# Methodik der Modellierung und Laborarbeit der Computertechnologien Abteilung "Optik" in der Hochschulbildung

Kodirova Khamida Nurmuhamadovna
Freiberuflicher Forscher Staatliche Universität Andischan,
Usbekistan
E-mail: hamida1983@yandex.com

**Zusammenfassung:** Der Artikel beschreibt die Methoden der computergestützten Laborarbeit im Laborunterricht im Bereich Optik im Hochschulbereich. Der Abschnitt "Optik" beschreibt die Notwendigkeit der Integration natürlicher und virtueller Formen der Umwelt bei der Erstellung und Anwendung von didaktischen Materialien für den Laborunterricht, den Einsatz von Informationstechnologie im experimentellen Prozess, Modellierung, Beobachtung und Vergleich mit dem berichteten Experiment . Dieser virtuelle Laborkomplex wurde als Werkzeug geschaffen, um Studierende auf die Laborarbeit und die Fähigkeit zur Durchführung von Experimenten, Fertigkeiten und die Fähigkeit, theoretisches Wissen in der Praxis anzuwenden, vorzubereiten.

**Schlüsselwörter:** Hochschulbildung, Optik, virtuell, komplex, Labor, Computer, Modellierung, Multimedia, Simulator.

# Methodology of modeling and laboratory work of computer technologies division of "optics" in higher education

**Kodirova Khamida Nurmuhamadovna***

*Freelance Researcher at Andizhan State University Uzbekistan

Email id: hamida1983@yandex.com

**Abstract:** The article describes the methods of computer-aided laboratory work in laboratory classes in the field of optics in higher education. The section "Optics" describes the need for the integration of natural and virtual forms of the environment in the creation and application of didactic materials for laboratory classes, the use of information technology in the experimental process, modeling, observation and comparison with the experiment reported. This virtual laboratory complex was created as a tool to prepare students for laboratory work and the ability to perform experiments, skills and the ability to apply theoretical knowledge in practice.

**Keywords:** higher education, optics, virtual, complex, laboratory, computer, modeling, multimedia, simulator.

Resolution of the President of the Republic of Uzbekistan Sh.M.Mirziyoev dated April 20, 2017 No PQ-2909 "On measures to further develop the system of higher education" is a logical continuation of the positive work in the field of science and education. Enrichment of the subjects taught in education with scientific literature and software is the main task of scientific research in the field of pedagogy today [1].

Today, to improve the quality of teaching physics in higher education, to introduce modern teaching methods in the educational process, to bring the quality of laboratory classes in the department of "Optics" to a level that meets modern requirements. and is a major achievement in the field of technology.

Nowadays, it is important to organize new types of educational processes and virtual laboratory work in higher education with the use of information and communication technologies. This shows that the practical part of physical knowledge is based on its theoretical, that is, the fundamental part, and that fundamental knowledge is applied in various fields of production.

Resolution of the President of the Republic of Uzbekistan Sh.M.Mirziyoev dated June 30, 2017 No PP-5099 "On measures to radically improve the conditions for the development of information technology in the country" The idea of bringing in is pushed with [2].

Today, great attention is paid to improving the quality of teaching physics in educational institutions, the introduction of modern teaching methods in the educational process, the selection of talented students, training competitive professionals in the labor market, development of research and innovation and practical results. At the same time, a number of unresolved issues in the field indicate the need to take measures to improve the quality of education and research efficiency in physics [3]. One of them is the implementation of the "virtual laboratory" project in the educational process.

The concept of Virtual (Latin Virtualis - possible, i.e., occurring or can occur under certain conditions) refers to the process by which things and events do not exist in time and space, but are likely to occur as objective objects or subjective images.

The term “Virtual existence” was coined in the late 1970s by Jaron Lanier at the Massachusetts Institute of Technology. In 1984, he founded the world’s first virtual being firm. The term refers to the idea of human existence in a computer-generated environment. The term "virtual being" was coined by American cinematographers. They have released a film of the same name about the possibility of artificially realizing imaginary possibilities that cannot be realized naturally for a specific reason in a graphic form.

Virtual existence is something that does not exist in practice, it is impossible to touch it with your hands, to feel its taste and smell. Nevertheless, it exists and man enters this imaginary world and not only observes and experiences it, but also has the ability to influence it, to act independently in this world, to change it [4].

Today, virtual existence is used in various areas of human cultural activity. Virtual existence is used primarily in the field in which it originated, in science, including physics, in the modeling of light phenomena, atomic and quantum states, fluid and gas dynamics, modeling of chemical reactions in chemistry, geology, geography and other sciences.

Virtual method is a method based on the confirmation of scientific results by modeling laboratory experiments using information technology during the training, which should be based on the sequence of laboratory experiments and scientific theories. The creator of virtual lab work is required to be a mature programmer as well as a knowledgeable physicist. Today, this method is used to illuminate all branches of physics, and the necessary virtual developments are being created and improved [5,18-p].

