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ROLE OF DIGITAL TECHNOLOGY IN PHYSICS

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Annotation
Physics is the science of understanding nature, stands majestically proclaim in almost every physics classroom. And certainly, in every physics classroom, the most effective way to understand this very nature has always been and remains an experiment. But it is becoming increasingly difficult to interest children in simple physical effects in the era of virtual entertainment and gadgets. This is especially true for such not very innovative sections, such as, for example, Molecular physics and thermodynamics. However, digital technologies open up new opportunities not only for entertainment, but also for education. Therefore, let's try to figure out what modern tools are available to the teacher, who wants to "revive" the standard course of experiments.

Keywords: Informatization of education, learning activities, performance of laboratory work, endothermic and exothermic reactions, laboratory facilities.

Introduction

The development of students' research skills is one of the important tasks of modern theory and practice of education, which is reflected in the regulations governing the organization, methodological support and content of education at the level of secondary general education. A variety of pedagogical approaches to solving this the problem has been the subject of many scientific papers. Physics, as an academic discipline in high school, has great potential for finding modern approaches to solving this problem. First of all, by virtue of its content, which includes some physical phenomena and processes that the student encounters in everyday life. One, and perhaps the main, feature of the modern stage of development of society is the processes of informatization of all aspects of human life. Informatization of education is an inevitable element of this process. However, this situation does not mean that the introduction of modern digital technologies in the learning process at school should be considered one-sidedly.

Let us analyze these processes on the example of the use of modern digital systems and technologies in laboratory classes in physics in order to develop the research skills of students.

First of all, it should be noted that the concept of “student research skills” can be formulated in various ways, based on some sometimes intuitively understood internal

structure. To some extent, to the detriment of the generality of the numerous definitions of the concept of "skill", we can say that this concept determines the readiness of a person to perform any action. For students, this action refers to the readiness to perform learning activities, which boil down to the ability to complete learning tasks classes.

The ability, brought to automatism to perform some action, turns into what is called a skill. However, it should be borne in mind that learning activities can be multicomponent in nature. In this case, the transformation of such an action into the corresponding skill does not occur. At the same time, a multicomponent educational action can be represented as a set of simpler ones, for which an advising skill can be formed.

By its very nature, students' research skills represent a willingness to perform complex learning activities. Therefore, the research skills of students can be understood as the readiness to carry out complex actions based on the skills formed to perform its individual elements. In this case, a natural question arises as to what skills should be formed in students in order to develop their ability to perform fairly complex learning activities. The answer to this question is rather difficult to obtain, but it can still be assumed that in first of all, it is necessary to develop methodological skills that are directly related to the so-called universal learning activities (ULA), widely discussed in modern pedagogical literature.

The subject content of the discipline "Physics" allows us to most clearly illustrate the universality of the scientific method of research on the phenomena that the student encounters in everyday life and transfer them as to the field of physical phenomena that cannot be observed.in everyday life, and on other areas of subject knowledge.

Laboratory work in physics is traditionally used to form the practical skills of students and can either be frontal in nature, when all students perform the same task, or be laboratory work in a physical workshop in which groups of students of 2-3 people perform tasks of various topics. Most often, in the conditions of a separate educational institution, the use of digital tools in the performance of laboratory work in physics comes down to performing virtual laboratory work that is carried out on the basis of available software, for example, the virtual physical laboratory "Live Physics", etc.

In some cases, this is absolutely justified and has a positive didactic effect, because in some cases it is possible to conduct a similar real educational physical experiment in school conditions is not possible for a number of reasons. However, when discussing the issue of using modern information technology tools, and teaching physics in general and when conducting laboratory work in particular, it should be taken into account that in this case it is necessary to overcome the very probable possibility of replacing real physical phenomena and processes in the minds of students with virtual images, mathematical models of these phenomena. It seems that this is fundamentally unacceptable. The main conclusion from the theoretical analysis of the problem is that the learning process requires a combination of real and virtual physical experiment.

At present, computer methods of research are becoming increasingly important in the physical and technical sciences. A unique phenomenon has been discovered: in digital form it is possible to represent and conduct a semantic analysis of any data. Be it text, image, sound or maps. A striking example is the concept of the Wolfram Language as a metalanguage for programming knowledge production processes. Application programs acquire internal intelligence.

Particularly in this respect are the latest versions of computer algebras, such as Maple 2015, Mathematica 10, which are able to optimize mathematical methods for analyzing a given model of a physical phenomenon, find new mathematical theorems. In other words, the computer becomes not only a means of transformation, in particular of archiving information, but also a tool for scientific research, a measuring device. However, the induction (generation) of copyright products with the help of new digital technologies requires the development users of certain, but little studied, competencies of an engineer of the near future. Such intelligence in relation to application programs for automating project activities can be called external.

One of the ways to resolve the contradictions between internal and external intelligence is the concept we are developing for the modernization of standard laboratory facilities based on digital technologies. Among the well-known applied computer programs, we single out those whose functioning is primarily turn due to the presence of elements of artificial intelligence. As part of the workshop on physics, they include computer systems that allow for a quantitative comparison of physical data any semantic load. For example, computer algebra allows measurement results to be combined into analytical forms. Another example of intelligent computer applications is virtual instrument technology. Virtual instruments are designed to process real-time flowand digitized physical signals, form a dashboard according to the current situation, take oscillograms of various scales, etc. This article presents samples of two laboratory works on atomic physics, illustrating methods for expanding the didactic potential of a physical workshop by means of intelligent digital technologies.

The first of them studies the motion of electrons in a magnetic field along a helix. In the second, the advantages of a prism spectrometer are combined with digital device. It is shown that due to the conversion of data into digital form, the accuracy of measurements and calculation of the parameters of the studied physical phenomenon is significantly increased. Thus, by the term "expansion of the educational space or resource" we mean the inclusion of digital intelligent technologies in the standard laboratory practice in physics and the creation of additional conditions that implement the student's research activities, under the control of the teacher.

The Molecular Physics Lab Kit contains a traditional list of equipment for the experimental study of the basic concepts and phenomena of molecular physics and thermodynamics. This is a calorimeter, a bucket of Archimedes, a device for studying gas laws, a Petri dish, a burette, flasks, capillary tubes, a set of weights, weights, a watering can ... - it does not sound very exciting to a student's ear. But a small detail

can turn it all into a real modern cognitive history. This is a Vernier digital temperature sensor with Go Direct technology. If during laboratory work it is replaced with a conventional thermometer, this will not only expand the educational potential of standard equipment, but also activate the interest in experimentation in the students themselves. What's so special about what a conventional thermometer can't handle, can a digital temperature sensor be added to experiments? First of all, it is digital. That is, this is already a gadget - with all the modern and the educational opportunities that flow from it. Obviously, it will be much more interesting for a child to work with gadgets in a lesson. If we consider the technical side of the issue, then the temperature sensor operates in the range from -40°C to 125°C. With it, you can explore all thermal processes, endothermic and exothermic reactions, determine the energy content of products, explore the climatic features of the environment, and much more.

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