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RESEARCH ARTICLE

Methodological Aspects of Teaching the Discipline "Information Technologies in Technical Systems" In the Context of Forming Professional Competence in Mining Students

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Abstract

The article is dedicated to improving the methodology of teaching the discipline "Information Technology in Technical Systems" to form the professional competence of mining students. The theoretical and practical aspects of using electronic interactive programs and platforms in the educational process are examined. The author proposed an improved training model based on the integration of interactive methods such as "Pedagogy Wheel", "Sindikat", and "Opposite Attitude", which allows for an increase in the effectiveness of training future mining industry specialists.

KEYWORDS

Professional competence, mining, information technology, electronic interactive program, teaching methodology, interactive methods, digital environment.

INTRODUCTION

In the context of modern transformations in higher education, special attention is being paid to the quality of personnel training for the mining industry. The formation of students' professional competence within the discipline of "Information Technology in Technical Systems" requires the implementation of innovative approaches that meet the requirements of the digital economy.

There are many methods for forming students' professional competence in training personnel in the mining industry [1]. In particular, it is important to regularly improve the qualifications of teaching staff, provide methodological and practical support to teachers and students, effectively organize the educational process, and revise the curriculum for the subjects included in the compulsory subjects block based on modern requirements. An important element of this process is the integration of specialized disciplines with information and communication technologies, which provides for their preliminary testing in the form of pilot projects before full-scale implementation into the educational process.

Taking the above into account, we concluded that it is necessary to introduce certain changes and additions to the current standard curriculum for the discipline "Information Technology in Technical Systems" for higher education in the mining sector. Based on this, an improved curriculum was developed, and the content of this discipline was studied through an analytical comparison between the standard curriculum and the proposed research program.

METHODOLOGY

The current curriculum for the discipline "Information Technology in Technical Systems" was developed for technical fields of higher education and is divided into lecture, practical, laboratory, and independent study hours depending on the specialty. Specifically, the curriculum for the discipline "Information Technology in Technical Systems" for students in the "Mining" direction consists of two modules, with a total

duration of 120 hours, including 30 hours for lectures, 16 hours for practical sessions, 14 hours for laboratory sessions, and 60 hours for independent study.

Through the study of the discipline "Information Technologies in Technical Systems," the student acquires skills in using computer technologies in mining, applying their technical capabilities in mining activities. Additionally, students develop skills in solving, analyzing mining problems, and integrating information technologies into professional activities using software tools specific to the mining sector and application software packages such as Kompas, Autocad, Mathcad, and Matlab. Research shows that for mining education students, we propose replacing the topics studied in Module 2 with programming languages and studying more theoretical and practical-laboratory aspects of modern automated design systems, applications in the design process, and geoinformation systems in Module 1. Through the use of ready-made software tools and innovative educational technologies, topics necessary for forming students' professional competencies and achieving practical results in the future training of mining industry personnel will be studied more deeply and widely.

Research shows that among the applied software packages used in mining classes: Matlab, MathCAD programs are used to solve engineering problems, and Kompas, AutoCAD software packages are used in graphical modeling. Automated design systems, the application of 3D models, and the use of digital technologies play a key role in forming students' professional competence in personnel training and yield effective results. As a result, the research curriculum we proposed, in addition to lecture topics providing general information about the aforementioned computer programs used in mining, included topics aimed at working with AutoCad and Kompas programs in practical and laboratory sessions. The practical application of these programs in the educational process has achieved positive results in forming the professional competencies of mining students by teaching the discipline "Information Technology in Technical Systems".

In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 816 dated October 10, 2018, "On Providing Higher Educational Institutions with Educational Literature," "Principles for Creating Electronic Information and Educational Resources, i.e., Electronic Textbooks in the Digital Educational Environment, and Requirements for Them" have been defined [2].

An electronic interactive program is software that interacts with the user in real-time and is used to train them, check their level of mastery, or effectively organize the professional training process [3].

When creating electronic interactive programs, programming languages such as HTML5, JavaScript, and high-level languages such as Python and C++ are used. Laboratories, practical classes, and other educational platforms supporting the learning process were also utilized.

Electronic interactive teaching and learning tools are relatively small electronic resources related to a specific subject or even individual sections or topics of the subject [4].

Relevant electronic interactive programs ensure students' familiarization with theoretical and practical material, as well as monitoring the effectiveness of teaching and education. The development and use of an electronic interactive program in the teaching process of the subject "Information Technologies in Technical Systems" made it possible to improve the quality of the educational process and organize it in a more perfect form. This will allow students to deepen their technical knowledge and develop skills in using modern information technologies.

Our research has shown that the electronic interactive program has become one of the primary means for students to effectively master information technology knowledge in technical systems and to develop professional competencies.

RESULTS

One of the primary tasks of the educational process is to prepare students for future professional activities and to develop the necessary skills and knowledge in them. According to the research results, combining theoretical knowledge with practical classes using electronic interactive programs and digital resources serves to develop students' practical abilities.

In teaching the subject "Information Technology in Technical Systems," methods such as "Opposite Attitude," "Pedagogy Wheel," and "Sindikat," "Cluster," "Synquine," "BBB," "Brainstorming," "Designing," "Web Quest," "Research," "Case Study," "Problematic Learning," "Communication," "Venn Diagram," and others are widely used.