The experimental method is the basis of laboratory classes in physics, mainly based on the confirmation of scientific theoretical concepts and rules obtained in lectures by experimental methods in laboratory classes. It should include the order of the experiment, the sequence of performance, theoretical information on the results and reasonable conclusions.

Information technology used in education is a pedagogical software tool and is part of the didactic tools designed to partially or completely automate the learning process using computer technology. They are one of the promising forms of increasing the efficiency of the educational process and are used as a teaching tool for modern technologies. The structure of information technology in education includes: software products (software packages) aimed at achieving specific didactic goals in the subject, technical and methodological support, additional aids.

According to the United States National Training Center, pedagogical and information technologies affect students ’minds, memory, and imagination and enhance their thinking. Linking the learning process with practice (laboratory) in order to master, memorize and expand the imagination on the forms of teaching showed a 75% result. This indicator shows the need for the theory to apply methods related to practice.

The organization of laboratory classes examines, thinks and compares the essence of students' scientific worldview, the scientific interrelationships of the most important interrelationships of things and events. The experiment is carried out in the manifestation of the means, features and connections that make up these events.

The methodological system of organizing the educational process should be aimed at developing students' scientific knowledge, the logical stage of memory activity. At the logical stage of memory activity, students need to practice, understand and memorize the material in a semantic way.

The desire to gradually develop students' memory, scientific imagination and cognitive activity is one of the first steps towards increasing the effectiveness of education. One of the means of activating the learning activities of students with different levels of memory is the process of organizing lessons using software tools, virtual developments, experimental laboratory equipment.

Learning experience is the demonstration of the essence of events and laws on the basis of experiments during the lesson with the help of special tools. Therefore, the learning experience from physics is simultaneous

-source of knowledge

-teaching style

-is a type of exhibition.

Ensures that students master concepts, laws and theories very well [6,p. 256].

Therefore, the purpose of laboratory classes is to strengthen and enrich the knowledge of students in the lectures, the use of laboratory work, the formation of thinking skills as a researcher.

Taking into account the above considerations, the laboratory work of the "Optics" department was studied in the laboratory with the help of physical instruments and technologies, and appropriate conclusions were reached.

This part of the research is devoted to the collection of virtual laboratory developments on "Optics", the development of improved developments on the basis of methodological recommendations, guidelines, software and the creation of a virtual laboratory complex of laboratory training on the basis of collected data.

Pedagogical software based on the use of information technology was used in the organization of laboratory classes in the department of "Optics". The research aims to create an electronic complex of laboratory classes in the department of "Optics", the use of information technology in teaching, the introduction of virtual laboratory classes, interactive software, visual models, multimedia electronic resources, dynamic illustrated modeling.

The fact that the topics allocated for laboratory classes form the fundamental basis of "Optics" shows the need for effective organization of these classes. It is expedient to improve the integrative functions of the educational process, to create an educational environment through modeled virtual experiments. Within the framework of the research, a set of virtual laboratory works was developed in order to organize education, taking into account the principles of effective use of tools to increase the

effectiveness of laboratory training, the development of creativity in students.This electronic manual is intended for laboratory classes taught to students of 5140200 - "Physics". Laboratory classes in the department of "Optics" of this type of higher education are taught in the fourth semester of the bachelor's degree, a total of 334 hours are allocated for classroom classes, of which 68 hours are set for laboratory classes.

Many higher education institutions have special classrooms for laboratory classes, new types of equipment for laboratory experiments have been introduced and updated, special computer classes have been equipped to monitor virtual developments, obtain results based on them, and prepare students for experiments. In laboratory classes, the group is divided into two subgroups, and for each subgroup there is a separate teacher, which increases the possibility of individual work with students in the classroom, assessment. The use of virtual laboratories in the teaching of "Optics" in physics in higher education institutions is expedient, and the author has prepared several virtual laboratories for the department.

Through special tests, animations, e-learning complexes, video lessons, e-textbooks, etc., the student can learn, complete and practice independently. The aim of this research was to improve the laboratory work in the field of "Optics" on the basis of designing experimental laboratory work using simulators Crocodile Physics 91, Crocodile Technology 91, Phen physics 90, Interactive Physics 95. The organization of trainings has been improved based on the inclusion of the following features in the virtual laboratory developments created with the help of this simulator:

- based on the introduction of guidelines, training programs are designed to focus on the acquisition of new knowledge, based on the level of knowledge and interests of students;

- test programs - used to check or assess the acquired knowledge, skills and abilities, with the introduction of thematic tests according to the level of knowledge of students;

- to increase students' scientific worldview and direct them to experiment on the basis of programs that create a virtual learning environment with the participation of teachers.

