

Ways to Use the "Physics at School" Platform in the Organization of Practical and Laboratory Classes in Physics

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Abstract:

The article summarizes the results of virtual demonstrations and experiments in teaching physics using digital technologies and Internet resources.

Keywords: learning efficiency, digital technology, computer modeling, virtual experiments, animation, animated demonstrations, virtual laboratories, computer modeling.

Introduction.

In modern society, the use of information technology remains necessary in almost all human activity areas. The acquisition of these technological skills at school largely determines the vocational education prospects of students. Teaching physics is the most convenient area for the application of modern information technology. The need to integrate a demonstration component into the learning process, which gives students a better understanding of the possibilities of using information technology and components that require the active use of knowledge obtained in computer science classes, is becoming increasingly important. The most important schools task today, including the teaching of physics, is to form a person capable of moving freely in the flow of information in an environment of continuous learning. At the present stage of school development the task is to transform the traditional system of education into a qualitatively new system of education - to educate a qualified, effective thinking person, adapted to the new conditions of society. One of the important areas in the implementation of these tasks is the introduction of digital information technology in the educational process [1].

Literature review.

The use of information technology is a renewal of the teacher's role, his willingness to transfer his knowledge and experience by new means. Internet connectivity, which allows the use of various resources in learning, is becoming increasingly popular. When working with the Internet, one can participate in various contests, quizzes and Olympiads. The use of Internet resources requires the science teacher to change his or her professional activities. The use of Internet resources also poses some problems. Data from different sites are not always reliable, so it is advisable to check them several times. Websites of scientific organizations and centers, universities and other educational institutions are considered to be more reliable. Reliable news sites often publish material copied from print sources. Websites with reliable information indicate the material source. If students are doing an assignment that involves searching for information on the Internet, they should have all these points explained to them.

The use of digital technology in the educational organization and extracurricular activities in school seems very natural from a child's point of view and is one of the most effective ways to increase

motivation and individuality of learning, development and formation of creative abilities. Every lesson evokes positive emotions in children, and even students with learning disabilities find it very interesting to work with computers. A digital technology lesson:

- enriches the connections between all participants in the pedagogical process and the interaction of all its components;
- promotes differentiation and individualization of learning;
- encourages student learning;
- develops self-discipline;
- makes teaching material more convenient and simplifies the solution of many didactic tasks in the classroom.

The use of digital technology makes it possible to simulate a wide variety of processes and events, greatly expanding the possibilities of practical exercises that are technically very difficult or completely impossible to demonstrate in the laboratory. The main advantage of this technology is that it can be adapted to any lesson and effectively helps the teacher and the student. Another important point is that there are some processes or events that cannot be visually observed under laboratory conditions, such as the motion of a satellite around the Earth. In this case, computer simulation demonstrations are invaluable because they allow us to "compress" the circle of time and space and, at the same time, draw conclusions and results that correspond to reality. Existing experiments were studied in detail in order to determine the level, methods, and prospects for the use of virtual laboratory works in teaching and to study their impact on the effectiveness of learning.

The results of D.I.Troitsky's study on the impact of the use of virtual laboratories on the quality of education are noteworthy. He notes that the use of virtual labs has resulted in a 17.7% increase in student achievement and a 10-50% reduction in time spent on lab work [2].

M.T. Takher also notes that the use of virtual laboratory works is an effective tool for improving students' knowledge. It also offers a combination of virtual lab work with traditional lab work, as well as a hybrid or blended learning strategy [3].

I. Titianova's conclusions agree with the views expressed by M. T. Takher. He notes that the use of virtual tools in teaching electrical engineering is effective. In his opinion, the combination of real-world and virtual experiences in electrical engineering education increases students' interest in science and makes it easier to understand the material.

Recently, there has been a decline in student interest in the natural sciences, including physics. However, it should also be noted that most students are interested in teaching and research and enjoy being in a creative research environment. Physics provides excellent opportunities for using research methods in the classroom and in children's extracurricular activities. The proper use of digital technology, one of the highest technical means of learning in the educational process, allows the teacher to carry out the learning process in a new environment where they are no longer the only source of information for students. Before talking about the important role of ICTs in preparing and conducting modern methodologically high level learning, it should be noted that information technology serves as a highly effective tool only when approached in the right way.

Of course, the use of digital technology in school will not solve all the problems, but remain a multifunctional technical tool for learning. Modern pedagogical technologies and innovations in the educational process are important insofar as they allow each student not only to "invest" in a particular knowledge base, but also to create conditions for the manifestation of cognitive activity of students.

In physics classes, computers primarily allow students to develop experimental, research activities. Computer models are a great tool for organizing such events. Computer modeling allows to create a vivid, memorable dynamic image of physics experiments or events on the computer screen, and opens up a wide range of possibilities for the teacher to improve lessons.

The use of digital learning resources in physics classes provides the following positive opportunities:

- taking into account the students individual characteristics;
- development of schoolchildren's creative abilities;
- fostering interest in the subject. ICTs contribute greatly to student engagement in the learning process.
- to reveal students' abilities, to intensify mental activity;
- ensuring quality assimilation of applied material;
- information technology greatly enhances the ability to provide educational information.

