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Research Article

IMPROVING THE METHODOLOGY OF USING SOFTWARE IN ORGANIZING VIRTUAL LABORATORY COURSES IN PHYSICS

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ABSTRACT

In this paper, the modern scientific and technological achievements of the organization of laboratory work in pedagogical higher educational institutions, the improvement of digital technologies with the help of software tools, and modern teaching methods are researched. In particular, the detection of diffusion phenomena using the Phet software environment is considered in detail.

KEYWORDS

Real laboratory, virtual laboratory, method, Phet, quality of education, digital technologies, software.

INTRODUCTION

The decision of the President of the Republic of Uzbekistan No. PQ-5032 of March 19, 2021 on measures to improve the quality of education and develop scientific research in the field of physics contains the following sentences:

Today, it is important to improve the quality of physics teaching in educational institutions, to introduce modern teaching methods into the educational process, to select talented students, to prepare competitive specialists for the labor market, to develop scientific research and innovations, and to

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direct them to practical results. attention is paid 14.06.23\PQ-5032 19.03.2021.pdf [1].

Fundamentally improving the quality of education in physics, training highly qualified pedagogues and scientific staff, providing educational institutions with modern laboratories, textbooks and other educational equipment.

Development of the potential of scientific organizations, effective organization of their activities, establishment of mutual dialogue and cooperation between the fields of science and production, as defined in the Address of the President of the Republic of Uzbekistan to the Oliy Majlis of December 29, 2020 ensuring timely implementation of tasks 681-IV 07.01.2021.pdf [2]:

Taking into account the above, modern methods of teaching physics, including the wide introduction of information and communication technologies, focusing on the use of modern methods and methods in training, have been researched in terms of current problems and their modern solutions.

Since physics is not only a fundamental, but also an experimental science, it is necessary for a future physics teacher to have comprehensive theoretical and practical knowledge and skills in this field [3]. It is clear from this that any physics teacher is required to have deep and solid knowledge of modern achievements and discoveries of physics, and theoretical knowledge is lacking. The role of laboratory training is incomparable in applying theoretical knowledge in practice, in becoming a fully qualified person in the field of physics.

Currently, students in the field of physics are faced with various problems in the organization of laboratory classes in physics in higher educational institutions. Pedagogical research, studies, and observations have shown that the preparation of students in physics and mathematics and the formation levels of basic experimental skills in laboratory classes show that students are studying at different levels. [4]. In physics lessons, students have a very high desire to do laboratory work, and on the contrary, the presence of students with very low ability. In order to receive it, it is necessary to carry out laboratory exercises and improve and develop modern innovative methods.

When students do laboratory work in physics classes, they pay a lot of attention to which section of the physics course they are in. In the department of mechanics, the laboratory work is somewhat simpler and requires more work from the student, which develops experimental skills that include mental and practical skills in conducting experiments.

Things are a little more interesting in the molecular physics department. In the existing laboratories of higher educational institutions, the students try to do the work more as a team, which means that all the students do the same work and each student receives the results individually. reduces interest in work.

The work in the electrical department is somewhat interesting for these students, and if we look more at the programs in the pedagogical institute, there are laboratories related to everyday life. is interested, the results of which are that most of the equipment at work is connected with electricity.

The fact that numbers are visible in modern laboratory devices and the percentage of error of the results obtained in the work is a reason for the interest of the students, and the laboratory work of the optics

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department also increases the interest and enthusiasm of the students to some extent.

When students perform laboratory work, it cannot be assumed that all students in the group perform the same work and get the results. In this case, there are cases of displacement, taking into account this, it is necessary to recommend modern methods of organizing laboratory training. In the course of training, we may face several problems in the organization of the lesson process with real laboratory work, taking into account this, it is necessary to use digital technologies in the performance of laboratory work and coordinate it with virtual laboratory work through modern software tools.

Today, many educational institutions are using innovative technologies in the educational environment, including virtual laboratories to work on physics, chemistry, biology, ecology, and other subjects, because the educational institution has many learning events and experiments that are very difficult or impossible. Effective use of interactive tools in the educational process not only improves the quality of education but also saves financial resources and creates a safe, environmentally friendly environment.

METHOD

According to A. A. Akhmedov, before allowing the student to perform the laboratory work, he should complete the tests on the theoretical topic. After the teacher checks to what extent the student has prepared for the subject in the process of solving the test, he allows him to do the laboratory work [4].