In order to use virtual developments in the coverage of each experiment, the virtual laboratory developments of Optics were combined into a single virtual complex. This complex was created as a means of preparing for laboratory work and conducting experiments to develop skills, competencies and the ability to apply theoretical knowledge in practice.

According to the curriculum, "Study of the law of refraction and refraction of light", "Determining the refractive index of glass", "Imaging in the lens",

"Determining the focal length of the lens", "Determining the radius of curvature of the lens using Newton rings", "Determining the wavelength of light using a diffraction grating" ”,“ Study of light dispersion and recombination ”,“ Study of light polarization using quarter-wave and half-wave plates ”methodological guidelines for virtual processing of laboratory work were developed and implemented for example (Fig. 1) [7, 584-587-p].

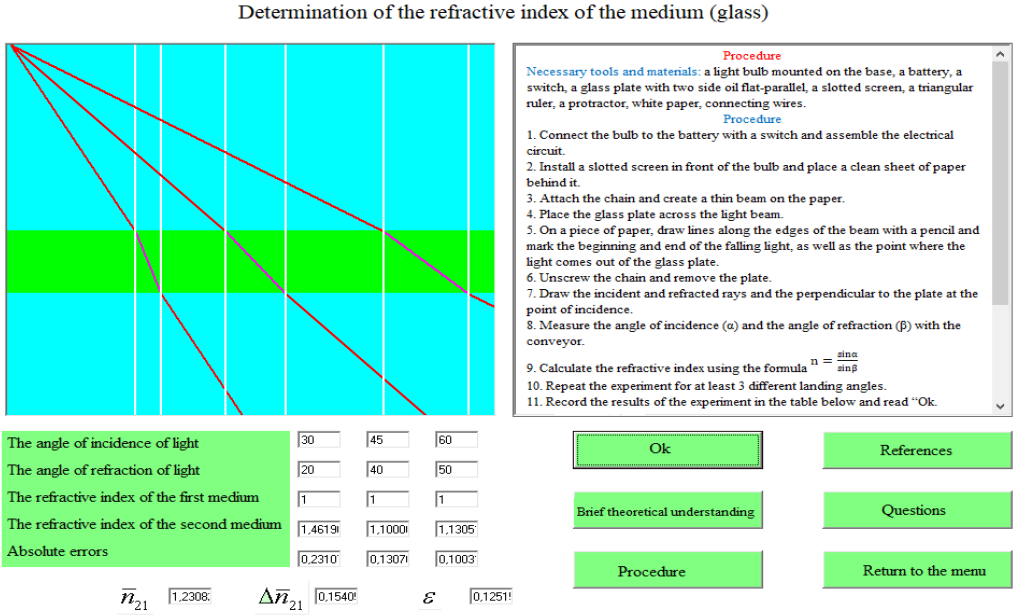


Figure-1. Determination of the refractive index of the medium (glass).

The virtual complex of laboratory classes is aimed at combining the capabilities of educational tools into a single system, creating opportunities for cost-effective, safe, free management of education in the classroom, as well as a comprehensive approach to the process. In developing the capabilities of the research system, attention was paid to:

The order of laboratory work;

- a brief theoretical understanding of laboratory work;
- input, processing of laboratory results and monitoring of the multimedia process;
- conclusion at the end of laboratory work;
- answer questions to reinforce the topic;
- automatic assessment of knowledge acquired in the educational process by solving test questions.

There is a need to use didactic materials in the field of "Optics" to create and apply in practice the interaction of natural and virtual forms of the environment, modeling of observable events in the experimental process, indirectly in virtual processes, observation, as well as the use of information technology. The creation of multimedia applications of technical experiments based on laboratory experiments,

devices, process is widely used in the educational process in countries around the world today.

The introduction of such applications in the educational process allows students to prepare for the experiment, work with tools, strengthen security measures. In this process, the features of simulator-programs are one of the prerequisites for high-performance, high-performance, cost-effective, functional, reliable, safe use of training. The student gets acquainted with the order of work, has a brief theoretical understanding, observes, understands, constructs the experiment on the basis of a multimedia application, and then directs it to the experiment. In terms of input, processing, summarization, access to a table of values obtained from Optics in virtual and experimental laboratory classes, and on this basis to generate graphic images in electronic form, the existing software products are one of the necessary tools for practical training. The effectiveness of such developments in laboratory education is high, the excess time is reduced, the efficiency of achieving accurate values is increased.

The following methodological requirements were met during the development of the complex:

- clear educational, pedagogical and developmental goals of each laboratory work have been developed. Tasks of laboratory work are defined on the basis of the studied legislation and the system of tasks, stages, instructions and teaching aids;

- in the process of observing virtual and experimental experience, there are opportunities to compare the results, to collect the experimental scheme, to work individually in the classroom;

- the role of experience in the development of students' scientific imagination, the compatibility of theory and practice, the comprehensibility of the presentation of experience in software, the interdependence of figurative and moving components;

- gradual mastering of educational material for students, the database of tests for assessing the level of knowledge is distributed by topic, and criteria for assessing cognitive activity are developed.

