Management of Independent Work of Students in Polytechnic Higher Education Institution

I Stolbova[1], M Kraynova[1], V Varushkin[1]

[1]Perm National Research Polytechnic University, Perm, Russia

E-mail: stolbova.irina@gmail.com

Abstract. Information and communication technologies are the most important factors that greatly influence the quality of education. The capabilities of ICT of the latest generations are high enough to ensure personification of the educational process. The article touches upon relevance of competent organization of students' extracurricular activities. The potential of some information and communication technologies for managing students' independent work is considered. Introduction of digital technologies in the educational process renovates teaching activities and stimulates the teacher to practice a creative individual approach to each student while studying the subject area. The forms of communication used in organization of students' independent work in the course of basic graphic training of students in Perm National Research Polytechnic University are discussed. Examples of electronic resources aimed at formation of instrumental competencies of graphic training are presented.

1. Introduction

In a dynamically globalizing society, the latest information technologies penetrate practically all spheres of public and private life. Forming social networks, information and communication technologies (ICT) involve more and more participants and, above all, young people [1]. The task of higher education is to be at the forefront of this development. Qualitative, innovative changes in methods, forms, modes and technologies of university education are urgent. In recent decades, the most important component of the education system modernization is informatization of the educational process based on introduction of modern information technologies [2]. ICT are becoming an integral part of the modern learning process. Usage of digital technologies is already fixed in the Federal state educational standards. An innovative educational process involves development and introduction of innovations aimed at progressive development in comparison with the established traditions and mass practice [3].

The possibilities of the latest generation ICT are such that they can ensure personification of the educational process, help to overcome the mass-reproductive nature of training, as well as to develop students' autonomy in the process of mastering the educational program.

A qualitatively new level of information support for educational activities in solving the vocational training tasks allows to organize a managed independent work and students' research activities of students. This is especially relevant in connection with the trend in modern educational programs regulated by the Federal State Educational Standard of Higher Education, to reduce the number of class activities and increase the share of students' independent work (SIW). Rational use of ICT allows to create the conditions for quality education and control [4]. The teacher, being at a remote

distance, can accompany the performance of individual tasks and adjust the learning trajectory of each student. The paper presents the experience of organizing a managed SIW in the framework of basic geometric- graphic training of students, implemented in Perm National Research Polytechnic University.

2. Educational communications

The young man today lives and operates in the information society, he uses a current means of communication and quickly adopts updated tools. The usual multidimensional communication process via the Internet is associated with perception and transmission of information. The actual source of information is communicative and effective if it is provided with feedback on the information transmitted. Feedback allows you to get a response for positive or negative correction of further actions on achieving the goal or to inform the source of information about the achieved performance or lack of it [5,6].

As A. I. Shutenko notes [7], educational communications can be referred to as well-known forms , methods and techniques of teaching, as well as innovative didactics based on ICT, since all of them, in one way or another, are presented as ways and methods for transmitting information. Educational communications can be interpreted as forming information spaces for transportation of knowledge, explanatory diagrams and models, as well as all the necessary information for full-fledged learning. It is obvious that informatization of education requires updating didactic approaches and concepts in high school pedagogy.

Educational communications at the university is the process of organizing and transmitting information (illustrative, graphic, theoretical, reference, scientific and methodical, empirical, and others.), This information reflects the content of education and translates practical experience in a certain segment of the professional training [8].

Informatization of educational process can significantly offload the teacher, whose work for the most part is reduced to organization and transfer of educational information. Today, a student needs a teacher who not only transmits information that is already sufficiently available on the Internet. The teacher needed is an organizer of communication in the information space of the subject area, creating learning practices in the educational process, developing student independence and stimulating his cognitive activity in education. Thus a modern teacher should have communicative competence, which implies: preparedness to analyze situations of communication in the educational process; ability to purposefully build and organize communication situations; free, wide and targeted use of communication tools; playing different roles in accordance with the function performed (tutor , mediator, moderator, editor, project training organizer, developer of educational trajectories, etc.) [9].

Thus, introduction of digital technologies in the educational process brings about novelty in the pedagogical activity of the teacher and stimulates a creative individual approach to each student while mastering the subject area. In connection with the increasing role of students' independent work, there is an interest in communication development for management of this activity [10] .

3. Management of communicative independent work

Modern digital information technologies make it possible to combine classroom work with compulsory independent activity of students through organization of controlled interaction on the website of the department and Internet communication via email [11]. As part of the basic graphic training of students, a methodology is being developed for organizing manageable independent work of students [12,13].

