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FEATURES OF TEACHING ENGINEERING AND COMPUTER GRAPHICS

Abstract: The article analyses various approaches to the content and study of geometric and graphic disciplines of traditional and modern teaching schools, which arouse different opinions among teachers. The discipline consists of three modules "Drawing geometry," "Engineering graphics," "Computer graphics." The teaching section of computer graphics focuses on the use of the graphic editor Auto CAD to form the professional qualities of future specialists. When presenting new theoretical material, it is recommended to use lectures-visualization, based on computer presentations and Internet resources. When conducting practical classes, the student's activities include performing a manual task and subsequent execution of drawings in the computer-aided design system using 2D and 3D modelling. In the course of independent work, the student performs sketching using drawing tools, and performs homework, answering theoretical questions. This approach allows students to form a spatial imagination that will help in mastering the modules of this educational discipline.

Key words: AutoCAD, computer graphics, descriptive geometry, engineering and computer graphics, engineering graphics, teaching technique.

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Introduction

At the current stage of the development of society, solving the problems of engineering activities are associated with the use of automated design systems (CAD) based on electronic computing. Engineering and computer graphics form the basis of engineering education and form the basic knowledge necessary for studying special disciplines. In the mid-60s of the last century, a new section appeared in engineering graphics - computer (machine graphics) graphics, which is based on the theory of sketchy geometry and the basics of engineering graphics. Scientists such as Arapov V. M. [1], Oshkina L. M. [2], Sakulina Yu. V.[3], Butkarev A. G., Rykov S. A., Bolbat O. B., Volkhin K. A. [4].

State standards necessary for the development and design of graphic design documents (drawings and diagrams), including in an automated manner, rules for the execution of drawings of parts, assembly units, standard products, principles for the construction of power supply circuits for telecommunications equipment and methods for modelling geometric forms in modern graphic CAD. Be able to mentally represent the shape of objects and their mutual location in space, execute and read drawings, use automated design tools to solve various problems (design documentation, geometric modelling). Traditionally, the graphic training of students in technical fields begins with the study of sketching geometry as fundamental science, then

engineering graphics, which includes projection and technical drawing, drawing standards and only then computer graphics.

Approaches to the content of geometric and graphic disciplines are different and cause a lot of controversy in the teaching environment. Representatives of the traditional school insist that textual geometry is a mandatory component of the geometric training of the future specialist, as it helps to develop spatial thinking. In their opinion, students should study computer technologies for creating a drawing after mastering the methods of drawing geometry. First, solving positional and metric problems, and then moving to modern drawing technologies. The computer is considered as an electronic cullmann for creating 2D drawing techniques.

Opponents of the old school consider the sketchy geometry of yesterday's science, and its methods are irrelevant. The article by Professor A.P. Tunakov "Why teach students dying disciplines" [5] caused a heated discussion. The professor made a rather bold statement, calling the sketchy geometry a dying discipline, unnecessary science in university programs. This statement received a lot of criticism from the traditional school, but also received the support of progressive teachers of graphics. They suggest introducing a new alternative theoretical course instead of sketchy geometry: "Theoretical Foundations of 3D-Computer Geometric Modeling," developed by A. L. Heifetz [6]. The course is based on working with 3D solid models based on direct operation in space, without projection transformations.

Other scientists believe that in the age of computer technology, computer graphics should be considered as a whole with engineering graphics [7, 8]. Their opinion confirms that today in secondary school drawing is not a compulsory subject, only in some cases an optional course. In each study group, up to 80% of students start studying the discipline from scratch. They do not have spatial thinking and do not know how to organize independent work [9]. Let us give the studies conducted by Volkhin K. A., and Pak N. I. [4. 10]. The authors conducted a questionnaire and testing of freshman students before starting the study of the discipline. Let us give some of the results they have obtained. "In students of the 1st year, there is an almost complete lack of synthesis of the holistic image depicted in the drawing of the object." "According to two orthogonal projections, not a single student recognized the parallelepiped, and a straight circular cone - 14% of respondents. Instead of the three-dimensional objects depicted in the drawing, the interviewed students recognized flat geometric figures: in the projections of the parallelepiped they saw 2 rectangles (71%), and cones - various combinations of triangles, circles and circles (57%). " The results of this study show a low level of teaching drawing at school. Therefore, the learning process must be organized in such a way that manual and computer drawing are combined.

The work program of the discipline "Engineering and Computer Graphics" is drawn up in accordance with the curriculum for the training of bachelors.

Engineering and computer graphics are taught using Autodesk AutoCAD, a computer-aided design system for 2D and 3D modelling. The discipline consists of three modules "Drawing geometry," "Engineering graphics," "Computer graphics." The Sketching Geometry module is performed by students on watman using drawing tools without using graphic editors.[11] The Engineering Graphics module provides for solving problems traditionally and then using the graphic editor. The Computer Graphics module introduces students to the modern capabilities of CAD systems using the example of using the graphic editor AutoCAD.

Lectures are given in a multimedia audience in the main sections of the discipline. The material is presented in the form of slides made in the program PowerPoint. At the end of the lecture session, tasks are given for independent study. For the independent work of students, hours are allocated for consultations, which are held in a computer class outside the training sessions.[12] They are attended by a teacher who answers questions that caused difficulties in solving typical problems and also accepts work. Practical classes are held in a specially equipped audience equipped with computers and cullmans for manual drawing. During the work, explanations are given on the topic in the form of mini-lectures (15 - 20 minutes), using presentations.[13] This material is located on the computer class server disk, which allows students to perform tasks in their own rhythm. Each student receives his/her individual assignment [14].

