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# SELECTION AND USE OF INTERACTIVE SOFTWARE APPLICATIONS TO ENHANCE STUDENTS' SCIENTIFIC RESEARCH SKILLS IN PRACTICAL OPTICS CLASSES IN HIGHER EDUCATION INSTITUTIONS

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## Abstract

This study examines the selection and use of interactive software applications to enhance the scientific research skills of Physics students in practical Optics classes at higher education institutions. Scientific research in the field of optics is aimed at developing new technologies, expanding existing knowledge, and improving current systems. Scientific inquiry plays an essential role both in scientific and technological progress and in the educational process. The paper explains that the integration of selected optics-related materials into the higher education curriculum through interactive pedagogical technologies should be based on specific pedagogical principles and regularities.

## Keyword

scientific research, scientific and technological progress, interactive technologies, educational research, distance learning components, organizational and methodological support, modern information and communication technologies, pedagogical conditions.

In the Decree of the President of the Republic of Uzbekistan, Shavkat Mirziyoyev, "On Measures to Further Improve the Information Technology and Communications Sector," the idea of actively introducing information technologies and computers into social life, daily activities, and the education system is emphasized. Furthermore, the Resolution of March 19, 2021, "On Measures to Improve the Quality of Education in the Field of Physics and Develop Scientific Research," established several important tasks for the field of physics.

Today, significant attention is being given to improving the quality of physics education in educational institutions, introducing modern teaching methods into the educational process, identifying gifted students, preparing competitive specialists for the labor market, developing scientific research and innovation, and ensuring practical effectiveness. At the same time, several unresolved issues in the field highlight the necessity of implementing measures aimed at enhancing the quality of physics education and the effectiveness of scientific research [1].

Currently, the method of modeling plays a significant role in all areas of human activity in understanding natural phenomena and applying them in practice. In physics, modeling is one of the main research methods. A computer model makes it possible to reproduce the behavior of a model with the degree of idealization and abstraction inherent in physical theory. Therefore, it is most effective to acquire skills in studying physical theoretical models through specially developed computer models.

An analysis of the problem shows that significant experience has been accumulated in domestic and foreign philosophical, pedagogical, and methodological literature regarding the use of models and modeling methods in various scientific fields. The data obtained in this way contribute to the formation of the idea of modeling as a more effective method compared to other research and cognition methods. Let us consider in more detail the use of various models and computer modeling methods in the process of physics education. For this purpose, it is necessary to analyze the concept of a "model," classify different types of models, and determine the role and place of computer modeling [2].

The organizational and methodological support for teaching the Optics section to Physics students through the interactive capabilities of distance learning components of digital technologies—such as assessment, graphical visualization, and transmission tools—has been developed based on prioritizing digital technologies (MX Media Flash; Java) that enable the visualization and modeling of physical processes. In this context, the content refers to the "Optics" working curriculum.

The software tools used in the educational process can be classified from a didactic perspective as follows (Figure 1).

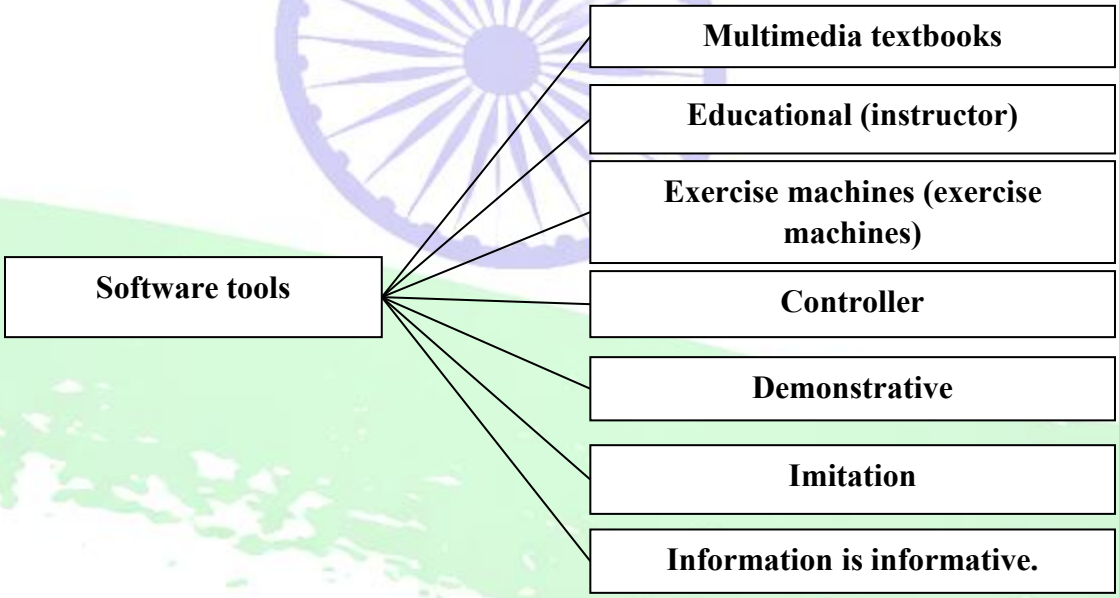


**Figure 1. Didactically classified software tools**

In general, software tools can be divided into four types of classifications (training, educational, modeling, games)[3].

Type 1: programs (training) - designed to strengthen skills and qualifications. In this case, the theoretical material is considered to have been learned. These programs recommend questions and

tasks to students in a probabilistic sequence, and count the number of correctly and incorrectly solved tasks.

Type 2: programs (teaching) - provide students with learning materials. The questions and tasks in these programs serve to organize human-machine communication and manage the educational process. If the tasks are performed incorrectly by the student, then they can be repeated in the program.

Type 3: programs (modeling) - based on the computer's ability to, firstly, calculate, and secondly, to conduct computer experiments. Such programs allow students to observe phenomena and processes by acting on commands that change the computer screen.

Type 4: programs (games) - provide the student with a world that exists only on the computer, a set of possibilities and an environment for creating ideas in their implementation. Such programs lead to the formation of educational and cognitive activity in students and the formation of ideas about a real object[4].

If we look at today's scientific development, technological progress and the globalization of information, we see that the role of "physics", in particular "optics", is growing incomparably. From the point of view of optical instruments alone, hundreds of modern optical instruments have entered the ranks of simple devices such as microscopes and cameras. Previously, only optical instruments based on the laws of geometric optics were known, and if we analyze the magnifying glasses that were traditionally used in teaching, now, in the era of digital technologies, many very important and practically important instruments based on the application of the laws of wave optics and physical optics have appeared. Such instruments have boldly entered everyday life. These include optical disks, digital compasses, laser technological devices, sighting tubes, distance measuring devices, telescopes, thermal imagers, digital televisions, optical weapons, snipers, 3D cameras and projectors, holographic devices, interference microscopes, diffraction analysis devices, interferometers, polarimeters and many other spectral instruments [5].

Based on the above, it is appropriate to study the classifications of educational, methodological and electronic didactic tools created to improve the educational methodological support of the discipline of optics, to clarify the didactic requirements for the development of educational electronic tools, to substantiate the compliance of the developed developments with these requirements, and to determine the content of the use of digital educational technologies in teaching the optics department.

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