The use of color, graphics, sound, and modern multimedia capabilities allows processes to be recreated as if they were real.

Students are most interested in computer models, which can control the movement of objects on a computer screen by changing the values of numerical parameters underlying the mathematical model. Some models allow to observe time-dependent graphs of a number of physical quantities, which simultaneously describe the experiment in dynamic mode during the experiment. Such models are especially valuable because it is very difficult for students to draw and read graphs. Computer models easily fit into a traditional lesson, making it possible to demonstrate real processes virtually "live". In addition, computer models allow to create new, non-traditional forms of learning [4,5].

Offers

The use of direct Internet resources in the organization of the educational process using virtual demonstration experiments and virtual laboratory works is becoming increasingly popular. One such resource that can be used to teach physics is the "Physics at School" platform. This resource includes computer animations and simulations that cover almost every section of the high school physics course (figure 1) [6].



Figure 1. The main window of the "Physics at School" platform

As a result of our joint efforts with Vladimir Vaskak, the administrator of this platform, the platform is now available in Uzbek. One can switch to the Uzbek version of the platform by selecting the flag of the republic with the mouse or by visiting <https://www.vascak.cz/physicsanimations.php?l=uz> [6].

Uzbek version of the platform includes 290 animations and simulations in 16 sections that can be used to teach school physics courses (Figure 2).

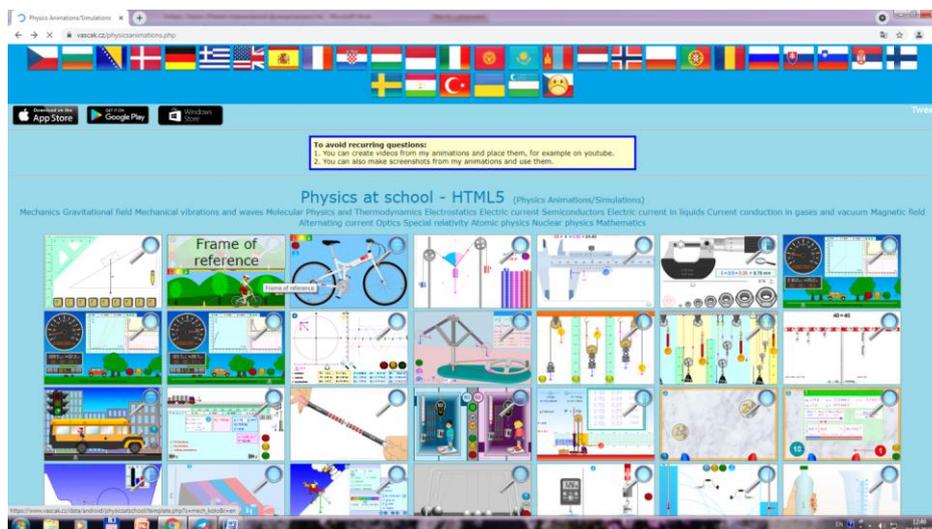


Figure 2. Sections of the “Physics at School” platform..

The platform resources can be used as a demonstration experiment when teaching physics or in virtual laboratory classes. As an example, here is a simulation of an X-ray tube, which can be demonstrated in a physics course. This simulation has two components, the left side of the mirror depicts the interaction of charged particles with the atom and the processes taking place in it, the mechanism of X-rays formation. The right part of the simulation window shows the X-ray machine operation (X-ray tube). One can control the modeling process with the corresponding buttons in the window (figure 3).

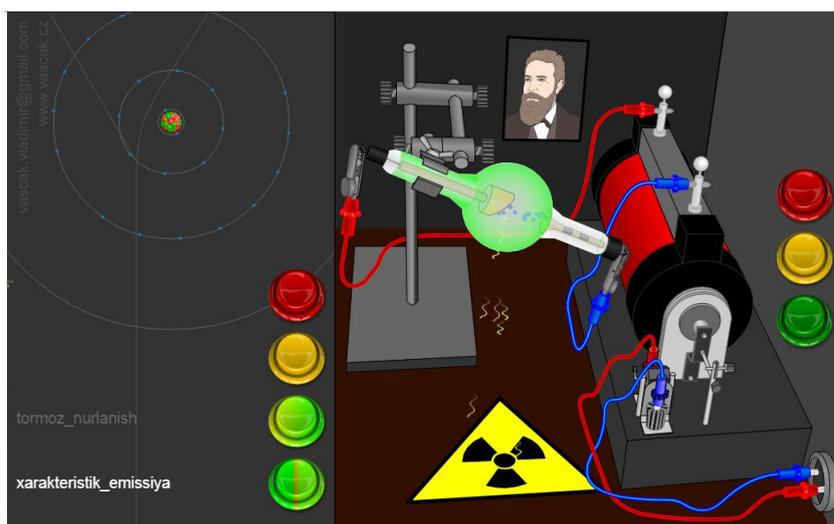


Figure 3. Modeling the X-ray tube on the “Physics at School” platform.