For students not to look lightly at laboratory work and to keep the necessary equipment as an eyeball, as well as if allowed after the level of theoretical training is recorded by the teacher, we will increase the responsibility for laboratory work, which will serve to increase the quality of education. [3.4].

Taking into account the rapid increase in the demand for laboratory equipment in physics, as well as the correct allocation and efficient use of time by students, the use of information technologies in the performance of laboratory work is appropriate. [5]. Several works are being carried out to increase the effectiveness of education using the development of 21st-century technology in conducting laboratory work in physics in a modern way. Nowadays, one of the important effects of digital technologies in science and education is virtual laboratories.

What is a "virtual laboratory"? V.V. According to Truxin's definition, a virtual laboratory is a set of hardware and software that allows experiments to be carried out without or without direct contact with a real installation. [5,6]. In the first case, we are dealing with a remotely accessible laboratory setup, which includes the actual laboratory, software, and hardware to control the setup and digitize the acquired data, as well as communication tools. In the second case, all processes are modeled using a computer [5-8].

The virtual educational laboratory is by the idea of open and distance education, and material and technical possibilities in the educational process reduce the urgency of problems, even if they are small, and help.

D.I. The results of Troitsky's research on the impact of the use of virtual laboratories on the quality of education are noteworthy. It states that through the use of virtual labs, student achievement has increased

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by 17.7% and lab time has been reduced by 10-50%. [5.6.7].

The use of digital technologies in the process of teaching physics, the demonstration of physical phenomena and processes that are technically very difficult or completely impossible to fully demonstrate in laboratory conditions, expanding the possibilities of conducting high-quality laboratory training, and simulating various processes and phenomena allows to do [6,7].

RESULTS

«Physics Education Technology» (PhET) The platform was created by K. Wiman, laureate of the 2001 Nobel Prize in Natural Sciences. The PhET platform includes models for various topics, created in Java and Macromedia flash.

The models presented on the PhET platform are Open Source and can be used by any user for free.

PhET program http://phet.colorado.edu you can download from the platform. Models in the PhET program can be widely used as demonstration experiments in physics, chemistry, mathematics and biology classes, and in the organization of virtual laboratory exercises. [6.10] There is a "Translated Sims" section on the official platform of the program, where it is possible to select the desired model and translate it into Uzbek by filling out a special account.

In this work, we present the process of carrying out the laboratory work "Study of Diffusion Phenomenon" in order to clarify the methods of using the program for students to strengthen and develop theoretical knowledge:

Topic: Study of the phenomenon of diffusion

The purpose of the work: to observe the "Diffusion Phenomenon" in the PhET programming environment.

Virtual elements: Thermometer, scale ruler to determine the mass number, scale ruler to determine the radius of the particles.

Theoretical part. Diffusion phenomenon.

Diffusion refers to the transfer of molecules of one substance to another substance, and molecules of the second substance to the first substance.

Let's perform the following experiment to observe the phenomenon of diffusion in liquids. Let's take a glass and put a teaspoon of sugar in it. Then let's pour water very slowly, without mixing with sugar. After a while, we see that the water at the bottom of the glass is cloudy. This is sugar syrup. Try taking a sip without shaking the glass. Drink again after 15-20 minutes. How has the taste of water changed?

Now let's conduct the experiment with water and manganese (potassium permanganate). In this case, we observe the progress of diffusion by the fact that the color of the water in the glass starts to change from the bottom [8.9.10].

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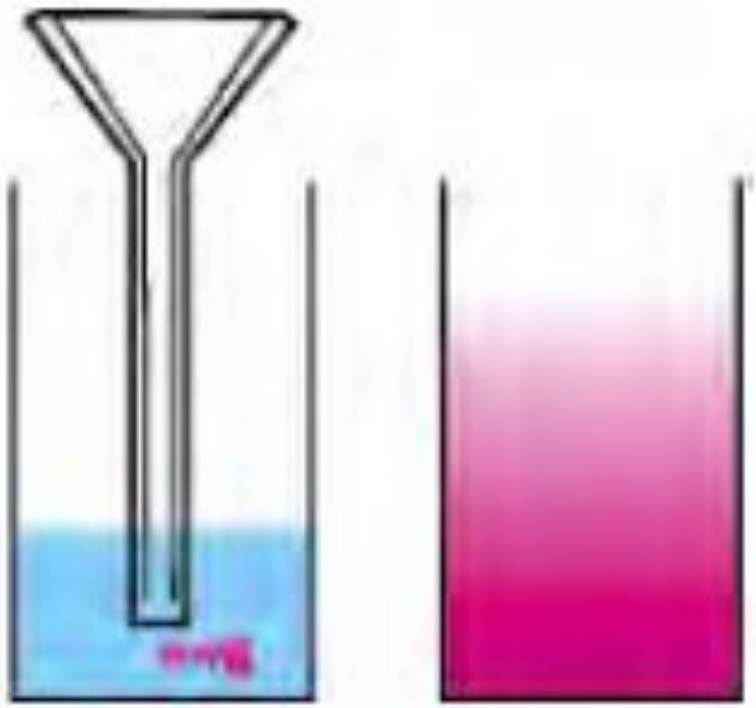