Organizing the educational process based on modern information and educational technologies also increases the opportunities for working with students both collectively and

individually [5]. Of these methods, especially "Opposite Attitude," "Pedagogy Wheel," and "Sindikat," we utilized for mining students when teaching the discipline "Information Technology in Technical Systems" based on our improved electronic interactive program. The use of such teaching methods has had a positive effect on the formation of students' knowledge and skills, and professional competencies in using information technologies in mining.

When applying the "Pedagogy Wheel" method in practical classes for the discipline "Information Technology in Technical Systems," students utilize technical and didactic tools at every stage of the lesson. Students practically reinforce the theoretical knowledge they have gained. The electronic interactive program and Google Drive's capabilities create wide convenience in applying this method, especially effectively used in distance learning or group work processes.

"Pedagogy Wheel" is a method aimed at broadly educating students using various teaching methods [6]. The possibilities of using this method in improving the methodology for developing the professional competence of future music teachers in digital education are detailed in the scientific work of G.J. Abilova [7].

Pedagogy Wheel encourages the use of a wide range of technologies. In this context, the following modern applications can be integrated into the educational process: Google Drive, Microsoft Office, social networks, educational platforms, and design tools. The practical session on the topic "Using the graphical capabilities of the AUTOCAD program in the design process" using the "Pedagogy Wheel" method provides students with the opportunity to develop a wide range of technical and professional skills. This approach serves to enhance the technical knowledge and competencies of students in the field of mining.

The technology for conducting a lecture lesson on the discipline "Information Technology in Technical Systems" using the "Opposite Attitude" method on the topic "Modern Automated Design Systems and Their Applications in Technical Fields" via an electronic interactive program directs students toward thinking through new relationships and deepening their knowledge. In the lecture, students are provided with information on automated design systems in technical systems using the "Opposite Attitude" method.

Electronic interactive program - Materials prepared in the form of text, graphics, animations, and videos help students understand the topics. Google Drive is the primary platform for material exchange and student group work. Google Docs and Google Slides - Groups are used to prepare collective notes and presentations. Google Sheets - Used as a tool for peer evaluation and written analysis for groups.

When using the "Opposite Attitude" method in a lecture, students express new and unusual opinions that differ from conventional approaches. Looking from the opposite side, students deeply analyze the positive and negative aspects of technologies and systems. Through group discussion, students learn to find joint solutions and explain new ideas to one another. By applying the "Opposite Attitude" method in training through an electronic interactive program and Google Disk, the following aspects of professional competencies are developed in mining students: critical thinking, problem-solving skills, teamwork, communication skills, and innovative thinking. Also among the core competencies: develops communicative competencies in logically constructing and answering questions on a given topic, information management competence using all information sources, and cognitive self-development competence.

Conducting the laboratory session "Creating a Model of Problems Related to Geological Exploration and Mining Metallurgy Using the Kompas Program" using an electronic interactive program and Google Drive using the "Sindikat" method develops students' competencies in responsibility and organization, problem-solving and analysis, and communicative competencies.

In our opinion, the use of the "Sindikat" method allows mining students to develop several cognitive and professional competencies simultaneously; specifically, this method helps them prepare for future mining technologies and collective work processes. The laboratory session will help students study real technological processes and gain a deeper understanding of software modeling in the fields of geology and metallurgy. As a result of using the capabilities of the electronic interactive program, students: Google Drive is used to obtain basic information on the topic, Google Docs is used for each group to collect their work and record reports and observations, Google Slides is used to create presentations and presentations between groups, through online contacts in Google Meet, groups can work together on their work and conduct presentations online, Google Drive is used as a storage for all documents, drawings and practical work.

Based on our research, developing the professional

competencies of mining students by conducting the educational process using "Opposite Attitude," "Pedagogy Wheel," and "Sindikat" methods in teaching the discipline "Information Technology in Technical Systems" leads to the following main conclusions: the use of the "Pedagogy Wheel" method allows for the formation of knowledge, skills, and competencies in students based on Bloom's taxonomy principles during the learning process. At the same time, special applications and tools are used that serve to develop students' knowledge and skills. In the "Opposite Attitude" method, students study various opinions and views, and learn to look at an existing problem from a broader perspective by expressing opposing views. The "Sindikat" method teaches students to work in team collaboration and to act together when solving problems. In developing the professional competencies of mining industry students, these methods provide students with comprehensive knowledge of technical systems and information technologies, enhancing their ability to apply their professional knowledge and skills in practice. Students develop the teamwork competencies necessary in the mining industry through group work, joint decision-making, and the development of technical solutions in collaboration. The use of these methods through an electronic interactive program serves to comprehensively form the technical and professional skills and professional competencies of mining education students. Students will be able to achieve high results in their fields through the effective application of modern technologies, teamwork, and critical thinking. As conclusions for the second chapter, the following can be noted:

CONCLUSION

The model for developing students' skills in independent modeling and developing solutions for applied mining tasks has been improved based on the use of interactive functions using automated design systems in teaching the discipline "Information Technology in Technical Systems.";

Based on the use of an electronic interactive program and the Google Drive platform in forming the professional competencies of mining students in teaching the discipline "Information Technology in Technical Systems," the use of interactive teaching methods "Pedagogy Wheel," "Sindikat," and "Opposite Attitude" has been improved;

It has been determined that the use of the improved educational module and interactive tools enhances the effectiveness of the educational process and allows for the development of students' professional competencies.

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