

PEDAGOGICAL DESCRIPTION OF THE DEVELOPMENT OF CREATIVITY AND SPATIAL IMAGINATION OF THE STUDENTS OF THE SUBJECT "CONSTRUCTION DRAWING" USING GRAPHIC PROGRAMS

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Abstract - This article is aimed at the use of graphic programs in the teaching of "Construction drawing" in higher education institutions and the development of students' spatial imagination and creativity through this tool.

Key words - construction drawing, spatial visualization, graphic program, 3D model, standard, conditional symbols, two-dimensional.

In the history of mankind, the emergence and rapid development of information and communication technologies, which allow to remember, store, transfer and change information, led to the creation of a new educational paradigm of the 21st century - information culture. At the same time, these processes, in turn, increase the possibility of students' cognitive activity and the role of the pedagogue changes. It is not only a source of scientific knowledge for students, but also a "looseman" in the sea of information, helping to select the necessary information, understand it logically, and effectively use it in professional activities that meet the principles of competence of modern education.

Computer graphics tools have fundamentally changed the approach to teaching methods: visualization of invisible processes and phenomena, such as magnetic and electric fields, chemical reactions, etc., allows to improve their observation and understanding.

Scientific research on the problem of using graphic programs (ArchiCAD) in construction drawing and analysis of other scientific and methodical sources revealed that a scientifically based integrated pedagogical system of using graphic programs based on the principles of didactic logic and continuity has not been specially implemented. In some works, a number of recommendations on the use of graphic programs AutoCAD in construction drawing are given. To date, the use of this program in the field of construction drawing is not considered an effective tool. It can be recognized that there are a number of factors as the main reasons for this. Including:

- AutoCAD software is mainly suitable for two-dimensional drawings;
- two-dimensional drawings are made separately (2D and 3D state of the object) in the AutoCAD program;
- it will be difficult for all students to understand the drawings drawn separately;
- To change ready-made standard symbols in the AutoCAD program, access to its functional commands is required;
- The number of standard conditional symbols in AutoCAD is very few and they are also limited.



Within graphics programs, many programs have functions that allow you to draw both 2D drawing and 3D model views at the same time. But most graphics programs include the standards of the countries they were created in. But while some of them can be changed, some cannot. This situation causes some inconvenience.

Among the BIM programs, there are programs that are designed specifically for the construction industry. These are ArchiCAD, Revit, Lira, Grasscoper and others. Among these programs, the ArchiCAD graphic program is the most convenient for explaining topics in construction drawing. This is based on the following factors:

- ArchiCAD graphic software can work even on computers with limited technical capabilities;
- Easy operation of the ArchiCAD program (works the same in 2D and 3D drawings);
- Creation of both 2D drawing and 3D view in the ArchiCAD program;
- connection of commands on the command panel to the construction area;
- the parameters of conditional symbols can be easily changed;
- availability of the function of changing ready-made 3D models in 2D state;
- automatic execution of simple and complex cuts;
- the availability of easy connection of models taken from other places to the standard library and the possibility to change their parameters like the standard;
- the possibility of gathering ready documents into one project album.

It became clear from the analysis that insufficient work was done on the development of students' spatial imagination based on the technologies of computer graphics programs, which was shown in the scientific research and analysis. In the process of teaching the subject of "Construction drawing", a scientifically based methodology has not been developed for the use of a multimedia electronic textbook created taking into account the capabilities of graphic programs. After all, methodological support is important in organizing the educational process.

In higher educational institutions where the science of construction drawing is taught, it is possible to see increasing the practical importance of the science by introducing and increasing computer graphics topics in the science programs. Today, science specialists are required to be computer literate and use the capabilities of graphic programs. Using computer graphics programs in educational processes:

- spatial imagination develops;
- mastery rates will be high;
- the duration of storage in memory increases;
- creative and logical thinking develops;
- new projects and opportunities for their creation are opened;
- provides some convenience to students in performing graphic works related to construction drawing and helps to facilitate the process of mastering the educational material.

