

Information and Communication Technologies in the Teaching of Disciplines of Professional Cycle



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Abstract: Today, information technology is being introduced into almost all components of human life and it is already difficult to imagine our society without IT innovations. Including the education system, which is currently modernized and equipped with new forms of training using information technology. This allows us to achieve new results in education in the form of increasing students' desire for cognitive activity and raising the general level of education of the population due to the rapidly growing quality of education. Since the introduction and active use of information technology in education, its effectiveness has also been increasing in parallel. The advantage of information technology is also that different technologies can be used depending on the particular discipline taught or depending on the topic, material that needs to be presented to students. To increase interest and master new material of the proposed audience by the teacher. This article analyzes the use of IT technology in the Engineering Graphics training course. Optimization of engineering graphics training consists in its modernization with the selection of new teaching methods, tools and techniques, use in the learning process, to increase efficiency, innovative technologies that contribute to the formation of students' creative way of thinking, as well as graphic culture.

Keywords: information technology, education, educational process, cognitive activity, efficiency, communication

I. INTRODUCTION

When introducing this innovation into the educational process, the teacher must have the skills to analyze and read the technical documentation for the hasty development of new technologies and their successful use in the learning process. [one]. The discipline "Engineering Graphics" selected for analysis is one of the basic disciplines necessary for the development of any technical specialty. Also, this course forms the students' skills in graphic modeling, creating graphic drawings and sketches, which, as a result of mastering, develops graphic literacy of students in technical areas of training, since this competency is necessary when working with timely production, which uses modern equipment in the form of machine tools with software, automation systems and robotics [2].

One of the areas for improving education in Russia was devoted to the implementation of ICT-information computer technologies in the educational process [3]. This was an important milestone in the development and modernization of the Russian educational process, which began to be used in the learning process information and communication and computer technology, allowing the learner to direct the entire learning process to himself, making it more individual, thereby revealing the full potential of the student in the study of a new discipline and allow the use of computer technology with a view to its self-development. In the process of mastering the discipline, the student should be able to correctly use the computer to carry out self-education, which is another purpose of ICT, is the development of the correct and effective use of computer technology to find the necessary information to achieve a bed educational goal [4].

However, to date, the full potential of using information computer technologies for a more successful study by students of engineering graphics is not realized in the moments with the use of computer programs in educational activities [5].

Their didactic opportunities are not fully realized, the system-educational functions of the educational process components are not used [6].

The methodological recommendations, requirements and criteria for the use of information and computer technologies, which would be enshrined in an electronic manual, have not been developed in order to effectively conduct classes by the teacher using IT technologies, as well as to perform various tasks by students using information technologies for a full and comprehensive study of the provided material [7].

Based on the studied scientific sources, this article identifies the problem of using information and computer technologies in the development of the Engineering Graphics training course [8].

As a result, a discrepancy was found between the opportunities that computer technologies provide in the study of any discipline, including in the study of engineering graphics, and the actual practice of their use in the study of this training course [9].

II. LITERATURE REVIEW

An analysis of the scientific literature on the application of technical discipline in teaching is revealed from various perspectives. Many interpret this concept as an emerging trend in the development of education,

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as well as the latest achievement in the theory and methodology of training in engineering graphics (Akimova I.N., Botvinnikov A.D., Vinogradov V.N., Gorshkov G.F., Zhdanova N.S., Ivashchenko G.A., Kosolapov M.A., Pantyukhin P.Ya., Perchenok R.L., Petrov Yu.N., Savitskaya A.V., Unsovich T.A., Chempinsky L.A. and etc.); theory and methodology of developing the structure and content of training in the field of informatics and informatization of education (Apatova N.V., Dobudko T.V., Zainutdinova L.Kh., Zakharova TB, Kozlov OA, Kuznetsov AA, Lapchik MP, Pak N.I., Panyukova S.V., Robert I.V., Romanenko Yu.A., Serdyukov V.I., Skibitsky E.G., Sokolova I.V., Sofronova N.V., Shcherbakov M.A., Henner E.K. et al.); recent achievements in the development of methodological approaches to the innovative system of education and the development of engineering thinking (Andreev V.I., Mazur Z.F., Ushachev V.P., Fedorov I.I. et al.). The use of information and communication technologies in the educational process at the present stage plays a huge role in the preparation of a highly qualified specialist.

III. METHODOLOGY

The authors developed an electronic course with the contents of the program for the integrated use of information technology in the process of studying the discipline "Engineering Graphics". The article presents the structure of the electronic course of the discipline with the methodological content of the drawing and graphic system "COMPAS".

