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MODERN ASPECTS OF TEACHING GRAPHIC INFORMATION MODELING USING SMART TECHNOLOGIES IN EDUCATION

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A B S T R A C T

The article analyzes the didactic features of using the graphical visualization method in the process of forming professional competence of students in technical specialties. The pedagogical potential of the method in teaching technical disciplines and its role in developing students' professional competence is highlighted. The study results show that the systematic application of the graphical visualization method can increase the efficiency of the learning process.

K E Y W O R D S

Graphical visualization, professional competence, technical education, didactic methods, visual learning, professional skills.

INTRODUCTION

Currently, in the technical courses of higher educational institutions, special courses on geometry and graphics are studied from the first to the fourth semester (depending on the period) when obtaining a bachelor's degree. The basic level of geometric and graphical representation of a problem includes such disciplines as: geometric geometry, engineering and computer graphics. Graphic geometry is included in the theory of geometric modeling, is the theoretical basis of geometric and engineering disciplines and computer graphics, and serves to study a number of disciplines in general technical disciplines. In general, this is one of the basic disciplines in the training of service engineers. Engineering graphics is a practical discipline that develops drawing skills. In this article, the science of computer graphics is considered a part of the science of engineering graphics, which in turn allows you to create drawings and images using information and computer technologies.

The science of computer technologies allows you to develop students' abilities in graphical imagination. Thus, the development of design documentation using an automated design system (ALT) on a computer has led to the development and introduction into the educational process of three-dimensional modeling systems such as KOMPAS 3D, Inventor, Solid Works, etc., which allow you to study the electronic models of designed parts and their operation.

The formation of a fully automated design system with its own unique Visual Modeling capabilities, as a result of which the course of a schematic geometry course provides the opportunity for Visual Modeling, which contributes to the formation of students' graphical representation skills. As a result, the role of geometric graphic representations in society has significantly increased, and the field of application of geometric knowledge is constantly expanding.

This is due to the fact that the electronic geometric model is an important tool for designing complex and medium-complexity products on a computer, performing technical calculations for projects, analyzing the effectiveness of designed structures, and analyzing designed documents. With its introduction, design based on geometric data begins in the modern educational process.
This will allow in the future to carry out calculations at any stage of project development, to visualize its scheme, to virtually check how the product works, to develop modern production technologies, to check "its parts and disassembly", to formalize project documentation, etc. That is, at any stage of project implementation, it will be possible to study the object and control its development.

Literature Review

It should be noted that engineering activities in the service sector are associated with solving creative professional problems that do not have a clear solution, therefore, motivation is necessary for success. Motivation, I.A. Zimnua - this is a "mixture", a complex combination of driving forces of behavior that directly determine human activity in the form of needs, aspirations, interests, ideals, goals (Зимняя И.А. Педагогическая психология. М., 2000. 484 с.).
According to the results of the analysis carried out in this article, the purpose of geometric graphic education differs from the goals of traditional education. Its specific features are the uniqueness of the content and the organization of the components of professional activity. The content component is based on the development of students' abilities in implementing innovations in fundamental geometric graphic and professional activities, aimed at creative innovations, the formation of students' graphic culture, as well as the formation of such competencies as the ability to use graphic information in the educational process. The professional activity component is aimed at training highly qualified professionals who are able to combine design, research and scientific activities, characterized by creativity and originality.

Research Methodology

In the development of graphic educational subjects, the software and technical means of the educational process allow us to abandon traditional methods of creating graphic products, ensuring the use of modern innovative graphic technologies.
Currently, researchers have developed the following:
– a two-dimensional graphic model. In this regard, the computer is used as an electronic drawing board;
– a three-dimensional graphic model, such as a three-dimensional graphic model, in accordance with the requirements of modern information technologies.
In this case, the necessary conditions for the implementation of model design activities are created, as a result of which an original (original) object model is created. In the process of implementing the design, it is important to solve various geometric problems in a graphical representation, which allows you to create an image of the original object in a spatial mode in accordance with the spatial model.

