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Methods of Improving the Information Competence of Construction Students Based On 3d Models and Mixed Reality Technology

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Abstract: Improving the quality of the educational process and improving their information competence in the education of engineering students are urgent issues, and new approaches and methods can be observed in the process of studying scientific research works in this field of developed countries. As a result of the studied work, we can see that the widespread use of digital educational resources in the educational process of foreign technical higher education institutions, the development of methods and tools for virtual modeling and visualization of technical and technological processes, and the systematization of information through intellectual systems are rapidly developing.

Keywords: Information competence, Computer simulation, Simulation modeling, Information visualization, Pedagogical technologies, Innovative methods, Mechanisms, Mixed reality, Didactic support.

Introduction: Today, improving the quality of the educational process and improving the information competence of students in technical fields are urgent issues, and new approaches and methods can be observed in the process of studying scientific research works in this area of developed countries. As a result of the studied works, we can see that the widespread use of digital educational resources in the educational process of foreign technical higher education institutions, the development of methods and tools for modeling and visualization of technical and technological processes, and the systematization of information through intellectual systems are rapidly developing.

Virtual reality technologies are considered an important pedagogical tool for modeling and visualizing technical and technological objects, thereby creating a virtual learning environment for technical students. The rapid development of digital technologies requires the improvement of technical students' skills in working with information and rapid adaptation to new technologies in their education [1,2].

In the last three years, the number of general IT specialists, as well as graduates of higher and vocational education, in the European Union countries has increased from 7.8 million to 8.7 million. Based on these international statistics on digital technologies, the following conclusions can be drawn[1,4]:

- Mobile internet, artificial intelligence technologies, big data and machine learning, 3D Models, VR/AR/MR technologies, Internet of Things (IoT) and industrial automation processes are changing working conditions and increasing the need for professionals with digital skills;
- The widespread use of digital technologies has a strong motivational impact on the desire to study and work;
- In the environment of new digital technologies, the concepts of time and space are losing their significance, dangerous and routine boring work is being transferred to automatic systems and robots, and

as a result, new internal capabilities of employees are being developed;

- The issue of digital literacy of employees is relevant, which is primarily defined as a set of knowledge and skills necessary for the safe and effective use of digital technologies and Internet resources. Digital literacy is based on information competences, the ability to solve various tasks in the field of using information and communication technologies. Various researchers are developing models of digital competences and skills that are largely complementary to each other. They identify such key areas as digital/information competences, communication and collaboration, working with big data flows, and solving problems that computers cannot solve.

METHODOLOGY

The main task and purpose of this proposed technology is to assess the information competence of civil engineering students based on Mixed Reality technology , diagnose and analyze the effectiveness of the pedagogical process. This methodology allows for quantitative and qualitative digital assessment and conclusion of the results and indicators of the pedagogical process. As a result, by introducing Mixed Reality (MR) technology into the educational process of the engineering field, it becomes possible to view and analyze civil engineering projects in a 3D MODELS environment, model complex technical processes, explain labor safety, the principles of operation of mechanisms and building models through simulations. From a scientific point of view, monitoring the pedagogical process, diagnosing, evaluating, making decisions and predicting the level of student mastery generally gives the concept of digital pedagogical monitoring[2,3,4].

DISCUSSION

Currently, in technical higher education institutions of developed countries (USA, Canada, Germany, Japan, China), high efficiency is achieved in the educational process through modeling and visualization of technical systems and processes related to the production sector. An example of this is Mixed Reality technology, which is designed to model processes based on virtual reality. Using these digital technologies, today, modeling of educational resources in medicine, business, chemistry, physics, biology and technical disciplines in a virtual reality environment is widely developing [3-5].

To better understand Mixed Reality technology, it is necessary to have information about augmented (AR) and virtual (VR) reality technologies. In AR, real-world objects are depicted using computer models, but they cannot be touched, picked up, or moved. In VR technology, real-world objects are digitized. The user leaves the real world and enters the virtual world. VR technology simulates movements, implementing the properties and actions of virtual reality in real time through computer synthesis[2,3,5].

In Mixed Reality technology, virtual objects become real and the user begins to interact with system models. The main features and differences of these technologies can be seen in Table.1.

Table 1: VR, AR and differentiation of MR technologies.

Capabilities	VR	AR	MR
Interaction with the real world	-	-	+
Instruments	Oculus VR, PlayStation VR, HTC Vive	Google Glass , Meta Vision	Microsoft HoloLens , MagicLeap
User status	In the virtual world	In the real world	In the real world

Environment condition	Full computer imaging	It can be seen as real.	Can be viewed and interacted with as if it were real

In foreign countries, by digitizing educational resources based on these Mixed Reality technologies and implementing them in the educational process, students of technical higher education are achieving high mastery of subjects. Several foreign scientific research works have been carried out on the application of Mixed Reality technology in the field of technical higher education and the analysis of the results, and today they are also of great interest to researchers in the field of pedagogy in other countries. Mixed Reality technology is considered the most important future educational technology for teaching technical higher education subjects[1,5].

One of the important factors in improving the information literacy of civil engineering students is solving problematic issues related to the subject using computer applications.

The technology for improving students' information literacy into three components and consider the content and structural tools of each stage separately (Table.2).

Table 2: Students information competence improvement technology stages.

Stages	Summary	Tools
Elementary	Aimed at developing basic information processing skills	Texts, spreadsheets, graphical data, information search
Motivational	Aimed at forming a motivating component of information literacy	Animated games, interactive resources
Improved	Aimed at developing skills for the full application of information technologies in the educational process and professional tasks	Mixed Reality technology models , digital imitation technologies

in the table, the improvement of students' information literacy is carried out on the basis of a logical sequence and didactic tools. At the initial stage of improving information literacy, the primary educational resources of the subject are used. This includes the development of skills in working with text editors, creating spreadsheets, creating graphical data, and searching for information.

That is, students of the civil engineering department will perform the following tasks:

- Design and processing of drawings of varying complexity within the scope of scientific topics in automated design systems AutoCAD, Autodesk Revit, Solidworks;
- They integrate completed projects into special virtual spaces using Mixed Reality (MR) technology.

CONCLUSION

The analysis of the proposed technology showed that there are opportunities to eliminate current educational problems in the socio-pedagogical process as a result of digitization of higher education in engineering and informatization of electronic educational resources. The learning outcomes, motivation and academic performance of the requirements in teaching technical subjects can be significantly improved through the use of 3D Models

and Mixed Reality technology and its immersive environment. The analysis of foreign scientific research also scientifically substantiates the fact that teaching students through an immersive learning environment based on experience and practical exercises allows them to effectively master new knowledge and develop skills in working with information. The studied studies show that in higher education of our republic, the process of experience-based learning through the use of Mixed Reality technology can become an effective way to master complex ideas and skills, and to work comfortably with information. For the effective use of digital educational resources created on the basis of MR technology in the educational process, their compliance with educational laws and didactic principles, methodological implementation strategy and teacher training are of great importance.

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