So, before conducting a practical lesson in the discipline using information and communication technologies, students were offered two forms in the study of information: one in a paper manual, the other in electronic form using the COMPAS drawing and graphic system.

As a result: 66% of students working with the electronic course of the KOMPAS drawing and graphic system completed the assignment for "5", while 34% of those working on paper allowance received a rating of "4" [10].

The study indicates the high efficiency of the electronic course in the discipline "Engineering Graphics" with the methodological content of the drawing and graphic system "COMPAS" [11].

IV RESULT AND DISCUSSION

The use of information and communication technologies in the training of future highly qualified specialists is taking place, according to the content of the educational program of higher education in the first year. The structure and content of the discipline meet the requirement of the educational standard of higher education with a technical profile of education [12]. To increase the level of independent study of material on the discipline, an electronic course has been developed with the methodological content of the KOMPAS drawing and graphic system.

The electronic course "Engineering Graphics" provides an opportunity to clearly and easily show the projection process, how it is formed, what its properties and features are, that is, to present previously difficult material for students is more understandable and intelligible. In order to simplify the understanding of students of various materials that are difficult to depict in a training lesson, and to speed up the time for their study and consolidation in an educational electronic course, videos will be presented explaining a particular

phenomenon, such as the process of projecting a point, its properties and features [fourteen]; projection of a straight line [15]; projection of a plane; section of a geometric body by a plane [16].

In addition to all this, there is also a video that contains requirements, examples and recommendations when performing graphics tests, as a result of which the student can perfectly cope with the tasks offered to him and achieve his educational goal [17].

An experimental check was carried out of the working capacity and effectiveness of the educational-electronic course offered to students, as a result of which students in the electronic course better coped with the tasks they proposed and received an incentive to further study the course "Engineering Graphics". There was an improvement in the performance of graphical tests. Upon completion of the educational course, students were offered the final testing, which allowed them to identify all the weaknesses of the created electronic course, to finalize and correct these shortcomings in the future. Subsequently, based on the results obtained, the shortcomings were eliminated, and the identified weaknesses that impeded or did not allow to fully realizing the potential of the created electronic educational environment were finalized [18].

This course is designed to prepare students in the educational field of "Technology" [19]. The program proposes the implementation of the following areas of pre profile preparation - the use of Compass 3D computer-aided design system for the manufacture of 2D drawings, fragments and 3D models [20].

The course program is designed for one year and is aimed at mastering computer drawing skills, as well as developing students' skills in analyzing and determining the shape of parts, studying and defining such a thing as a "product", acquiring students' skills in performing various drawing works, their reading, analysis, search for disadvantages or advantages, carrying out work on their completion, studying the types of sections and sizes of drawings; perform solid modeling [21].

The main goal of the course is to connect the acquired knowledge in geometry lessons with computer skills to solve the specific task of representing the object in the form of a graphic model [22].

The tasks of the created educational environment include the formation of students' skills in mastering the graphic language, for its use when working with computer technologies or in tasks offered to the student, as well as the skill of transferring, viewing, analyzing, storing, displaying and methods of reading information, rules that allow the student to obtain the necessary information and information [23]; the formation of students' culture of the execution of drawings, compliance with the rules of their implementation and reading; the formation and development of students' logical way of thinking [24]; the development of creative thinking and the acquisition of skills to transform the shape of objects [25]. During the course, schoolchildren get acquainted with the interface of automatic design systems, gain practical skills when working with Compass 3D, and with the practical application, they consolidate the knowledge gained from geometry lessons [26].

For the assignment, the student receives:

A rating of 5 if he:

- 1) Fully mastered the material offered to him, received the knowledge necessary for his further activity on the shape of objects, has clear ideas about their image, how they look, can reflect all conventions;
- 2) Knows the rules about previously studied materials;
- 3) When answering a question, he speaks, consciously, knows the technical terminology with which he builds a logical, consistent and correct answer to the question posed, with understanding and awareness answers additional questions on this topic;
- 4) Practically makes no mistakes when reading the drawings, and if the answer is negotiated due to possible inattention, then with the help of leading questions the teacher finds an inaccuracy and independently eliminates it.

Grade 4 if he:

- 1) Fully mastered the material offered to him, but makes some mistakes or inaccuracies, and also has difficulty answering additional or leading questions from the teacher;
- 2) Having difficulty reading the drawings, but hesitantly answers the questions of the teacher and makes small mistakes, but knows the legend;
- 3) On the whole, he answers the question posed correctly and, in a certain logical sequence, has a clear understanding in answering the question posed;
- 4) When reading the drawings gives an incomplete answer, in which the gaps are filled with a little help from the teacher.

