

METHODS FOR INTENSIVE DEVELOPMENT OF STUDENTS' SPATIAL IMAGINATION IN THE STUDY OF ENGINEERING AND COMPUTER GRAPHICS*Fayzullayev Khayriddin Alimurodovich**Karshi State Technical University. Professor*

Abstract. The article is devoted to the importance of studying the discipline "Engineering Graphics" in training qualified specialists in the areas of the national economy related to technology and engineering, and explores methods for intensively developing students' spatial imagination.

Keywords: Spatial imagination, information technology, drawing, engineering graphics, computer graphics, multimedia, graphics, stands, models, posters, computer tools, designer, digital stylistic support.

Scientific research is being conducted in engineering departments of higher educational institutions of our country on the formation of students' motivation for independent distance learning, the development of spatial imagination and graphic thinking, creative thinking skills, the introduction of multimedia educational technologies, virtual modeling methods. In this regard, it is important to expand the opportunities for multimedia education to develop students' spatial imagination, competence in working with graphic tasks, design drawings. Multimedia education as an important factor in ensuring competitive personnel of future engineers, technologists, designers, architects, improving digital methodological support, increasing the role and effectiveness of multimedia electronic textbooks in developing students' spatial imagination, and substantiating the requirements for an imitation model in the process of developing students' spatial imagination based on graphic knowledge are important urgent issues.

Currently, in higher educational institutions, the work on the formation of students' spatial imagination, independent and creative thinking skills using stands, models, posters, and computer tools in teaching the subject "Engineering Graphics" is rapidly developing. However, the lack of sufficient educational and methodological resources, electronic books, textbooks, multimedia lectures, and sets of assignments prepared on the basis of computer technologies in this subject is not considered sufficient for today, when modern educational technologies should be used. The low level of use of graphic programs, electronic textbooks, video projectors, and electronic boards in teaching the subject indicates the existence of serious problems in the field and their scientific and methodological solution. As noted, the formation and development of students' spatial imagination and independent thinking skills in teaching the subject "Engineering Graphics" is one of the main tasks of teaching this subject. That is why teachers use various teaching aids (models, display posters, handouts, computer tools) to form spatial imagination in students. Currently, teachers face many problems in teaching the subject of "Engineering Graphics". Spatial imagination is a complete understanding of the shape, size, appearance, situation, and characteristics of the depicted object, drawing, item, detail, etc. Spatial imagination is understood as the ability to visualize the drawing, detail, etc. in the human imagination and to record it on paper. There are certain experiences in teaching the subject of engineering graphics using computer technologies in higher educational institutions. However, due to the lack of sufficient scientific research on the methodology for developing students' spatial imagination based on multimedia computer technologies in teaching the subject of "Engineering Graphics", there remains a

need to develop electronic resources that can be used in graphic education practice and implement them in the educational process.

In the educational process organized using existing traditional methods, it is not always possible to fully master the planned topics within the specified time. Problems related to the development of students' spatial imagination, independent and creative thinking skills through various pedagogical methods, as well as increasing the efficiency of mastering educational material, still remain. Researchers have achieved educational effectiveness by organizing classes based on multimedia presentations of information and details related to drawing geometry using the visual capabilities of the computer. At the same time, a number of scientific studies have been conducted by foreign and domestic scientists on the use of multimedia technologies in teaching the subject of "Engineering Graphics" [1-6].

Currently, using modern technologies, it performs the following tasks:

- The necessary technical and software tools for implementing a science database;
- a tool to assist the teacher in the educational process;
- A tool for perceiving and understanding educational materials through animation tools;
- a means of forming the imagination of a person who is learning; a means of forming and strengthening computer skills;
- a means of updating and supplementing educational materials;
- a tool for controlling knowledge and skills (testing) and shaping creative activity;
- a tool for creating and distributing the most up-to-date knowledge base in the educational process;
- object of reading and learning information in distance education;
- multimedia electronic library;
- ensuring the synchronization of all information on science.

Among higher education institutions, in the distance learning and educational system, the Internet allows access to high-quality textbooks and scientific materials, audio and documentary information, accelerates the exchange of information, simplifies the educational system, and allows the use of computer technologies in tests, experiments, and business games to verify the knowledge gained.

The use of computer technologies in teaching the subject "Engineering Graphics" creates the following opportunities:

- "Engineering Graphics" teaching tool;

"An object for teaching computer graphics based on the principles of the discipline "Engineering Graphics";

a tool for developing spatial imagination, creative and logical thinking skills based on these subjects;

a tool for checking acquired knowledge in computer-based tests;

a tool for studying and analyzing various geometric figures in the subject of "Engineering Graphics" using a simulator; a tool for solving graphic tasks in the subject using a virtual experimental stand;

a tool for using multimedia capabilities in lecture classes;

a tool for using a set of tasks in the subject;

a tool for using computer games; a tool for finding answers to control questions; a tool for using a glossary to understand the meaning of terms in the subject;

a tool for using a database of sufficient level for an independent learning process, etc.

The problems of student activity and independent thinking are one of the didactic roots of practice. If students cannot spatially imagine the state of graphic materials, the teacher's work will not be effective in terms of a positive educational result. Modern computer technologies and software tools created on their basis effectively help students to think independently and form spatial imagination in mastering the subject. In teaching the subject "Engineering Graphics", the use of automated design system programs, along with the use of multimedia e-books, is highly effective. These may include AutoCAD, 3d Max, and Compass programs.

The multimedia e-book is used for the following lesson objectives: Educational goal: to organize students' study of theoretical information on the subject being studied through spatial visualization and the implementation of graphic tasks based on this knowledge during practical lessons. Educational goal: to clearly understand the sequence of theoretical and practical knowledge on the subject being studied through spatial visualization and to use them as a necessary tool in real life, to form the skills of independent work and creative abilities. Developmental goal: to transform knowledge into skills, and skills into qualifications, and to develop the ability to work independently based on the developed spatial visualization of the subject being studied. The use of a computer as a didactic tool in the development of students' design and technological creativity skills gives effective results. Because modern computer tools serve as a convenient tool for applying theoretical knowledge in practice and quickly and objectively determining the level of mastery of the acquired knowledge and skills. Video lesson - a lesson development that presents certain knowledge and skills in video form, both visually and with sound, and helps the user (student, specialist, etc.) to learn the necessary knowledge by seeing and hearing. Leveled graphic task - the development of graphic tasks for students according to the principle of progression from simple to complex. Many foreign and domestic scientists have conducted research and made scientific recommendations on the use of computer technologies in graphic education [8-9].

Showing spatial solutions to problems before solving them encourages students to think independently and approach the problem creatively, and creates an opportunity for them to go back and show the part they do not understand until they understand it. Also, if there are interactive models of such problems, students can try to complete their tasks on interactive models. By entering the parameters of the tasks into the interactive model, the solution to the task appears on the screen. In AutoCAD, students can also form spatial imagination through standard details. When creating these details, they can try to create them in various ways using the necessary dimensions. This opportunity can be compared to a virtual experimental stand. In addition, its parameters and details can be edited as much as desired.

Conclusion: Based on the analysis, the following issues are relevant: in the current education system, it is advisable to ensure the continuity of education in general secondary schools, vocational schools, and higher education institutions, to focus on didactic methods in the superficial parts, to form spatial imagination and constructive thinking in students, and to increase students' cognitive activity.

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