Analysis and results

In the process of graphic teaching, undergraduates develop their spatial imagination, which allows them to mentally study the shapes of spatial objects and change them. Therefore, at the initial stage of

studying such disciplines as engineering and computer graphics, it is necessary to develop spatial thinking in students, which allows them to solve graphic problems using computer programs.

The traditional method of learning by constructing two- and three-dimensional models did not lead to serious contradictions with orthogonal projection algorithms. The development of the content structure of the lesson is based on the fundamental assumption that the study of two- and three-dimensional models should be used not only as a visual tool, but also as an effective tool for solving graphic problems. Possession of linear geometry and engineering graphics is an indicator of readiness for creative design activities, and the expansion of solving metric problems contributes to the formation of research competence.

The competency-based paradigm of education implies the orientation of the educational process to the individual. In this case, the task of the teacher is to organize the educational process, in which the main focus is on independent work on the specific educational trajectory of students.

The logic of the adaptation based on the competency of graphically studied subjects determines the importance and place of such disciplines as engineering and computer graphics in the formation of professional competencies at the undergraduate level of education. Also, since the language of these disciplines is the language of technology, the curriculum of the “Technology” discipline includes subjects aimed at teaching this language.

The technology of teaching engineering and computer graphics developed in this article provides for the formation of the components of professional competence of future engineers, taking into account the content of graphic disciplines. The following rules are taken as a basis for developing technology:

1. To substantiate the importance of graphics-related subjects in the professional development of service bachelors.
2. It is taken into account that students study graphics-related subjects from the first to the fourth semester.
3. The goals and objectives of the educational process are determined by the appropriate content of the subjects and their correct methodological support.
4. The interdisciplinary interrelation of such subjects as engineering and computer graphics, as well as their integration and combination with other disciplines, is clearly linked to their future professional activity.
5. The specific features of studying such subjects as engineering and computer graphics are taken into account.

Based on the results of the application of technology, our research analyzed the impact of teaching such disciplines as engineering and computer graphics on the development of professional skills of future engineers. It is worth noting that the level of formation of all components of professional competence of students has increased.

As a result, in order to ensure the reliability of the scientific results of the study, in this article, taking into account not specific competencies, but the competence of future engineers, this concept is much broader, taking into account not only cognitive and activity components, but also motivation.

It should be noted that, taking into account the opinions of some authors, in this article, competence is understood as a specific characteristic of a person, that is, having a certain set of competencies.

Thus, in this study, competence is considered as an integrative characteristic of a person (abilities, motivations, knowledge, skills) that ensure the successful implementation of future professional activities.

In accordance with the State Educational Standard of Higher Education, a future engineer in the field of service must possess general cultural, general professional and professional competencies.

As a result of the literature review, it was found that competence is manifested in the ability of a person to achieve success, reflects the knowledge and experience in practical use, in this regard, it is possible to distinguish such components of competence as: motivational, cognitive, and activity.

In order to achieve more reliable experimental work and objective results, this article defines the content of each component.

The motivational component of the professional competence of a future engineer reflects the motivation of students to use information technologies. It should be noted that the motive is understood by us as a need, goal, intention, motivation, and a characteristic that determines the behavior of a person.

The motivation that drives the activity, the profession itself, affects the self-determination of a person, satisfaction with the results of his work. Professional motivation is associated with the motives for choosing a profession and carrying out professional activities. In the context of the study, it should be noted that the use of information technologies in professional activities requires motivation to master knowledge in this area.

The specific features of engineering activity are that it reflects and solves the fundamental problems of the relationship between technical solutions and social consequences. In accordance with the requirements of the State Educational Standard of Higher Education, a future engineer in the service sector must master such types of activity as: organizational and managerial, research, production, technological and service.

All activities require the introduction and use of information systems and technologies, taking into account service processes. Motives determine the activity of students in their studies and future professional activities. It should be noted that motives can be internal and external. Internal motives include interest, success in completing a task, which are relatively stable over time and are actually determined by personal characteristics.

