer geometry and graphics and is the basis for the geometric and graphic training of specialists at a technical university.

Constantly developing information, communication and computer technologies have a great impact on the field of geometric and graphic education. This is due to the new content of engineering work, in which information technologies, computer tools and computer equipment are used at all stages.

In modern conditions, the role of geometric and graphic training is significantly increasing, since the field of application of geometric knowledge in various fields of engineering activity is significantly expanding. This is primarily due to the fact that a geometric model occupies an important place in computer design technologies, which is the starting point, the initial link of various stages in the design, manufacture and operation of products, engineering structures and other structural systems. The modern design process begins with the creation of a three-dimensional model based on geometric data (parameters). Such a model makes it possible for a specialist to visualize the image of a future design, perform calculations, perform a health check, design a production technology, check some manipulations (assembly and disassembly), prepare the necessary design documentation, etc. At the same time, computer modeling allows you to explore the object, as well as control the results at any stage of design. Thus, the advantage is given to those specialists whose thinking is capable of synthesizing the imaginative and rational. Mastering the methods of geometric modeling of objects and processes greatly contributes to the development of the ability to such a synthesis.

The traditional paradigm is focused on values, norms and patterns of activity inherited from previous generations. The innovative model of education is based on cultural and national traditions and features, is aimed at the future, has an anticipatory and predictive character. Traditional and innovative education are genetically interconnected, without the first there is no second. The scope and nature of educational innovations largely depend on the scope and nature of traditions. They represent two opposite sides of a single educational process, the interaction and contradiction between which acts as an internal source of self-development, i.e. the transition to a higher quality level of education development.

For effective geometric and graphic training of modern specialists in the new educational system, it is of great importance to search, create and implement non-traditional educational technologies - information, computer, telecommunications - innovations, the application of which requires radical changes in methods and means of teaching, forms of organization of the educational process, theory and methodology of modern education.

Such an approach is important, but should not come at the expense of knowledge of fundamental sciences that develop a creative specialist. We must not forget that the computer is used in solving traditional educational tasks and serves to improve the quality of education. It is impossible to create illusions in a student that a computer can replace everything. Psychological support of educational processes related to computer support should be directed to the study of fundamental sciences. This characteristic of the use of computers in the educational activities of students is justified by the theory of the development of mental abilities in the aspect of the activity concept.

Therefore, the issue of the whole multifactorial and multidimensional problem of informatization and computerization of the sphere of geometric and graphic education at a technical university is relevant. It should be noted here that the very idea of the information paradigm of education has already led to negative consequences when trying to replace the study of geometric and graphic disciplines with computer graphics. However, time has shown the fallacy of such views, since the possession of a visual-figurative language of geometric and graphic images contributes to the development of individual abilities of a person, increases creativity of thinking, and the formation of skills for actively seeking solutions to both educational and practical tasks. The synthesis of traditions and innovations has always been present in the geometric and graphic education of an engineer

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and served as a kind of impetus to the formation and development of new pedagogical practice and new innovative experience. The rational use of computers in the learning process fills the teacher's activity with new content, allows differentiating and individualizing the learning process, stimulating cognitive activity and independence of students. Note the following important points of using computers at various stages of teaching.

1. The stage of presentation of educational information to students. The unity of ideas about the concepts of real physical and abstract geometric space is the basis of cognitive processes. Axiomatic and constructive procedures, logical and figurative-associative components in thinking should complement each other. For example, the study of the theory of geometric modeling, followed by its visual application to the tasks of practice on a computer.

2. The stage of assimilation of educational material in the process of working on a computer. One of the reasons for the failure of students is that they cannot isolate the semantic core of the educational material from a large volume of educational information. In recent years, the performance of computers has dramatically increased, as a result, the student can simultaneously compare different types of information, highlighting its features and invariants.

