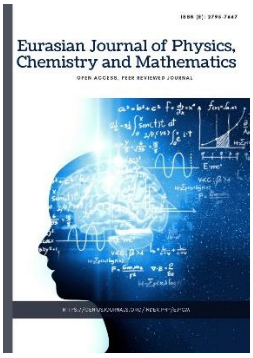

Virtual Aspects of Studying A School Course In Astronomy

Saydayev Obid Bahodir o'g'li

Jizzakh State Pedagogical University, Sharof Rashidov-4, 100130, Uzbekistan
Email: obidsaydayev@gmail.com

ABSTRACT

The article discusses automated and virtual experiments as new stages in the development of the experimental method of understanding natural phenomena. It is shown that, in accordance with these trends in big science, school physics experiments should also be improved. The functions of a virtual experiment in teaching are considered, and the types of models on which it can be based are determined. The problem of the methodology for including a virtual experiment in the educational process is analyzed in close connection with the question of the place and role of modern physical experience in the system of methods of scientific knowledge. The issues of using a virtual experiment as part of traditional explanatory and illustrative teaching methods are covered

Keywords: astronomy, school astronomy course, formation of a natural science picture of the world, key aspects of school astronomy

Introduction. Thanks to the development of multimedia technologies and modern computer processing mechanisms, we are able to create colorful animations, videos, and applications to attract close attention to detail, which is important when studying an object. Today it is possible to add an image to the screen that can operate with real-world objects, adding a new virtual part to it; such technologies are also called augmented reality technologies, which are widely used in the education system [1-5]. The use of virtual and augmented reality technologies when studying physics makes it possible to immerse the student in the educational process. Which is very important when studying such an important discipline as physics. Since physics is the basis of all engineering specialties. The benefits of using virtual and augmented reality technologies in the educational process are mentioned by many authors in their scientific works. Using modern technologies, it is possible to organize a new type of paint for a more detailed study of any object in different disciplines. The combination of technologies gives a noticeable effect in which there is an increase in engagement. The interactivity of the learning process increases. Virtual and augmented reality technologies provide a comfort zone for modern generations, who have become accustomed to all the capabilities of this technology. Today, technological and pedagogical solutions are being integrated to create a new quality of education system, in which the main role will be played by the computer, virtual reality tools and the computer network.

1. The concept of a virtual educational experiment.

When preparing a "live" educational picture (computer animation) of a physical phenomenon or its interactive model for an educational virtual environment, in fact, the computer modeling method, already mastered in modern physics, is used. In other words, the production of such an educational resource is a software implementation of a solution to a well-defined mathematical problem that quantitatively describes a model of a real physical object or process. Let us briefly consider in this context the essence and some features of the computer modeling method. Let us note at the beginning that mathematical models, which can form the basis for the development of computer models of a physical phenomenon, differ in the way they describe the phenomenon. As is known, this can be either its analytical description using known laws of nature, or a plausible analytical description. The study of a mathematical model of a phenomenon can allow for a rigorous analytical solution of the problem [5]. However, more often, due to the nonlinearity of the equations describing the behavior of the model and the large number of variables in these equations, numerical methods for solving them are used. The mathematical model constructed by the researcher always represents only one degree or another of similarity to the real physical phenomenon reproduced during modeling. This can be a very rough model, reflecting a limited number of essential properties of a real object, or a model in which a real object is recreated in a sufficiently large number of its essential characteristics. The higher the degree of similarity between the model and the real object, the more difficult the mathematical problem posed to solve will be.

2. Teaching methods and forms of studying astronomy in the school course

The effectiveness of teaching astronomy is achieved through coordination and interaction between various methods and forms of teaching. In some cases, inexperienced teachers often confuse the concepts of "form" and "method"; for this reason, we specify these concepts. The main thing here is the nature of the interaction between the teacher and students (or between students) in the course of their acquisition of knowledge and the formation of skills. Forms of education: full-time, correspondence, evening, independent work of schoolchildren (under the supervision of a teacher and without), lecture, seminar, practical lesson in the classroom (workshop), excursion, practical training, elective, consultation, exam, individual, frontal, individual - group . They can be aimed at both theoretical training, for example, a lecture, seminar, excursion, conference, round table, consultation, various types of independent work of students, and practical training: practical classes, various types of design (design and research work). A method is a way of studying natural phenomena, an approach to the phenomena being studied, a systematic path of scientific knowledge and establishing the truth; in general - a technique, method or manner of action; a way to achieve a goal, a certain ordered activity; a set of techniques or operations for the practical or theoretical mastery of reality, subordinated to solving a specific problem [6]. The method can be a system of operations when working on certain equipment, methods of scientific research and presentation of material, methods of artistic selection, generalization and evaluation of material from the standpoint of a particular aesthetic ideal, etc.