The site of the department for remote use contains all the available electronic educational resources: lectures-presentations with theoretical material; various thematic instructional guidelines; workshop with analysis of typical tasks; laboratory workshop on graphic editors; data with variants of individual graphic works, guidelines for their implementation with examples of formalization; accessible for public use sections of the system of automated quality control of graphic training [14,15].

Each student group from the very first week of training creates an e-mail address of the group, which is usually used until graduation. Thus, a communicative channel is opened, through which a two-way communication is organized between students and teachers in various dialogue modes [16]. E-mail allows students to receive information resources in the form of training materials for any discipline for each training module through links on the department's website and via e-mail attachments.

Most teachers who have their own e-mail actively use it as a tool for communicating with students. The teacher's personal e-mail provides the opportunity to communicate with students regardless of classroom lessons, remotely consulting interested students on emerging issues. For today's first-year students who have a low level of school graphic preparation, it is necessary to systematize additional study material, consolidate the theoretical knowledge obtained at the classroom and develop practical skills. "Mentoring" e-mails of the teacher have a block character (the current thematic theory, practice, tasks for independent work, examples, routine test controls) and regular mailing in accordance with the subject schedule [17]. It stimulates systematic learning activities of students and helps with successful mastering of the discipline.

Independently performed individual graphic tasks for students have methodical support. For this purpose, electronic educational resources have been developed for each topic containing the initial data of individual variants, a step-by-step algorithm for performing a typical task, an example of formalization, and requirements for the task defense [4,18]. In case of difficulties, current express check of the assignment can be carried out by e-mail.

To consolidate skills and form instrumental competencies of graphic training during independent work, students are offered developed electronic manuals (laboratory works) with a step-by-step frame guide in a graphical environment, which contains both textual instructions and a copy of the screen image, which should be on the computer screen at this stage [14]. Files of work performed are sent to the teacher for verification.

Modern management of the educational process is based on monitoring of learning outcomes that students attain at various stages. Automating the control of knowledge and skills of students allows to organize end-to-end monitoring of student performance at all stages of mastering the educational program, systematizing students' independent work, as well as increasing students' motivation and interest in mastering the discipline [15].

For each of the training modules, thematic tests are prepared for students' self-control as well as control tests, which evaluate the level of training at the end of the module. The modular domains cover key concepts (didactic units) in accordance with the curriculum. Intramodular testing is conducted by students independently through the Internet on all topics of the training module. On the other hand, these tests are a prerequisite for obtaining admission to the control test at the end of the training module, which is performed during the planned classroom control activities in the computer classroom of the department. The result of passing this type of independent work is an automatically formed e-list, from which the teacher receives preliminary information on the assessment of students on the training module and their preparedness for the control test. The two-step test control system has shown its effectiveness and is adequately perceived by students in case of non-admission to the control event. This technique provides regulation of learning activities, organizes the management of students' self-preparation for control activities, forms an objective self-assessment of achievements in the subject area and stimulates an increase in their level of training [13].