Organizing construction drawing classes using graphic programs and multimedia electronic textbooks has several advantages over traditional methods of teaching. They are:

- the quality of the lesson is at the required level;
- the information given on the subject is clear and understandable;



- drawings and objects that are related to science and need to be explained are done in front of students using computer graphics capabilities;
- will be able to see the 3D model of the constructed building in six views or four views at once and see the clear model from different angles;
- the possibility of giving simple and complex cuts in the finished object and viewing these cuts in one way;
- the possibility to explain the lesson allocated for the topic in a short time;
- lectures on the topic, sets of tasks, test questions of different levels, the availability of a glossary for terms in science can be used as an auxiliary tool.

Multimedia tools have significantly expanded the visibility of the educational process: models, graphics, colors, sound, and the use of video technology are among them. This variety allows for the modeling of different learning situations, including learning games.

The traditional practice of construction drawing classes is usually to draw a drawing of the subject on the board and have the students copy it into their notebooks. But often in construction drawing, it is not enough to show one drawing on the board. In this situation, the pedagogue needs to use pre-prepared drawings. In addition, using the animation capabilities of graphic programs, it is possible to show drawings that have not yet been shown on the board and to leave a deeper impression of the essence of the subject on the minds of students. This, in turn, makes the explanation of complex topics somewhat simpler, and the process of students' understanding of the learning material becomes easier.

Explaining the essence of the subject with the help of computer graphics has the following advantages:

- the ability to work with several drawings at the same time with the help of graphic programs;
- at the same time, it is possible to use the drawing as an exhibition material;
- the quality of the visual information on the screen should be higher than the information on the audience board;
- it is possible to show the proof of two-dimensional drawings in three-dimensional drawings at the same time;
- materials on the construction drawing department are easier to learn due to the high presentation of the lecture;
- availability of the possibility to clearly draw conventional signs in construction drawings;
- students have a complete idea of the text of the lecture;
- better understanding of the drawings that students need to learn on the subject through 3D models;
- speed of presentation is higher than a regular lecture;
- if any student has a question later, the teacher can easily go back step by step to the previous drawing;
- the similarity of an electronic lecture to a traditional lesson increases interest in it, helps the development of spatial thinking.



Today, there are various graphic programs that allow you to create electronic models of plans in construction drawings or a number of construction items. BIM and Autodesk companies are the leaders in creating graphic programs that allow creating such models. Modeling of such objects in engineering graphics disciplines helps them to be better understood by students and significantly increases visibility. Visibility is a very important link, especially for the discipline of construction drawing.

In addition, the electronic textbook prepared with the help of modern computer technologies has a number of advantages, as it replaces traditional printed textbooks, as well as the ability to solve problems that are not related to the pedagogue. For example, after the teacher has drawn the drawings explaining the topic during the lesson, if the students have a question, he cannot go back to any stage of the drawing. As a result, students' learning will be somewhat reduced. In the e-textbook, in addition to having the ability to do this in animated drawings, it is also possible to show a clear view of that drawing.

Advantages of e-textbook:

- selection functions of materials;
- viewing animated materials at the desired speed and sequence;
- easy transition from one material to another;
- use the textbook at any time and place;
- simultaneous reinforcement of textbook information through videos.

Along with the emergence of the automated design system, many higher education institutions began to consider the issue of completely or partially removing the teaching of drawing geometry as a subject from the curriculum. There is a growing recognition of the need to look for alternatives to drawing geometry in order to develop spatial imagination in the disciplines of engineering graphics.

In all developed and developing countries, the use of an integrative approach in science remains one of the urgent problems. Therefore, the role of computer graphics in the teaching process is changing significantly. Computer graphics is considered not only a learning resource for students and teachers, but also a main teaching tool. Because computer graphics is becoming the main tool of graphic preparation of students. The reason is one of the main factors of effective and rapid development of students' spatial imagination through computer graphics. All this is the main goal we have set before us to enliven the educational process, motivate students to understand the essence of the subject faster and better.

In conclusion, computer graphics can be used as a learning object for electronic drawing and as a tool in the teaching of drawing geometry and drawing. This implies the formation of students from teachers of higher education institutions not only to work in the automated design system, but also to effectively use the didactic capabilities of these software products in their future professional activities.

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