Grade 3 if he:

- 1) Not fully mastered the material proposed to him, but mastered most of the conventional images and symbols;
- 2) There is no completeness in the answer, and the answer is built without logical connections, but is partially true;
- 3) It has difficulties in reading the drawings, can not cope without the help of a teacher, does not always answer leading and additional questions.

Grade 2 if he:

- 1) Has knowledge gaps in more than half of the material proposed to him;
- 2) Lack of knowledge about the most important and basic principles of discipline;
- 3) There is no logic in the answer; he makes serious mistakes that he cannot correct even with the help of leading questions from the teacher.

The article presents several practical tasks that we have developed, which are accompanied by appropriate instructions that will help the student better navigate the task [27].

a) Exercise number 1. The construction of a broken line by the length and angle of inclination of the line and by the coordinates of the endpoint of the segment. Command Continuous input of objects.

Task: Build a broken line p1-p2-p3-p4-p5-p6-p7-p8 if the segments p1 - p2, p2 - p3 are given by the coordinates of the points p1 (0, 0), p2 (10, 20), p3 (30, -10), and the segments p3 - p4, p4 - p5, p5 - p6, p6 - p7, p7 - p8 are given by the length and angle of inclination. Figure 1, table 1.

Table 1

Line	Length	Slope
P3 – p4	20	0
P4 – p5	15	45

P5 – p6	35	-30
P6 – p7	50	90
P7 – p8	60	180

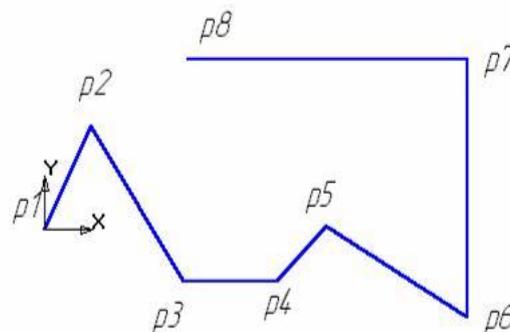


Figure 1

1. Create a new document of the fragment type and save it in your folder under the name Upr2.frw.
2. Activate the Continuous Entry of Objects command, figure
3. The parameters of a segment when it is created and edited are displayed in separate fields Parameter lines: two X and Y coordinate fields of the initial (p1) and final (p2) points, the segment length field (ln), its slope field (an), the style field segment.

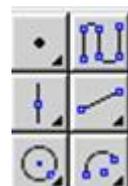


Figure 2

3. Place the cursor at the origin - point p1 is fixed. Point p2 awaits the input of the parameter. Click on the X coordinate field and enter the value 10. To enter the Y coordinate value in the field, press [Tab], enter 20 and press [Enter]. The segment p1 - p2 is constructed. Similarly, construct the segment p2 - p3.
4. To build the segment p3 - p4, activate the field for the length of the segment, enter the value for the length of the segment 20 and press [Enter]. Activate the segment angle field, enter 0 and press [Enter]. Section p3 - p4 is built.
5. Similarly, build the remaining segments.
6. Save the document by clicking the Save button on the control panel.

Exercise number 2. Construction of a curve line by points (spline).

Task: Build a graph at the points given by the coordinates X and Y, table 2, figure 3

Table 2

Points	Coordinates	
	X	Y
P1	0	0
P2	5	10
P3	10	15



P4	20	25
P5	40	30
P6	60	50
P7	100	60

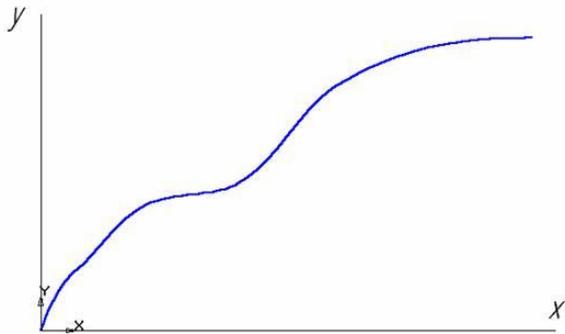


Figure 3

1. Create a new document of the fragment type and save it in your working folder under the name Upr3.frw.
2. Activate the Line command, select the current Thin style and draw two axes: vertical (y axis) and horizontal (x axis).
3. Activate the Continuous Entry of Objects command. On the object parameter line, activate the Spline command, Figure 4 .. Select the current Basic spline style.