3. Methods for organizing virtual laboratories

Depending on the educational topic, the goals set for the computer program for simulating the astronomical 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 [3]. 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. Attempts to develop our own software products, taking into account the specifics 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, so the programs run directly and do not require preliminary installation, which is necessary for the development of a mobile laboratory workshop. 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. [1].

4. Methods and techniques for conducting a demonstration experiment

It is absolutely clear that the effect of any experiment primarily depends on the quality of school astronomical instruments. First of all, the following requirements are imposed on them: high technical qualities, simplicity of design, sufficiently large sizes, aesthetic design. The demo installation should be as simple as possible. This is important for understanding the experience and drawing conclusions from it. Installations should use devices that are known to students or whose operating principles are understandable to them. However, as the history of the development of astronomy teaching methods testifies, the simplicity and complexity of a particular demonstration are relative concepts. Thus, until recently, experiments showing the properties of the motion of celestial bodies were considered complex and almost never carried out in high school. With the advent of such instruments in the arsenal of astronomical offices as a set of instruments for studying the properties of astronomical bodies and movements. Meanwhile, for the needs of everyday practice, it is useful to at least approximately define the concept of “simple demonstration installation”. Obviously, this can be done this way: a demonstration installation that is as close as possible to its circuit diagram is considered simple, but only so much that this does not noticeably reduce the quality of its work. It is clear that natural scientists, the creators of experimental installations, when creating them, do not set themselves the task of making them suitable for teaching; they pursue a different goal. In the methodology of astronomy, the process of adapting experiments first carried out in scientific laboratories to the tasks of teaching is carried out. This process proceeds by simplifying experimental setups, eliminating from them everything that does not serve to clarify the essence of the astronomical phenomenon being studied (only simplifications that vulgarize scientific results are unacceptable). The success of a demonstration experiment depends not only on the quality of the instruments themselves, but also largely on the astronomy teacher’s knowledge of the device, technical data and skills in operating these instruments, the conditions of the experiment itself, and the intensity of the demonstrated physical process [8].

5. Monitoring of the educational virtual program in the educational process of student preparation

Two groups (experimental and control) of 3rd year students of the Faculty of Physics took part in the experiment. As part of the described study, 12 laboratory works were carried out in each of the groups: using a virtual laboratory in the experimental group and with the fragmentary introduction of elements of computer simulation of an educational workshop in the control group. An important aspect when forming groups is the preliminary collection of information, which includes: the results of the entrance control, which in this study serve as an indicator of the initial level for assessing, monitoring and forecasting the individual indicators of students admitted to the 3rd year. In terms of evaluation, it is possible to correlate the marks in the certificate and the entrance diagnostics. The use of materials from laboratory work allows us to determine the basic level of the subjects. To identify the possibilities of using a virtual workshop, it seems appropriate to consider the performance of students at various stages of its implementation (Table 1). To determine the level of mastery of virtual laboratories in the subject of astronomy by schoolchildren, a diagnostic survey was conducted, as a result of which it was revealed that among the respondents there were a sufficient number of schoolchildren who had an idea of the possibility of using virtual laboratories in their activities. In addition, at the beginning and end of the year, a survey of students was conducted to identify their attitude towards performing research work using virtual equipment, determining the motivation of children in physics classes, the level of development of key competencies and educational skills.

Table 1. Level of development of key competencies and educational skills in the subject of astronomy among schoolchildren

Skills and abilities	Indicators	At the beginning	At the end of the
Intelligent	Ability to highlight the main thing in the information provided	60%	73%
	The ability to think critically about a particular aspect	61%	71%
	The ability to set a goal, plan a result, work out an algorithm for solving a problem, and analyze the result	54%	73%
	Ability to find and propose a new solution	53%	75%
	Ability to understand the operating principles of virtual laboratories	54%	72%
Communication	Ability to collaborate in pairs group	78%	95%
	answer questions correctly	58%	68%
	Ability to independently formulate correct questions	58%	75%
	Ability to get involved in a project (business)	69%	76%
Organizational	Ability to plan your work	55%	69%
	Ability to achieve planned results	56%	71%
	Need help during the work process	64%	56%

The results indicate the success of using digital equipment in astronomy laboratory classes. With the correct use of virtual laboratories in astronomy classes, students will more effectively develop the following components of cognitive needs and the development of cognitive abilities:

- ability to classify;
- ability to observe;
- skills and abilities to conduct experiments;
- ability to draw conclusions and inferences;
- ability to structure material.