Figure 1

The phenomenon of diffusion is also observed in solids. They had such an experiment. They took two plates of highly polished lead and gold and placed them on top of each other. They put a load on them and left them at room temperature for 4-5 years. After that, when they were taken out, it was observed that the plates had penetrated each other by about 1 mm.

The pyramids of Egypt were built of hewn stones. But the rain does not pass through the joints of these stones. Because the contact layers have been mutually diffused because they have been touching each other under load for a thousand years.

Therefore, the phenomenon of diffusion is faster in gases, slower in liquids, and very slowly in solids. The rate of diffusion also depends on the temperature. Diffusion accelerates with increasing temperature. Diffusion plays an important role in nature.

For example, due to diffusion, toxic gases from industrial enterprises spread into the air. Carbon dioxide released during exhalation does not accumulate around the nose. Pickling vegetables is also based on the phenomenon of diffusion.

Diffusion is of great importance in human and animal life. For example, oxygen in the air enters the body through human skin due to diffusion. Due to diffusion, nutrients pass from the intestines of animals into the blood.

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Order of work:

1. In the Phet window, select the "Heat&Thermo" section.

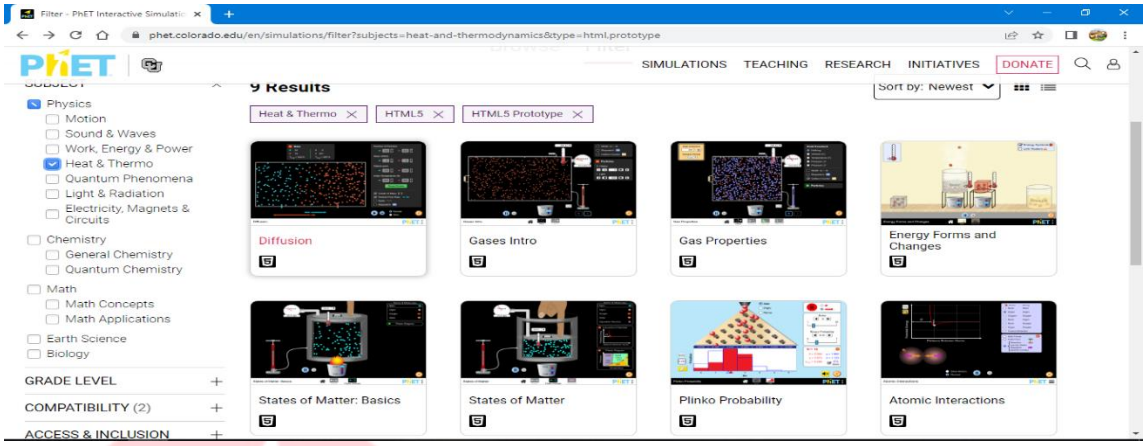

Figure 2

2. Run the Diffusion simulation from the opened simulations.

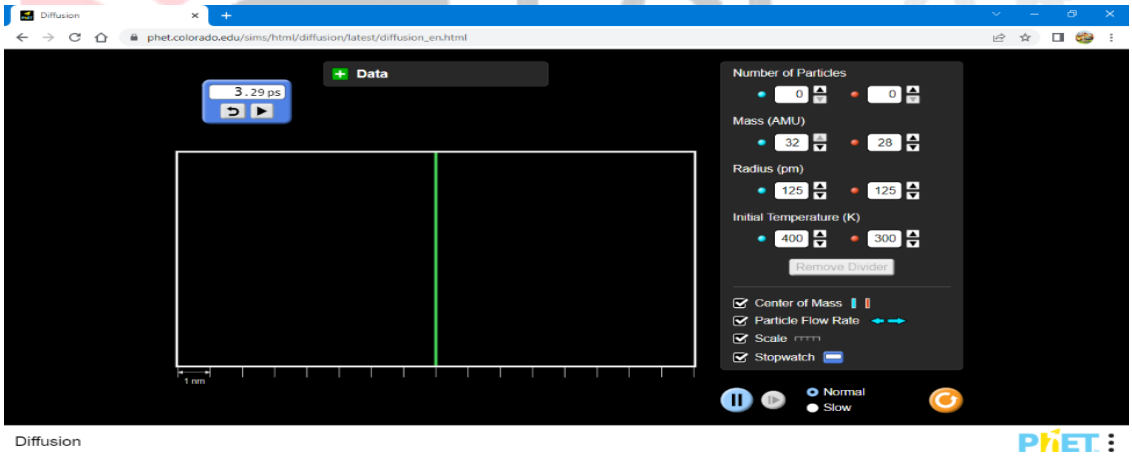

Figure 3

3. In the upper right corner of the window, observe the diffusion process by changing the number of particles, the number of masses, the radius of the particles and the temperature of both gases.

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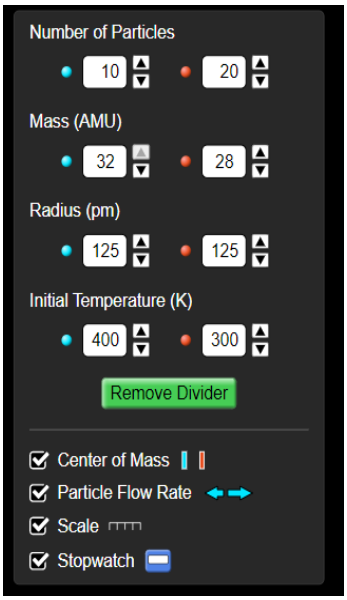