A distinctive feature of the “Physics at School” platform is that it has animations and simulations reflecting many physical processes that cannot be demonstrated in the school laboratory, not only in the school laboratory, but in any laboratory environment. An example is the physics course "Specific

Conductivity in Semiconductors. The animations "Generation and Recombination" and "Special Semiconductors" can be used when studying "Mixed Conductivity"(figure 4).

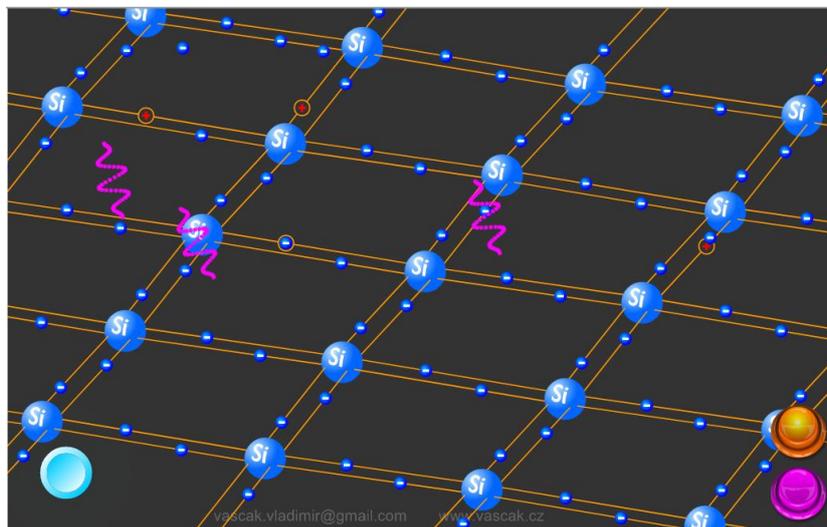


Figure 4. "Generation and Recombination" simulation on the "Physics at School" platform.

As it is well-known, the physics course provides basic information about atomic and nuclear physics. It is impossible to observe the processes occurring in the atom, especially in the nucleus (nuclear reactions), except in special scientific laboratories. The release of large amounts of energy and radioactive radiation in nuclear reactions makes it impossible to directly observe this reaction from a safety perspective. For this reason, the demonstrations and experiments in this section are not part of the school physics course at all. "Physics at School" platform contains 10 animations and simulations on atomic and nuclear physics. As an example, we gave the animation "Nuclear Reactions" (figure 5). Using this animation, one can observe the nuclear reactions types (decomposition, aggregation, transmutation, chain reaction), a separate reaction process for each type. The animation shows the elements involved in the nuclear reaction, the intermediate and resultant elements formed during the reaction. The process can be controlled by the corresponding buttons in the simulation mirror, which can be used to start, pause and resume the reaction.

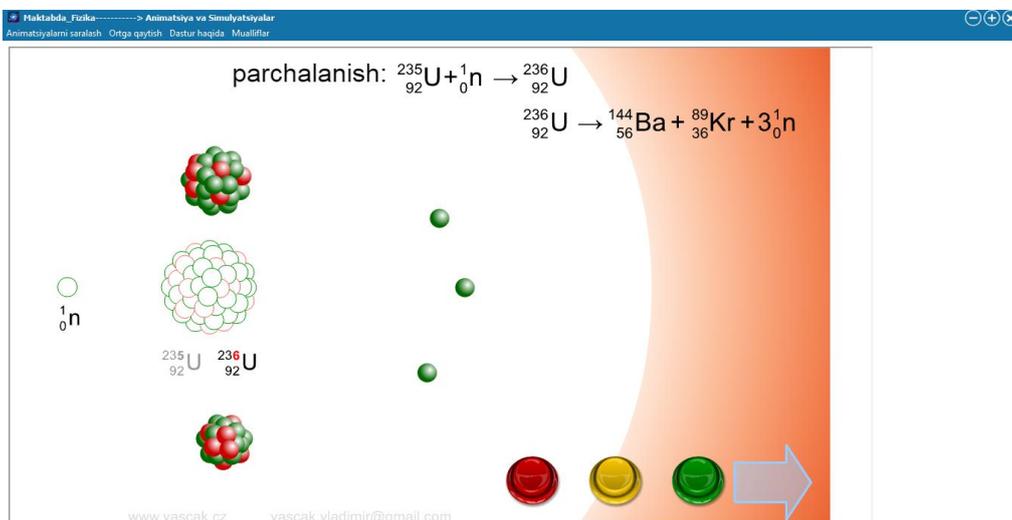


Figure 5. Modeling "Nuclear Reactions" on the "Physics at School" platform.

Conclusion

It is known that students are very happy and eager to do practice, experiment and laboratory work in direct contact with devices and mechanisms. Of course, virtual demonstrations and experiments cannot completely replace traditional physics laboratory classes, but it is recommended to use them as an additional tool.

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