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PROS AND CONS OF COMPUTERIZATION WHEN TEACHING ENGINEERING GRAPHICS AT A TECHNICAL UNIVERSITY

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Abstract:

The purpose of this work is to review and analyze foreign experience in the use of computer technologies in teaching graphic disciplines. The pros and cons of computerization of the educational process in the course "Descriptive geometry and engineering graphics" at the Tashkent State Transport University are considered.

Keywords: professional competence, engineering graphics, practical activities, software tools, drawings, engineering skills, computerization of education.

INTRODUCTION

Employers around the world are experiencing an increasing shortage of engineers whose professional competence would match the ever-increasing complexity of the components and systems of the technosphere. Much of theengineering education system does not provide an acceptable level of compliance for their graduates.

Experts from theMassachusetts Institute of Technology point to the following flaws:

- young specialists, having come to the place of their first work, reveal a lack of professional competence and are forced to complete and retrain;
- knowledge, skills and abilities acquired in fundamental and major disciplines are formal and non-specific, not related to the professional problems of the employer;
- the training of a young specialist in analytical, systems and engineering thinking is weak;
- poor knowledge of engineering graphics tools and standards; the total inability to sketch on a piece of paper the simplest sketch and count in the mind even within the two acts of arithmetic;

The first object of total computerization in engineering education was engineering graphics. The vast areas of drawing rooms were freed from countless drawing tools that gave way to computers, terminals, plotters, printers, copiers. [1]

Without a thorough command of engineering graphics, there is no engineer. In the context of globalization, the role of engineering graphics as an international language of communication not only between people, but also in theontact "man - computer". Mastery of engineering graphics means the presence of knowledge, skills and abilities transformed into professional competence for practical activities. The level of skill in engineering graphics it should ensure the performance of the most important engineering functions:

- spatial thinking, that is, professional knowledge of mental tools in order to create a virtual model of a part, machine, system or other object in the technosphere;
- Mastery of reproducing these virtual engineering products on solid media using hand or machine tools.
- mastery in reading and understanding the drawings of other performers.

Modules of the engineering education system are faced with the phenomenon of a significantly different level of basic training in drawing among applicants to higher educational institutions for engineering specialties. Therefore, the task of pulling up and leveling knowledge, skills and abilities is in the first place in the didactics of engineering graphics. . For this purpose, a large amount of study time is allocated, mainly for practical and independent studies, in the following disciplines:

- descriptive geometry
- projection drawing
- technical drawing

In such a sequence of disciplines, the growth of the engineering component of engineering graphics is ensured up to the level of professional skill of knowledge, skills, abilities and professional competence.

In all educational projects, diploma projects and term papers, strictly adhered to strict standard requirements for the quality of the drawings performed. Special departments of engineering graphics were mandatory inthe structure of engineering faculties.

Didactic and technological techniques accumulated by the system of engineering education in the acquisition of graphic competencies provided the student with a fairly high level of skill in engineering graphics. At the same time, two basic principles were strictly observed in the practice of training:

– all exercises were performed on paper using traditional hand tools by repeated iteration by means of an eraser;

- the teacher had a high level of skill, was the carrier of empirical solutions, even after thenth iteration he could find errors in the drawing. Therefore, it was in the contact "student - teacher" that the transfer of knowledge, skills and abilities took place, which then transformed into engineering skill.

Thus, the traditional method of teaching engineering graphics created a solid foundation for the student's progress towards engineering excellence.

With the advent of computer graphics and computer-aided design programs , a wave of computer euphoria arose, under the influence of which the described structure of learning was destroyed:

—the teaching time for descriptive geometry has been sharply reduced;

— the traditional principle of increasing the engineering compositionof the faculty was practically lost in the training of engineering graphics;

— the student "abandoned" drawing tools as unnecessary - after all, now he draws an automaton: a printer, a plotter, a photocopier, a fax machine.

A student lost the opportunity to learn at least minimal manual drawing skills. The task of drawing a simple sketch on a piece of paper without the help of gadgets turned into an insurmountable problem.

But the main disadvantage of computerization of engineering graphics is that the teacher has disappeared from the learning process - the main carrier of knowledge, the editor-in-chief and the proofreader. And today, young specialists who have mastered engineering graphics, but have not passed the stages of "working on errors" under the guidance of a teacher, having come to their first place of work, give out not quite professional workers or assembly drawings.