When launching a laboratory work program through the complex, it is possible to create theoretical data on the topic, virtual development, virtual work instructions, a table for entering the results obtained in the work, a graphical view of the results obtained. In addition, homework assignments for laboratory classes allow the student to work independently, comparing the results obtained with the measurement of physical quantities in each laboratory work with theoretical data.

Based on the study of available methodological resources and work experience, guidelines for virtual developments were developed, and methodological

recommendations for the use of tools aimed at developing students' scientific imagination and creativity were given.

Such exercises compare the results obtained by the student in virtual developments with the results obtained in the experiment, as a result of generalization of the conclusion strengthens the theoretical knowledge of the laboratory topic.

The possibility of obtaining results of this laboratory training on the basis of experimental equipment is available in higher education institutions, and virtual development is considered as a means of directing the laboratory experiment.

The process of conducting, conducting, calculating, submitting results and accepting completed work on laboratory work on these topics has been simplified.

The complex of laboratory classes creates the following opportunities in the organization of the educational process:

1. The content of laboratory work is given. The student enters the development by defining the necessary experiment. At the top of the screen is the work theme you selected.

2. The guide introduces the topic of the selected work, purpose, brief theoretical information, the procedure, the guidelines for virtual development, control questions and a list of recommended literature.

3. The virtual development of the laboratory is given, on the basis of which the tabular part of the work is completed in the order and on request as specified in the instructions. The same table allows you to calculate the relative and absolute error generated in the laboratory work.

4. It is possible to deliver the completed table in PDF format to the teacher via the Internet, and the virtual laboratory set can also be used for distance learning.

5. The results obtained on the basis of the table are generated using graphs in the program itself, and this allows you to check which part of the result has an error.

6. It will be possible to print the results on paper using the seal command.

7. The database of tests assessing the level of knowledge of students is distributed by topic, and after the completion of the test there is an opportunity to see the scores and incorrect answers.

8. Use the "Exit" command to terminate the program [8].

The product of the EXM program "Teaching Optics" through the modeling of virtual experiments has the potential to be highly effective in the daytime, evening, correspondence and distance stages of the educational process. Based on this set of virtual laboratory developments, students can carry out the process of conducting, submitting and reporting on laboratory classes in optics, using the achievements of modern technology in the educational process.

The set of virtual laboratory developments provides the following features:

- gives a separate schedule for each task;
- provides a graphical representation of the relationship between the quantities based on table values
- at the stage of work, the student sees himself as a researcher and the indicators obtained as a result of the study entering tables. In addition, when the data obtained during the observation of virtual and experimental experiments are entered into the system, the data is displayed graphically, allowing to compare the results, assemble the experimental scheme and work individually in the classroom.
- electronic assessment of theoretical and practical knowledge acquired at the final stage of the training is carried out on the basis of test assignments.

This virtual laboratory complex involves the development of students' experimental knowledge, creative approach to laboratory work, its schematic design, heuristic approach to the process of applying theoretical knowledge in practice, independent experimentation, and the ability to work on experimental results. Focused on improving.

## References

1. Resolution of the President of the Republic of Uzbekistan. - T .: March 05. 2020. №RD-2909. "On measures to further develop the system of higher education.
2. Decree of the President of the Republic of Uzbekistan.- T .: February 19.2018. №RD-5349 "On measures to further improve the field of information technology communications."
3. Resolution of the President of the Republic of Uzbekistan. - T .: March 19. 2020. №PQ-5032 "On measures to improve the quality of education and research in the field of physics."
4. Fayzieva. M., Sayfurov. D Educational-methodical complex on the module "Virtual education technology", Tashkent-2016, pp. 41-43.
5. Mirzaakhmedov.M., Gafurov.N., Ibragimov.B., Sagatova.G “Methods of teaching physics” .- T .: Teacher, 2002.
6. Zhalolova.P.M. Problem statement virtual laboratory work // Materials of the Republican scientific-practical conference. Namangan, 2018.-256-b.
7. Kodirova Khamida Nurmuhamadovna, (2021). Methodology Of Using A Virtual Laboratory To Determine The Breaking Indication Of The Environment

(Glass). The American Journal of Social Science and Education Innovations (ISSN – 2689-100x) Published: April 30, 2021 | Pages: 584-587 Doi : https://doi.org/10.37547/tajssei/Volume03Issue04-95 .

8. Virtual models of physical experiments (DGU №11154) e-learning tool "Teaching the department of optics through modeling of virtual experiments."