The final stage of the graphic training is execution of the project task. This task has individual parameters for each student, but sets the general framework for all. This stage is usually performed outside the classroom. First year students can find it difficult to work independently at the individual project. To support the process, manuals are developed that contain examples of similar design projects.
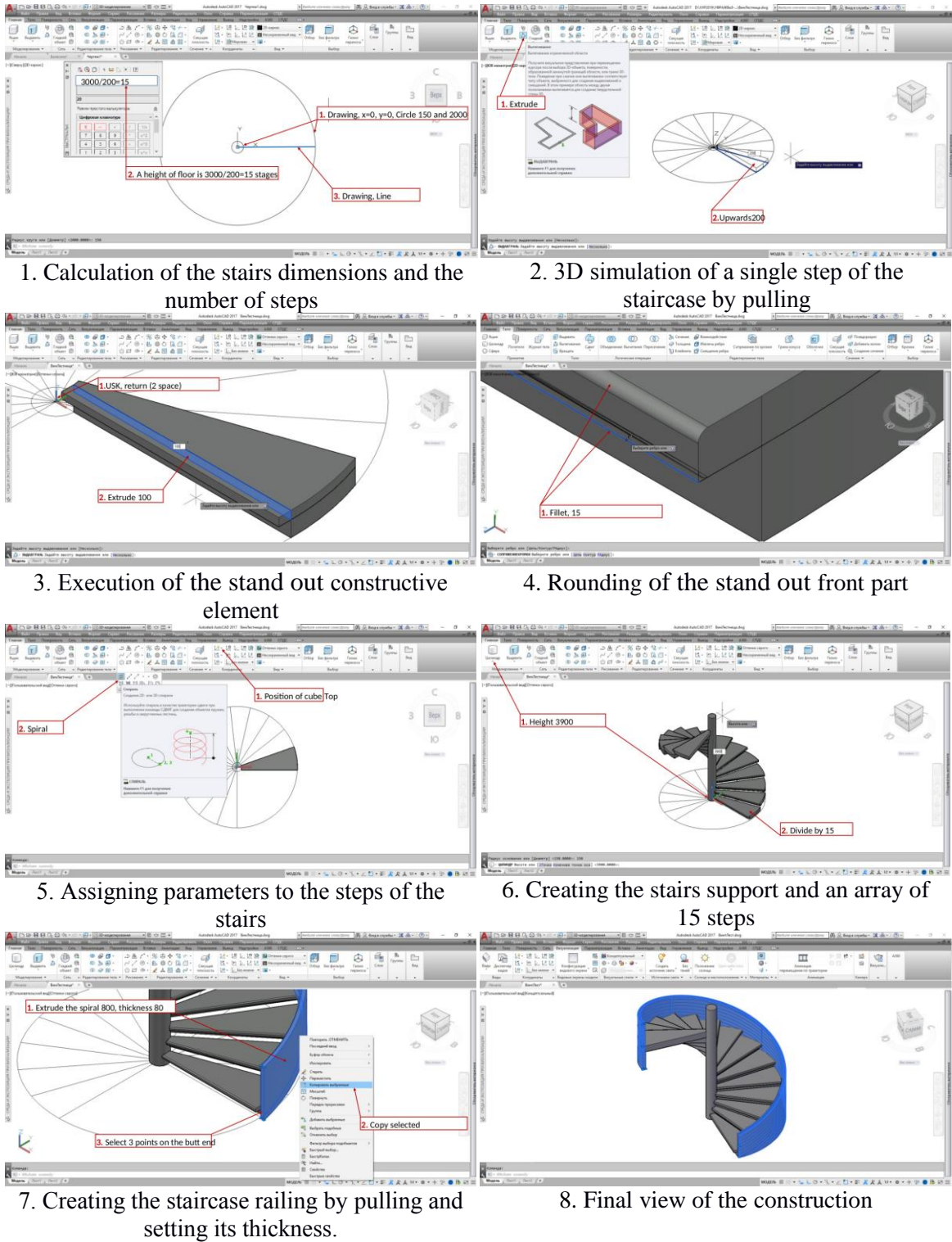
1. Calculation of the stairs dimensions and the number of steps

2. 3D simulation of a single step of the staircase by pulling

3. Execution of the stand out constructive element

4. Rounding of the stand out front part

5. Assigning parameters to the steps of the stairs

6. Creating the stairs support and an array of 15 steps

7. Creating the staircase railing by pulling and setting its thickness.

8. Final view of the construction

Figure 1. Phased guidelines for designing a spiral staircase.

Figure 2. Visualization of the developed models of stairs made by students.

Figure 1 shows fragments of the resource representing the process of 3D modeling of a spiral staircase - a project carried out by students of the Construction direction of training [18, 19]. Design is carried out in the graphic system AutoCAD. There is an example of a possible phased design, wherein in each stage is given a visual representation of what is happening on the computer screen, with textual explanations on navigation.

Capable students with sufficient creative potential can offer their own design version. All the rest perform a typical ladder with its individual parameters. Fig. 2 shows examples of visualization of projects of spiral staircases developed by students. Requirements for the defense of completed projects are also coordinated by the teacher via the Internet. One can preview the presentation and correct the comments specified by the teacher, to the announced defense date.

4. Conclusion
Digital information and communication technologies today are necessary attributes of educational activity [20, 21]. Skills and abilities to use Internet resources in the project activities are an integral part of the professional competence of any specialist. The experience of professional communicative activities acquired by students enhances their didactic potential, develops self-organization and regulates independent work aimed at obtaining the demanded level of education [1]. The competences necessary in modern life and the skills of independent acquisition of knowledge that will be needed throughout all life are developed [6]. Moreover, these qualities are strengthened as with intensification of access to digital information and communication technologies.