RESEARCH METHODOLOGY AND ANALYSIS

Optimization of engineering education:

- increasing the number of training hours for engineering graphics;
- technical drawing, sketching and manual drawing should be introduced as mandatory workshops;
- the engineering graphics module using the CAD/CAM system should be introduced gradually, as the teacher creates a minimum amount of knowledge, skills and abilities in descriptive geometry;

However, an in-depth analysis of all the pros and cons that the computerization of engineering graphics brought with it should be carried out. At the same time, the best achievements of didactics and technology in teaching engineering graphics should be restored in the system of engineering education.

The advantages of computerization of engineering education still include theuse of modern technological resources in the educational process, which stimulatestudents to consciously understand and assimilate educational material. [5]

Among the most promising areas of application of information technologies in teaching the course "Descriptive Geometry and Engineering Graphics" can be identified [3]:

- Use of technology resources to demonstrate theoretical material and accompanying visualization of course content
- Using Remote Information Technology to Provide Students with More Interesting Information and Useful Information on the Discipline
- Use of graphic editors, for example, Autodesk AutoCAD to create drawings of parts, Autodesk Inventor to create solid models of parts and assembly units, etc.
- Active involvement of students in the development of new information technology resources to further improve the visualization of the course content and simplify theoretical information.

OUTCOMES

Information and communication technologies (ICT) dictate new requirements for the professional and pedagogical qualities of the teacher, for the methodological and organizational aspects of the use of information and communication technologies in teaching. Today, any teacher has at his disposal many opportunities for the use of ICT tools in the learning process - these are information from the Internet, numerous electronic textbooks, dictionaries and reference books, presentations, programs that automate knowledge control, new types of communication - chats, forums, e-mail, teleconferencing and much more. [3]

For example, at the Tashkent Transport University, teachers of the Department of Informatics and Computer Graphics use technological resources such as a personal computer, televisions, projectors and an interactive whiteboard when demonstrating theoretical material. This form of presentation of the material is based on the traditional content of the theoretical course, however, due to the introduction of visualization elements, it is perceived by students much better, as can be seen by taking into account the positive dynamics of the control of residual knowledge.

The second direction is distance educational materials. A very large number of questions of the course are submitted for independent study by students. For better assimilation of the educational material, as well as to stimulate the independent work of students, special attention is paid to this aspect in the methodology of teaching engineering

graphics. To date, many electronic resources, presentations, materials for self-control, video lectures have been developed, which are available on educational platforms.

The third direction is drawing and graphic editors. These programs are used to perform laboratory work of the discipline. Work in interactive editors allows you to interest students in time-consuming drawings, automate some operations. Much less time is spent on drawing execution [4]. Graphic editors also make a significant contribution to the visualization of drawings, allow you to create three-dimensional models of parts, as well as independently create assembly units.

Also, teachers use platforms (Facebook, Telegram, Instagram) to communicate with students, in which they constantly have access, that is, teachers are at the same technological level with students. Conduct monitoring of the course, analysis of educational material together with students, in order to improve their didactic and educational materials for the course.

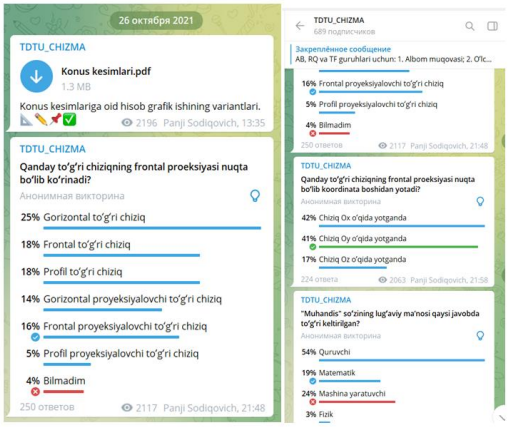

Fig.1 Information channel on descriptive geometry in Telegram messenger.

FINDINGS

Thus, it can be concluded that modern information and communication technologies help to realize the availability of theoretical materials and the visibility of practical materials of the course "Descriptive Geometry and Engineering Graphics". I would like to note that the integration of electronic and classical technologies in the choice of teaching methods contributes a lot to a more successful development of the course and increase the level of residual knowledge of students.

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