This is justified by the fact that working with equipment reduces study time for mastering labor-intensive direct methods of studying the environment, activates mental work, develops attention, children develop an increased interest in the subject, they gain experience working with interesting and modern equipment, computer programs, and experience in interaction between researchers , experience in information retrieval and presentation of research results. The use of virtual equipment contributes to the formation of cognitive needs and the development of cognitive capabilities, and the acquisition by students of the special knowledge necessary to conduct research. Students get the opportunity to engage in research activities that are not limited to the topic of a particular lesson, and analyze the data themselves. When organizing experimental activities using virtual equipment, such thinking skills as: the ability to analyze are better and more effectively formed; classify; compare; highlight criteria and evaluate facts, events, phenomena and processes using different criteria; test assumptions; prove; establish the sequence of facts, events, phenomena; highlight cause-and-effect relationships; make inferences; combine; transform; predict; come up with something new.

The overall results were quite expected; individual indicators revealed certain difficulties of students, including skills in working with various types of programs. In general, the results obtained allow us to build an algorithm for (general, individual) correction and elimination of students' shortcomings. They also confirmed the correctness of choosing a combined approach when using virtual laboratories as a didactic tool along with other information products, since the work based on the use of a virtual model described in this article showed the effectiveness of its use in improving the quality of knowledge of students of secondary vocational education in the activity system virtual laboratories.

This, virtual laboratories are organically integrated into the modern educational process, occupying their unique niche in the wide variety of didactic tools offered within the framework of the educational technologies used. Analysis of the implementation of virtual systems in our experience allows us to draw the following conclusions. The use of virtual laboratory work has made it possible to reduce the time allocated for them, as well as transfer some aspects of it into an independent mode of operation. The use of virtual laboratory work allows not only to strengthen the practical skills of students, but also to transfer part of the fund of assessment tools to virtual situational tasks. This allows not only to assess the student's practical skills, but also to track his readiness to pass the qualifying exam in the professional module.

Conclusion

This paper examines the methodological aspects of teaching astronomy in high school. The main problems of studying astronomy in modern society and some ways to solve them have been identified, through analysis recommended by the federal list of educational and methodological complexes in astronomy and the available modern forms and methods of teaching astronomy in secondary schools. In addition, modern equipment for conducting observations, laboratory and research in the course of studying astronomy is considered. The content of the methodology for studying the section "Fundamentals of Astronomy" is analyzed, which includes an analysis of the features of studying theoretical material, the system of recording knowledge on the topics of the section, laboratory and research work. Experimental research work was carried out to study the effectiveness of the developed methodology: a survey sheet was compiled to identify the educational needs of students and their initial level of knowledge of the elements of the section "Fundamentals of Astronomy"; based on the survey results, adjustments were made to the created methodology, which was later introduced into the educational process . During the control stage of the experimental search work, the research hypothesis of this work was confirmed.

List Of Sources And References

1. Stellarium . Stellarium Astronomy Software. URL: https://stellarium.org/ru
2. Zeilik Michael. Conceptual Astronomy . USA , John Willey @ Son . Inc. , 1993.

3. Astronomy. Methodological manual: grades 10-11. Basic level: textbook. manual for teachers of general education. organizations. edited by V. M. Charugina. - M.: Education, 2017.
4. Bartunov O.S., Samodurov V.A. Astronomy and the Internet: a history of relationships. Earth and Universe. 2010. No. 1. P. 49-59.
5. Baryshnikova A.N. Using ICT in high school astronomy lessons. Issues in the methodology of social sciences and humanities: modern context. - Belgorod: Agency for Advanced Scientific Research, 2018. - pp. 65-67.
6. Vinnik M.A. On the question of the role of astronomy education in the learning and development of students. Bulletin of Moscow State Regional University. Ser. Pedagogy. 2010. No. 2. P. 169-173.
7. Vorontsov-Velyaminov B.A., Strout E.K. Astronomy: B.A. Vorontsov-Velyaminov - M.: “Bustard”, 2017.-240 pp.: ill.
8. Vorontsov-Velyaminov, B.A. Astronomy: B.A. Vorontsov-Velyaminov - M.: “Enlightenment”, 1983. - 143 pp.: ill.
9. Black, P. and Wiliam, D. (1998), “Assessment and classroom learning,” Assessment in Education , 5 (1), 7-74.