In the first practical lesson on "Studying General Rules for Drawing Execution," students will learn about the interface of the AutoCAD program, setting up the workspace and executing the layout of the A4 sheet.

The next three classes on the first module "Drawing geometry" are performed on the watman. For greater clarity, coloured pencils are allowed, which helps to better perceive and remember the topic. Therefore, in this academic year, students were asked to first solve graphic problems on paper with writing a report in which a detailed work plan is given, with further execution of the drawing on the computer.

Perform work on "Views. Create Simple Sections and Create Complex Sections and Slanted Sections learn how to create a drawing and design as required. At the first stage, students build the third according to two projections, perform the necessary sections and sections, and place dimensions. At the

second stage, three-dimensional objects are modelled using program AutoCAD. In computer modelling of an object, it is often necessary to change the point of view, scaling and to move from one projection to another [16], which also allows developing spatial thinking and creative abilities. The third phase shows the conversion to a three-dimensional model projection drawing.

Practical work on the topic "Electrical schematic diagrams" is carried out only on a computer, this allows you to master the technology of creating annotative blocks, filling out the list of elements in the form of a table according to the requirements.

During the transition to state educational standards of the third generation, 16 training hours were allocated for the study of computer graphics for all construction specialities.[17] During this time, students should study the following topics: introduction to computer graphics, general information; Working with primitive graphical objects and their attributes Tools for setting up the working environment Editing objects in a drawing

means for obtaining an assembly drawing; Drawing space and layout Creating graphic documentation. such a large amount of information can only be covered by various innovative technologies. one of the approaches to solving this problem is the methodology for performing laboratory work on computer graphics discussed in the article (Fig. 1). to enhance feedback from students at the beginning of each class, it is advisable to conduct automated test control. for its implementation, a system of test tasks has been developed. the main advantage of using tests when testing knowledge is to obtain an instant objective result and the possibility of comparing its result with the results of others. Earlier written surveys involved time-consuming testing. by the time the results are announced, questions may already be forgotten, and the mark is not associated with a specific topic.[18] When performing test tasks on a paper basis, there is always a desire to check their answers with the answers of comrades. these negative aspects of paper-based test tasks can be avoided using computer technologies.
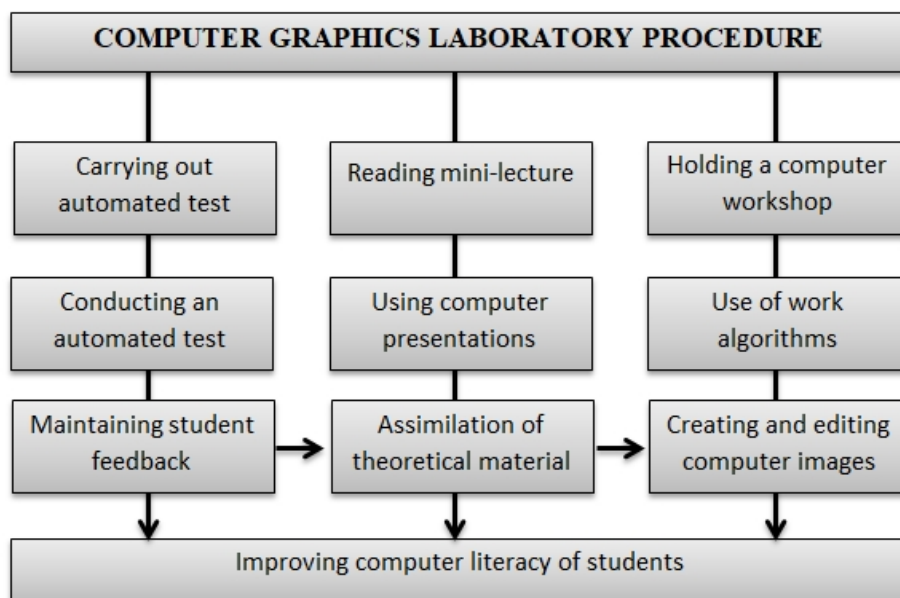
COMPUTER GRAPHICS LABORATORY PROCEDURE

Carrying out automated test — Reading mini-lecture — Holding a computer workshop

Conducting an automated test — Using computer presentations — Use of work algorithms

Maintaining student feedback — Assimilation of theoretical material — Creating and editing computer images

Improving computer literacy of students

Fig. 1. Methods of laboratory work on computer graphics

The system automatically calculates the test result and generates a database for each student. tests allow the teacher to observe the course of the educational process and provide students with the necessary assistance on time since he has the opportunity to analyze the statistics of answers to test questions and the amount of time spent on answers. The test results are of great importance for consolidating the material being studied, encouraging students to study, as well as for quickly adjusting them to the perception of new educational material.

When presenting new material in laboratory works, it is recommended to use mini-lectures and a

computer workshop. The training material, depending on the specifics of the images being built, is arranged in blocks, each of which covers one of the sections of computer graphics. Each lesson begins with one hour of lecture. during a mini-lecture, the teacher brings to the trainees the necessary minimum of theoretical material, for example, methods and means of computer graphics, commands, features of the used algorithms, methods of constructing images, etc.

Conclusion

With this approach, the study of computer graphics is not only a study level but allows you to

more fully study the program. AutoCAD Working on computers is not just studying the graphics package, but continuing to study engineering graphics. Every bachelor studying geometric and graphic disciplines must own a drawing tool and be able to complete the drawing in the traditional way, so manual drawing cannot be done. We believe that a combination of traditional and innovative methods of preparing engineering drawings will increase the overall level of professional training among students.

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