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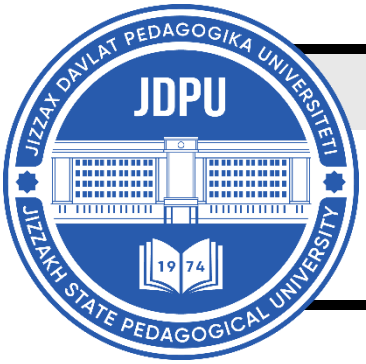

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THE ROLE OF DIGITAL TECHNOLOGIES IN LEARNING FOR PHYSICS EXPERIMENTAL LABORATORIES

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ABOUT ARTICLE

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Abstract: In the article, the problem of digital technologies, the rapid development of the digital infrastructure of educational institutions, the training of personnel with modern digital competencies, the updating of specialties and educational fields taking into account the trends in the labor market, the formation of educational programs based on flexible educational trajectories, the development of the concept of continuous education, as well as , the processes of introduction of artificial intelligence systems in the educational environment are covered. Also, studies aimed at the introduction of digital technologies, which allow planning concrete steps to improve the educational system and change the work of educational institutions, have been carried out and suggestions have been formulated.

INTRODUCTION

In recent years, this work in our country began with teaching programming to schoolchildren, and during this time the digitalization of education became an integral part of education policy. Aiming to speed up the country's scientific and technical development and socio-economic development, the task of developing computer literacy of the population and introducing digital technologies into the educational process was further advanced into the educational system. The role of modern technologies in the process of improving national education is increasing year by year, their introduction serves to modernize and

develop education, as well as to increase the quality of training of future specialists and to bring education to science. At the same time, such technologies require a revision of existing approaches to educational activities, as well as an analysis of their impact on society and individual social groups. In this regard, studying the digitalization of education and its social consequences seems to be a very relevant area of scientific research.

The field of education is one of the most rapidly developing, promising sectors that are important in the country's development and require modern information technologies and digital resources. Today, innovative technologies in the field of education and digitized resources are widely used. This is one of the priority directions for further improving the quality of education and teaching efficiency. Education consisted of mental work, activity and creative thinking of teachers and students is a multifaceted and complex process. Improving the effectiveness of the lesson is inextricably linked with the establishment of the educational process on a scientific basis and the practical application of new pedagogical technologies. The main goal of organizing innovative activities in higher education institutions is to ensure consistency of cooperation between teachers and students and to establish it in a specific goal-oriented manner. The use of information and digital resources in the educational system will help you to be more productive. This allows to improve the quality of learning and create convenience for students.

1. VIRTUAL LABORATORY EXPERIMENT

In such cases, a virtual laboratory experiment, simulated on a computer monitor screen, allows you to attract the attention of students to study physical phenomena and becomes a good methodological support in organizing the educational process [1-5]. By virtual laboratory experiment we mean a method for studying a physical process using a set of hardware and software, providing the student with the opportunity to change individual parameters and record the results of a physical phenomenon (process) on a computer.

The basis for organizing and conducting a virtual laboratory experiment is the appropriate software. An analysis of scientific literature has shown that today the authors have paid considerable attention to the problems of introducing computer and information technologies into the educational process [6]. Currently, the world market has a sufficient number of ready-made computer programs for solving such problems, for example, a single Collection of digital educational resources, “Physics in Pictures”, “Open Physics”, “Physics”, etc. An analysis of the progress of virtual work has shown that the time spent on performing a virtual experiment by students is practically no different from the time spent on a real laboratory installation. However, as one gains experience in implementing computer experiments, the time required to complete a virtual experiment tends to decrease. Based

on the results obtained, conclusions were drawn about the effectiveness of the methodology used. Remote work is not a complete replacement for laboratory research. Students do not personally conduct real experiments, but essentially observe a demonstration experiment while watching a video film; they cannot make mistakes in the experiment, analyze these errors, and, therefore, cannot correct these errors. During remote experiments, students do not come into contact with laboratory equipment, and, therefore, do not develop the skill of communicating with physical instruments. At the same time, one of the most important tasks in training engineers and technologists is the development of analytical and, in particular, practical skills [6].

Fig. 1. Photo fragments of performing virtual laboratory work

Also, computer animation of laboratory work helps to increase the speed of information transfer to the student and increases the level of its understanding; audio accompaniment of the work allows you to better perceive the material being studied, thanks to comments; video accompaniment provides a visual demonstration of the material being studied and improves its perception [2]. With distance learning, the role of students' independent learning activities is significantly enhanced. When performing virtual laboratory work, students must independently follow the specified link, find the necessary information, carefully review and listen to the educational material, process the information received, analyze and draw conclusions. Thus, students gain independent work skills.

Depending on the educational topic, the goals set for the computer program for simulating a physical process, a virtual workshop can simulate a real laboratory installation as completely as possible or, conversely, almost completely abstract from its unnecessary details; makes it possible to carry out work, including demonstrating consequences that are unattainable or undesirable in a full-scale experiment (fuse blown, electrical measuring

device; change in the polarity of switching on devices, etc.). Thus, virtual laboratory work has undeniable advantages, namely the possibility of conducting a laboratory workshop when setting up a real experiment is difficult, when it is necessary to instantly process the results obtained [5]. The above circumstances encourage many teachers to independently create educational computer programs, including virtual laboratory workshops. Of course, they will not differ in the quality of programs made by professional programmers, but there will be no violations of the methodological plan. It is worth noting that the excessive “beauty” of program elements only distracts the student’s attention from the physical essence of the phenomenon being studied - everything is good in moderation.

2. RESULTS AND DISCUSSIONS

Attempts to develop our own software products, taking into account the peculiarities of teaching a general physics course, have been made; all of them were carried out within the programming capabilities of a standard office suite of any computer; the programs launch easily and do not require preliminary installation, which is necessary for the development of a mobile laboratory workshop [3]. Some of the listed programs are as close as possible with their interface to a real stationary laboratory installation, i.e. the devices shown on the screen are equipped with all the necessary controls - switches, regulators, toggle switches, etc. An example of virtual work in which there is excessive detail should be given laboratory equipment is not needed at all and is even methodologically “harmful”: work devoted to the Compton effect. In real laboratory work, an X-ray machine with all the attributes is required. Obviously, in virtual laboratory work, technical difficulties will only distract students from the essence of the physical phenomenon, therefore the model of the laboratory setup should be extremely concise (Fig. 2).

Fig. 2. Installation for studying the Compton effect

In this virtual laboratory, the dependence of the wavelength of X-ray radiation scattered on electrons on the angle of this scattering is studied. The entire interface consists only of the symbolic “ON” button of the X-ray machine, the receiving X-ray sensor and the scattering angle indicator (in the figure, for example, this is 45°). Here you can see both the original wavelength of the X-ray radiation and the wavelength of the scattered radiation, i.e., all the data necessary for the experiment is presented [6]. The simplicity of the interface helps to understand the very essence of the effect, without being distracted by the technical difficulties of a real experiment, and also to quickly complete all laboratory work, even with only a single computer, when students have to do the work one by one.

CONCLUSION

The results of the work make it possible to conduct practical classes in disciplines related to measurement technologies in a frontal or remote format without the need to purchase and use real laboratory equipment, and also help to develop software and methodological support for the educational process. In addition, the creation and implementation of new educational technologies, including digital ones, is one of the most important components of the development program of leading universities. Digitalization of education stands out as an important factor in increasing the efficiency of the educational process.

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