3. The stage of repetition and consolidation of acquired knowledge (skills, skills). Knowing the process of forming new information and all the difficulties associated with this process, the teacher should teach students to overcome these difficulties. The main criterion is a clear phasing in the work. Only after the complete completion of one stage should you move on to the second. The incompleteness of each of the stages reduces interest in the work, since conditions are not created for the maximum manifestation of mental capabilities. For example, teaching computer graphics shows that students who have not mastered the basic principles of descriptive geometry and engineering graphics cannot work with computer graphics packages efficiently.

4. The stage of self-control, intermediate and final control of learning outcomes. The creation of computer programs for assessing the assimilation of knowledge (computer testing) with mandatory consideration of the specifics of the content (scientific information), as well as the patterns of assimilation of this information by a specific contingent of students, will differentiate and individualize the learning process, increase the independence of students.

So, on the one hand, a strategically new information approach to geometric and graphic education requires the future specialist to be able to build geometric models with computer visualization. On the other hand, using only computer modeling will lead to a dead end situation in which the process of cognition will not be based on the study of real natural and/or artificially created objects and their modeling, but on the study of the information computer environment. In other words, it will lead to learning in which there is no component of the development of geometric (visual-figurative) thinking. Therefore, it is necessary to find a mutually beneficial compromise in the methodology and methodology of studying and constructing geometric and graphical models.

Investigating the problem of informatization of education (in particular geometric and graphic), the following conclusions can be drawn:

- informatization is considered as a necessary condition and the most important process affecting all the main directions of reforming the education system, however, the quality of information components can be improved by strengthening the methodological component of fundamental sciences;
- in the course of computerization of training at a technical university, it is necessary not only to preserve, but also with the help of computer technology to strengthen the training of specialists based on knowledge and understanding of the principles of construction and functioning of technical objects and processes (visual-figurative models);
- the analysis of the available works on the use of computer support shows that the criteria for the integration of fundamental and informational geometric and graphic training are in the process of development, as well as the criteria for assessing the quality of this integration, which determine the goals and directions of modernization of education.

The modern stage in the history of education is characterized by the rapid development of information and communication technologies, the creation of new design methodologies, maintenance of complex systems, the emphasis of the philosophy of education on the self-worth of a person as a person in a post-industrial society, which necessitates the integration of scientific achievements not only in the field of theoretical, applied geometry and computer graphics, but also other sciences.

Throughout the history of the development of technical thought, the geometric method of solving problems has been its most important integral part. Geometry is now increasingly acting as a method of cognition and a way of thinking. Geometric language (visual-figurative) is used in science, technology, art, and everyday life. In practice, geometric and graphical

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models reflecting the structure of the original are widely used in connection with the design of complex objects. These models allow solving problems related to the layout of objects, design, construction, architecture, solving optimization problems based on linear and nonlinear forms.

The importance of the geometric method is also great in the development of personality. The peculiarity of this method, coming from visual representations, creates favorable opportunities for students to develop such professionally significant qualities as spatial and visual-imaginative thinking.

Geometric and graphic education at a technical university is carried out as a management of the unity and integrity of training, education and self-development of the personality of a future professional engineer in accordance with the qualification model of a specialist and the State Educational Standard of Higher professional Education.

The main goal of geometric and graphic education should be to develop the ability to geometrically explore the phenomena of the real world, to create geometric and graphic models of real situations, objects, phenomena, processes and the ability to use them in any professional activity. If the goals facing modern geometric and graphic education at a technical university are solved, then graduates are at least able to build geometric and graphic models within their specialty, set geometric problems, choose a suitable geometric method and algorithm for solving a professional problem, apply methods using modern information technologies to solve the problem, apply adequate methods of geometric-graphical modeling and formulate practical conclusions based on the conducted geometric analysis.

The solution of these issues requires the construction of an integral system of education at a technical university, conditioned by the system integration of geometric and graphic general engineering and professional knowledge and combining all stages of engineering training with common educational goals and objectives. Currently, the problems of geometric and graphic training of future specialists related to the teaching of geometric and graphic disciplines remain and need to be solved.

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