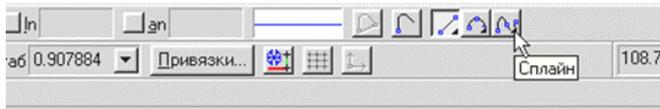


Figure 4.

4. Set point p1 to the origin. Set point p2 (5, 10). To do this, activate the X coordinate field, enter the value 5, in the Y coordinate field, enter the value 10. Thus, set all the other points. After entering the last point, click on the Create Object and Abort Command buttons.
6. Save the fragment by clicking the Save button on the control panel.

Note:

To plot, you should use FTDraw software. This software is used for editing and plotting various function graphs. To perform various tasks, this library is equipped with all the necessary software for graphing both tabular and functional dependencies. Including to complete the task you must use the library. The library allows you to build graphs:

1. Functional dependencies according to equations in Cartesian coordinates.
2. Functional dependencies according to the equations in polar coordinates.
3. Plotting table dependencies in Cartesian coordinates.

To test knowledge on the results of the work performed, we used the questions of testing developed by us section by section.

Based on the results obtained from two groups: those studying material in a book format and a group studying material in an electronic course with the methodological content of the KOMPAS drawing and graphic system, we made the corresponding conclusion [28].

Final certification was carried out in the format of differentiated classification. Based on the material passed, control questions were developed [29]. After the test, we

calculated the result, evaluating the knowledge of students of two groups. The result of the differentiated classification of the group of students studying the material on paper teaching aids is shown in Figure 5.

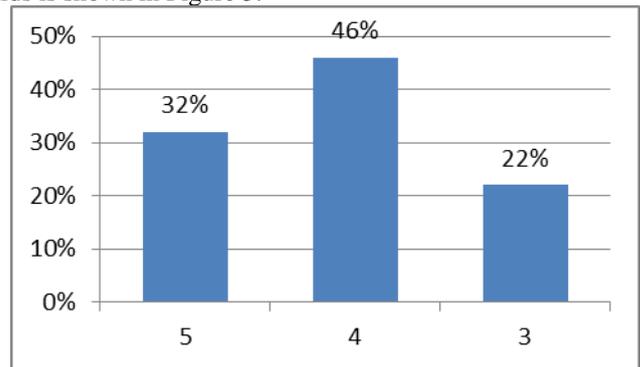


Figure 5 Students groups' results, Who learning materials on paper methodical books.

32% of students of group get mark «excellent», 46% of students of group get mark – «good», 22% of students of group get mark «satisfactory» .

Picture 6 is shown groups' results, who learning materials on electronic course with the methodical content of the drawing and graphics system «COMPAS».

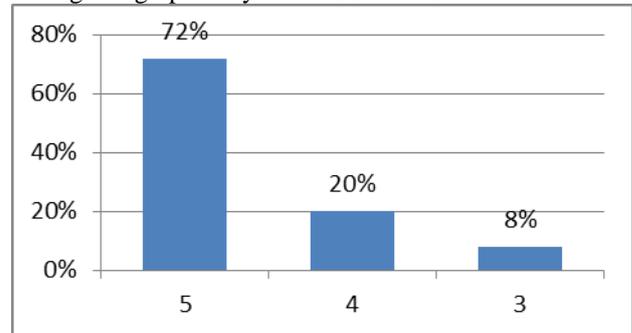


Figure 6 The results of the group that studied the material on an electronic course with the methodological content of the drawing and graphic system "COMPAS".

According to the results of the test, we see that the indicators that studied the material on an electronic course with the methodological content of the COMPAS drawing and graphic system, the indicator who passed the assessment five is much higher [30].

Thus, the applied information and communication technologies in the learning process in the discipline "Engineering Graphics" is effective in the traditional teaching method.

V CONCLUSION

The use of information and communication technologies in the process of training in the disciplines of a technical profile allows students to present the material more readily and efficiently. And they also allow them to immediately immerse themselves in the educational process and realize their full potential when studying the discipline and when fulfilling the tasks they proposed to assimilate the knowledge they acquired as a result of mastering the course. Computer technologies make it possible to visually study previously difficult for students to understand material much faster and more efficiently using the technical equipment of the Engineering Graphics course.



It is important to note that the integration of information technology in the educational environment shows that students master the material much faster and more successfully, and also increases the general level of students' knowledge.

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