Effective organization of independent work of students is manifested in the competition of fellow students. The use of such communications to a large extent contributes to increasing the level of motivation of students in studying the discipline. Managed independent work of students on the basis of digital information and communication technologies increases the interest of students in achieving a higher result in mastering the discipline, and generally improves the quality of graphic training of university students.

References
[1]   Zvereva E and Kharitonova O 2015 ICT as an effective tool in the modern education system (Russia) *J. Statistics and economics* **3** 3-5
[2]   Omarova S 2018 Current trends in education in the era of digitalization https://doi.org/10.30853/pedagogy.2018-1.17 (Electronic Materials)
[3]   Educational communications in the innovative educational process https://studmed.org/57075/ pedagogika/obrazovatelnye_kommunikatsii_innovatsionnom_obrazovatelnom_protsesse (Electronic Materials)
[4]   Stolbova I, Aleksandrova E and Nosov K 2017 Information technology functionality in engineer geometric-graphic training vol 21 (Russia) *J. Open education* **1** 59-67

[5] Mitayeva O 2010 Organization of independent work of PPT students https://www.studmed.ru/pedagogika/sovremennye-obrazovatelnye-tehnologii/ (Electronic Materials) 11

[6] Pushkina G 2011 Independent work of university students: competence-based approach and the introduction of Internet technologies (Russia) *J. Bulletin of the Financial University Humanitarian sciences* **3**

[7] Shutenko A 2011 The development of educational communications in the modern university (Russia) *J. Higher education in Russia* **7** 80-86

[8] Shutenko A 2015 The concept of building educational communications in the system of university training *Contemporary Social Studies* (*electronic scientific journal*) **11**

[9] Chanysheva G 2005 About communicative competence (Russia) *J. Higher education in Russia* **2** 148-151

[10] Leushin I and Leushina I 2017 Some problems of organizing independent work of students in a technical college (Russia) *J. Higher education in Russia* **6** 51-57

[11] Yashina N, Sorokina L and Kostikova E 2017 On the teaching of engineering graphics in the construction university *Digest of articles SGASU Architecture and design. Traditions and innovations in construction and architecture* 277-280

[12] Petukhova A 2015 Engineering and graphic training for students of construction specialties using modern software systems (Russia) *J. Geometry & Graphics* vol 3 **I** 47-58

[13] Alexandrova E, Nosov K and Stolbova I 2017 The organization of graphic training of students on the basis of information and communication technologies Proc. Int. Conf. On The quality problems of graphic training of students in a technical college: traditions and innovations (Perm) 1 37-54

[14] Stolbova I, Aleksandrova E, Kraynova M and Kochurova L 2015 On the creation of educational package to support graphic training of students (Russia) *J. Geometry & Graphics* vol 2 **3** 29-37

[15] Kochurova L, Kuznetsova L, Stolbov O and Stolbova I 2017 Monitoring the quality of graphic training based on an automated control system Proc. Int. Conf. on *The quality problems of graphic training of students in a technical college: traditions and innovations* (Perm) **1** 304-320

[16] Novozhilova S and Egorycheva E 2013 Information support in modern technologies of teaching graphic disciplines (Russia) *J. Geometry & Graphics* vol 1 **3-4** 33-35

[17] Kloktunova N, Venig S and Solovyova V 2017 Ergonomic requirements for the presentation of educational information on the screen (Russia) *J. Higher education in Russia* **4** 152-159

[18] Stolbova I, Aleksandrova E, Kraynova M and Varushkin V 2018 Updating the graphic education of construction students *Vysshee Obrazovanie v Rossii (Electronic resource)* 27 **3** 153-162

[19] Stolbova I, Aleksandrova E and Kraynova M 2017 Innovative organization of project activity of construction students IOP Conference Series: materials science and engineering (Electronic resource): Intern. Conf. on Construction, Architecture and Technosphere Safety (ICCATS 2017) (Chelyabinsk, Russia) vol 262

[20] Korotkiy V A, Usmanova E A and Khmarova L I 2017 Geometric Modeling of Construction Communications with Specified Dynamic Properties IOP Conf. Series: *Materials Science and Engineering* 262 012110 ICCATS 2017

[21] Korotkiy V A and Khmarova L I 2018 IOP Conf. Ser.: Mater. Sci. Eng. **451** 012115