

THE IMPORTANCE OF THE VIRTUAL LABORATORY IN THE TRAINING OF FUTURE PHYSICS TEACHERS THROUGH THE STEM EDUCATION PROGRAM

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Abstract: The article presents methodological recommendations “The role of the virtual laboratory in the training of future physics teachers in the STEM education program” in higher pedagogical educational institutions. These recommendations serve to expand the knowledge of physics and STEM among schoolchildren and students. It has also been stated that it is important to link this to the STEM education curriculum when learning physics.

Keywords: STEM, logical thinking, experiment, physics, virtual laboratory, teaching, educational technology, engineering, artistic exploration, teaching mathematics, knowledge, ability, skill, competence.

Physical education in the system of continuous education is an integral part of the pedagogical process and serves the education and comprehensive development of the individual in accordance with the general goals of education. From the first years of independence of our republic, based on the experience gained as a result of reforming the education sector, and on the basis of a number of conclusions, it is necessary to pay serious attention to improving the current education system, the level of current development and future needs. Based on ensuring continuity of education, a new edition of the Law was adopted “On Education,” and this law is very important because it covers all areas of the current period of development.

Today, in the educational process in higher education institutions around the world, integrative models of the pedagogical process are widely used, aimed at improving the theoretical and practical foundations of the use of advanced innovative technologies. Particular attention is paid to improving the mechanisms for developing the professional training of students through the effective use of social and pedagogical parameters of innovative technologies. In this regard, a special place is occupied by the scientific results of prestigious research centers, such as the UNESCO Institute of Education (Hamburg, Germany), the International Institute of Education (USA), European Integration (ECSA-Austria).[2]

These studies solve the problem of identifying mechanisms for improving the quality of education based on the use of innovative technologies, improving the process of training future specialists based on competency-based approaches. Therefore, the prompt introduction of innovations in education, by attracting industry specialists to work independently, to actively participate in research work, and to find practical solutions to the problems of improving professional qualifications and skills in them, becomes of current importance.

One of the main goals of the STEM education program is to improve students' logical thinking skills. Therefore, special attention is paid to the use of openness, flexibility, individualization, modern educational technologies based on the implementation and development of the STEM program in the field of education. When teaching physics based on the STEM educational program, the future teacher must conduct his activities creatively and expand the range of logical thinking, based on existing conditions and acquired experience. In particular, based on the STEM educational program, a student (future teacher) must complete the following tasks during practical and laboratory classes in physics:

- increase their interest in studying technical and communication changes in the world;
- to form inventive and constructive abilities by studying the development of science, technology and technology;
- observe and analyze physical phenomena, study the dependence of the phenomenon being studied on other phenomena;

- it is important to develop methods for experimental research of phenomena and laws.[1]

The STEM (science, technology, engineering and mathematics) education system is changing our interests and views on education. In this case, the student acquires practical skills and at the same time increases his will and technical creativity. Because if a student can present the knowledge he has acquired in lectures and practice and make equipment with his own hands, this will further increase the student's self-confidence. The STEM education system is the logical result of combining theory and practice.

In the process of logical thinking of future physics teachers, an important place is occupied by the development of thinking and thinking abilities. Currently, in the field of education, special attention is paid to the use of open, flexible, individualized, modern educational technologies based on the implementation and mastery of the STEM educational program, and this shows its positive results in the educational process. By teaching physics as part of a STEM education program, the future physics teacher will be able to expand their logical thinking as a result of constant work with a creative approach based on existing conditions and work experience. For this, studying and preparing a virtual laboratory is of great importance. A virtual laboratory is a newly developed sophisticated technology that allows a person to sense an object without feeling it - a real vision. Physics experiments are the most visual and intuitive way for future physics teachers to study physics. This is also the best way to stimulate the interest of future physics teachers in physics.

The physics laboratory is based on the concept of STEM, a new educational concept that integrates several curricula. Combining learning with virtual experiences in STEM education provides opportunities for: students to perform experimental operations at different levels and at different times; Thus, it serves to improve students' ability to acquire knowledge and level of practical work, helps develop skills and improve students' literacy.[1] With the development of virtual laboratory technologies, the importance of virtual laboratories in teaching is becoming one of the technologies that allows future physics teachers to conveniently perform virtual laboratory work on the subject in a place and at a time convenient for them.

Research in physics education is needed to develop logical and creative thinking. We can talk about some of the most general methods of logical thinking and, in general, general algorithms of mental activity. But this requirement also implies that future physics teachers must be able to conduct active research and find heuristic solutions. The desire for consciousness is a character characteristic of every future teacher, cultivated by the method of educational work.

STEM education has as its main purpose "teaching science", "teaching technology", "engineering", "learning art" and "teaching mathematics", while virtual physics lab is STEM. "Teaching science" means that future physics teachers should also pay attention to scientific-experimental connections when conducting and managing virtual physics laboratories, actively acquire relevant scientific and cultural knowledge, and gradually develop each part of virtual experiments into a scientific layer. it's careful. "Learning technology" means that it is a key feature of interdisciplinary STEM education. Future physics teachers must not only have basic knowledge of physics, but also have computer programming and modeling skills so that students can fully explore various technologies. "Practice in engineering" refers to practicality in STEM education. "Mathematical learning" requires students to master good experimental thinking and teaching methods. For example, conversion methods, analog methods, inverse methods, etc. have a good learning method, which greatly helps the experiment to be successful. In short, combining the virtual physics laboratory with the concept of STEM education provides theoretical support for the virtual physics laboratory and a practical teaching tool for STEM education. [3]

The creation of a virtual physics laboratory is the rapid development of modern science and technology and the achievement of great achievements in the history of education in the traditional physics laboratory. This development of science and culture of future physics teachers will help to

acquire qualitative and cultural knowledge and develop their literacy. STEM education concept good theoretical basis for virtual physics laboratory. Having said that, the goal of the STEM Virtual Physics Lab is to provide every possible support to future physics teachers.

The development of students' thinking and reasoning in the process of logical thinking is important for future physics teachers. In developing the thinking abilities of future physics teachers, it is necessary to observe and analyze exercises and phenomena related to analysis and summation, comparison, generalization, determination of cause-and-effect relationships, classification and systematization, and dependence of the phenomenon being studied. to other phenomena, students' understanding of phenomena and laws. It is important to develop methods of experimental verification.

Recommendations

1. Khamroeva S.N. - "Education of future physics teachers based on the STEM educational program" Methods of using modern educational technologies in teaching astronomy: problems and solutions, Republican Scientific and Practical Conference 2022 May 17, 157-159 p.
2. Yulong Bail, Dianfei Peng, Jie Yang.- Design of Virtual Physics Laboratory Based on STEAM Education "Advances in Social Science, Education and Humanities Research, volume 428".
3. Khamroeva S.N., Bozorova L.Sh. The role of the virtual laboratory in training future physics teachers through STEM education "First Renaissance: International scientific and practical conference "Abu Rayhan Beruni and the evolution of natural sciences", May 25, 2023