According to the Werks-Dodson law, intrinsic motivation has a positive effect on any type of activity. In addition, a high level of positive motivation plays the role of a factor directly related to compensation. The desire to achieve material benefits is an extrinsic motive. Internal motivation allows students to develop the ability to collect, analyze, process and systematize information on the field of professional activity using modern information technologies.

Motivation for future activity is the need for self-development, the desire to study, master and implement modern information systems and technologies, which allows the future engineer to realize his potential as a high-class specialist who meets the requirements of the era. Motives contribute to the development of creativity, as the subject reproduces himself in a creative way. The theoretical analysis of motivation was supported by practical research. In order to identify the motives for using information technologies, a pedagogical experimental study was conducted with the participation of 40 working engineers in the service sector.

According to V.I. Kochetov and S.I. Lazarev, computer graphics, as a branch of computer science, forms the basis of the technological activity of future engineers. Future service engineers are guided by computer graphics: computer

The criteria for the formation of the cognitive component of professional competence are as follows:

- in the field of information and communication technologies;

- in the field of computer modeling;
- in the field of engineering graphics;
- in the field of computer, interactive graphics and CAD;
- in the field of working with color, choosing the right colors, using the necessary file formats and tools for processing graphic information.

N.A. Moreva in her research work highlighted the possibilities of using the basic service technologies of the Internet for engineers: methods of using cloud technologies for obtaining and storing information for use in professional activities.

The professional competence, as emphasized in the previous paragraphs of this article, is associated with engineering graphics. According to V.M. Fetisov, qualified engineers in the field of engineering graphics should have the following skills:

 projecting a point in the quadrants and octants of space;
 depicting polygons;
 constructing the line of intersection of a surface with a plane and a straight line, as well as the line of intersection of one surface with another;
 constructing curved surfaces, as well as axonometric projections;
 constructing graphic models of geometric bodies and surfaces, which are widely used in modern engineering.

The analysis of pedagogical research on the problem of professional competence in the field of computer graphics allows us to distinguish the following group of skills:

- creating drawings, graphic objects and other graphic documents in various graphic editors;
- using tools and various color models, choosing the right colors and color combinations, making changes, creating and editing graphic objects and graphic data in general;
- using various graphic editors to build, create, configure graphic objects, design blind pages;
- independently acquired knowledge, skills and abilities, as well as working with graphic objects, to develop innovative projects in the field of service provision and apply them in solving practical problems using graphic editors.

The criteria for the formation of the activity component of professional competence include:

- use of Internet services for information processing;
- determination of the position of a point and a straight line relative to the projection planes in different octants;
- construction of graphic models of geometric bodies and surfaces widely used in modern engineering.
- solving positional and metric problems;
- creation of diagrams, graphic objects and other graphic documents in various graphic editors;
- use of tools and various color models, selection of appropriate colors and color combinations, making changes, creation and editing of graphic objects and graphic data in general;
- use of various graphic editors for creating, creating, adjusting graphic objects, designing blind sheets;
- in the field of service provision, innovative projects are implemented and practical issues are solved, which is reflected in the presence of such skills as the use of independently acquired skills in working with graphic objects among graphic editors. Thus, taking into account the fact that professional competence is presented as an integral characteristic of the future engineer's personality (abilities, motives, knowledge, skills), ensuring the successful implementation of future professional activities

based on the use of information technologies. Within the indicated competence, such components as: motivational, cognitive, and activity are distinguished.

Conclusion/Recommendations

The graphical visualization method is an effective didactic tool for the formation of professional skills of students. With the help of this method, complex technical concepts are conveyed to students in an understandable and demonstrative manner, the connection between theory and practice is strengthened. Graphic visualization develops students' technical thinking, improves problem-solving skills, and reduces errors in practical exercises. At the same time, systematic application increases the effectiveness of the educational process and prepares students for future professional activities. Widespread use of graphic tools in teaching technical subjects. Actively engaging students in practical exercises on complex processes. Integration of the graphical visualization method with other pedagogical methods.

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