Figure 4

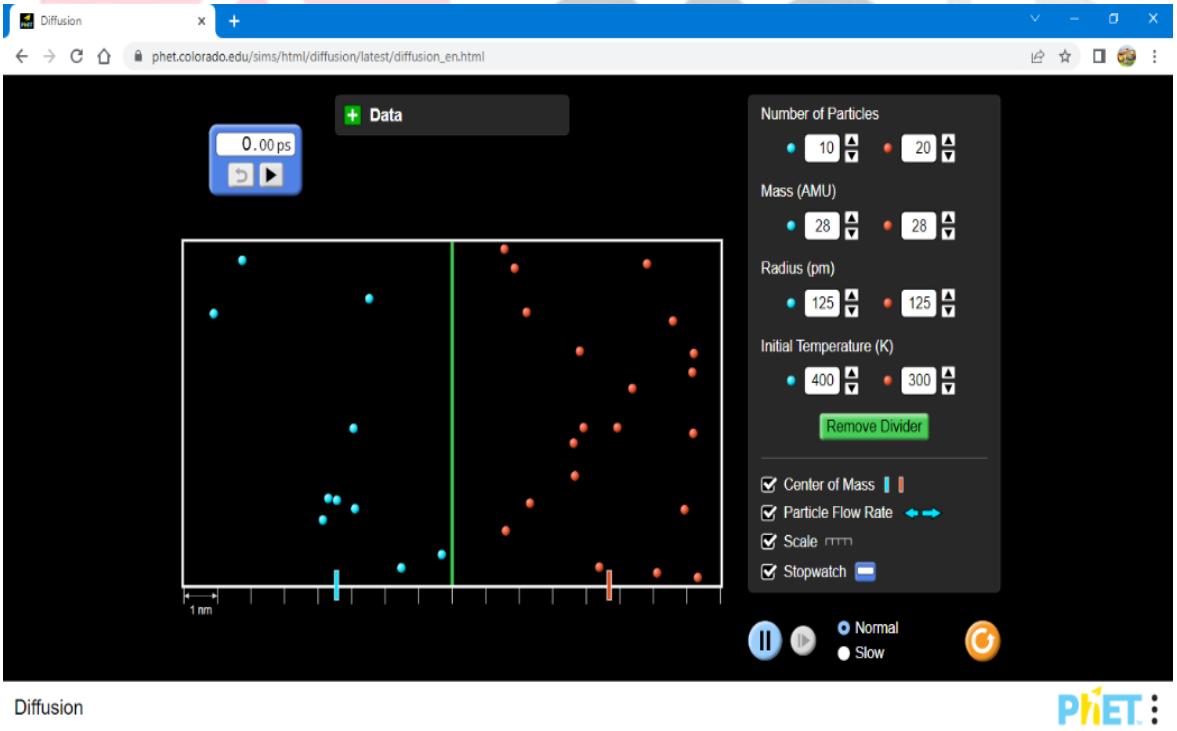

Figure 5

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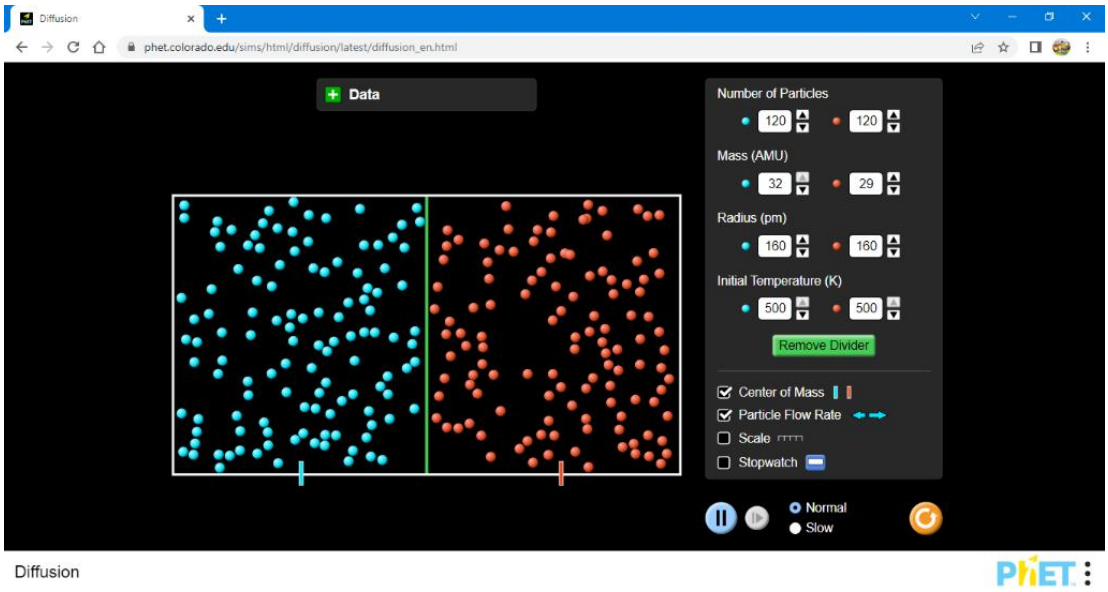

Figure 6

Control questions

1. What is the cause of the diffusion phenomenon?

2. Why does diffusion speed up with an increase in temperature?

3. Give examples of diffusion phenomena observed in gases, liquids and solids.

4. Do you know immiscible liquids?

If the student completes this virtual lab work independently, he can also complete the lab work related to the rest of his topics in the PhET programming environment or through other programs listed above.

Taking into account that higher education institutions of pedagogy mainly train teachers for schools and academic lyceums, due to the lack of physics laboratory equipment in the workplaces of graduates of higher education institutions or their outdatedness, the future physics teacher used modern technology. especially if we take into account the interest of schoolchildren in computers, smart communication tools and the presence of most of the technical tools in them, the virtual laboratory allows to do the work without difficulty. If students perform tasks using modern tools, their interest in the field of physics and their desire for discovery will develop. Today's demand for laboratory work avoids the "old-fashioned" uniformity, and the transition to digital technologies increases the effectiveness of teaching [11.12.13].

Today demands to avoid old ways of doing laboratory work, move to new ideas and models, and increase the effectiveness of teaching [4]. role has a special place.

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The student can perform the virtual laboratory work independently without choosing a place and time through smart communication tools, which increases the student's enthusiasm and develops interest in science and creativity.

CONCLUSION

Our research shows that before performing the laboratory work, the student should be given complete instruction on the topic of the laboratory work in the science program, and each student should read and study this instruction independently, and the student should not understand the knowledge in it, or first ask the teacher questions about the tools and equipment and get to know the instructions on how to do the work, and then reinforce the information given in the instructions in the form of a short question-and-answer session between the student and the teacher will be appropriate.

Organizing the laboratory work in real and virtual form, led to an increase in the student's knowledge of physics and an increase in the quality and efficiency of the educational process. In addition to acquiring deep and solid knowledge and skills in physics, the student plans to learn and apply the knowledge gained in the future, using the unique aspects of the physics teaching methodology, i.e. the use of digital and pedagogical technologies in teaching. will cry.

The organization of classes using modern digital technology tools in the performance of laboratory work in higher educational institutions of pedagogy is different from ordinary laboratory classes, the fact that real and virtual laboratory work is carried out together is interesting, useful, and effective for students, and the quality of the lesson has increased. observed.

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