

DOI: <https://doi.org/10.5281/zenodo.11098092>

UDK 53:372.853

THE THEORETICAL BASIS OF LABORATORY EXERCISES IN LEARNING PHYSICS

Karshiboev Shavkat

Alieva Makhsuda

Rakhmonov Umed

Jumaboyeva Sarvinoz

Uzbekistan-Finland Pedagogical Institute. Samarkand city,

Spitamen shokh street No 166.

shavkat.qarshiboyev.89@bk.ru

ABSTRACT

This article examines the foundations and methods of physics laboratory training at higher education institutions. Laboratory training is an integral part of the educational process, as it provides students with their first practical exposure to scientific activities. The study investigates how modern laboratory work and experiments impact the development of students' scientific competencies and their worldviews. It also provides a detailed analysis of the classification, advantages, goals, and tasks of laboratory training. Through laboratory work, students gain an understanding of the importance of experiments in life.

Keywords: *laboratory, experiment, method, quality of education, frontal laboratory, competence, physical practicum.*

АННОТАЦИЯ

В данной статье рассматриваются основы и методы лабораторной подготовки по физике в высших учебных заведениях. Лабораторная подготовка является неотъемлемой частью учебного процесса, поскольку дает студентам первое практическое знакомство с научной деятельностью. Исследование исследует, как современные лабораторные работы и эксперименты влияют на развитие научных компетенций студентов и их мировоззрения. Также дан подробный анализ классификации, преимуществ, целей и задач лабораторного обучения. Благодаря лабораторным работам студенты получают понимание важности экспериментов в жизни.

Ключевые слова: *лаборатория, эксперимент, метод, качество образования, фронтальная лаборатория, компетентность, физический практикум.*

ANNOTATSIYA

Ushbu maqolada biz oliy o'quv yurtlarida hozirgi kunda fizika fanidan laborotoriya mashg'ulotlarining nazariy asoslari va metodologiyasi tahlil qilingan. Laboratoriya mashg'uloti o'quv jarayonining asosiy elementlaridan biridir, tajribalarni bajarish davomida talabalar birinchi marta ilmiy sohadagi amaliy faoliyat bilan tanishishadilar. Zamonaviy laborotoriya ishlarining ilmiy elementlari va eksperimentlarning talabalarda ilmiy kompetensiyalarini shakllantirish hamda dunyo qarashini rivojlantirishga bo'lgan ta'siri tadqiq etilgan. Shuningdek, laborotoriya mashg'ulotlarining tasnifi, afzalliklari va maqsadi, vazifalari chuqur tahlil qilingan. Laboratoriya ishlarini bajarish orqali talabalarda hayotda tajribalarning roli haqida tasavvur shakllanadi.

***Kalit sa'zlar:** laborotoriya, tajriba, metod, ta'lim sifati, frontal laborotoriya, kompetensiya, fizik hodisa, fizik praktikum.*

INTRODUCTION: Teaching physics in higher educational institutions requires, first of all, acquainting students with the achievements of modern physics, to show the place and role of this science in scientific and technical development, and to form a natural scientific outlook in future specialists. Physics is a science that studies natural phenomena.

Many laws of physics were discovered due to observation of natural phenomena or specially designed experiments. Experiments confirm or disprove physical theories. Also, the faster a person learns to conduct physical experiments, the faster he becomes an experienced physical researcher [1.57]. Even though students are shown physical experiments during physics lessons in higher educational institutions, it is impossible to imagine teaching physics only in a theoretical form. It is necessary to implement such work into the educational process, in which the students themselves perform work that includes assembling the device, measuring physical quantities, and performing experiments. Laboratory classes instill in students a natural interest in knowledge related to understanding the world around them through their own experiences and feelings. During the performance of laboratory work, students develop an idea about the role of experiments in life [2.3].

When performing experiments, students develop experimental skills, including intellectual and practical skills. Intellectual abilities include the following skills:

1. Assembling the experimental device. 2. Follow up. 3. Experience 4. Measurement

During experiments as part of laboratory work, students learn to work with laboratory devices and instruments, understand the laws of physical phenomena, and get acquainted with research methods. Laboratory work is one of the main elements of the educational process, during experiments, students get acquainted with practical

activities in the scientific field for the first time. Laboratory classes, as well as other practical training sessions, are students' well-grounded theoretical work in lectures and seminars and the practical application of the knowledge gained.

These trainings connect elements of theoretical research and practical work. When students conduct laboratory work, they better accept the educational material on any subject, because many formulas and definitions that seem incomprehensible at first glance have a certain meaning, theory and the relationship between practice is shown [3.4.5].

Advantages and functions of laboratory exercises

Laboratory classes are a form of individual employment of students in generalization classes, in such classes they deepen and strengthen theoretical knowledge by conducting experiments. the following goals can be achieved when conducting a laboratory seminar:

1. Determine the purpose of the experiment, 2. Proposing hypotheses, 3. Selection of tools, 4. Planning experiments, 5. Calculation of errors, 6. Analysis of results, 7. Preparation of a report on completed works

- Practical application of new knowledge acquired in classes through discovery in laboratory conditions helps to deepen the rules of theoretical material;

- Students acquire the skills of conducting experiments, and learn to correctly analyze the received data;

- To obtain basic knowledge for the implementation and modeling of work related to scientific research activities;

It is very important to choose the right laboratory work when creating a program. Therefore, when creating a program for a physics course in pedagogic universities, it is necessary to rely on the part of the laboratory training that is better implemented using visual methods. For such lessons, the teacher correctly chooses the material on which the educational experiment can be conducted, and the only purpose of the experiments here can be the study of phenomena. In addition, in training students, we must not forget to reveal modern scientific research methods on the subject and find their application. When choosing questions for educational programs that are planned to be implemented with the help of practical work, it is necessary to clearly understand what role is assigned to them within the studied topic, and whether it is possible to learn knowledge without using it in experiments [4,47].

When the teacher plans to conduct any laboratory work, he takes into account not only his academic tasks but also the educational goals of other teachers, as well as the activities of students in general. The main thing in the competent implementation of experimental training is mutual understanding between teachers and accurate

coordination of educational programs for conducting useful laboratory exercises. Based on this, for students to be able to understand laboratory training as a single whole system that reflects this science, practical laboratory training should be inextricably linked with the courses of various academic subjects. It should be taken into account that teachers are not always able to use it in reality. From this, we conclude that the main requirement of the laboratory lesson is the correct selection of the content of the educational material and the methods of organizing the lessons so that the cognitive activity of students can develop in solving scientific and practical problems.

The result of the laboratory activity depends not only on the methodical, theoretical, and practical training of the teacher but also on many combinations, such as his organizational work in the process of preparing for the practicum. The condition of the laboratory base itself and its methodological support, the level of students' preparation, and positive activity in the lesson play an important role in the success of practical work.

LITERATURE ANALYSIS AND METHODOLOGY: A.V. Lunacharsky showed the special importance of educational methods in his work. He wrote: "Whether the child is bored, whether teaching slides over the surface of the child's brain almost without a trace, or, on the contrary, that teaching is part of the child's play, the child Whether it is accepted with joy as a part of his life, whether it merges with the child's psyche and becomes his flesh and blood depends on the teaching method [2]. Laboratory work is a teaching method in which students can understand physical phenomena. If we consider laboratory work in the framework of didactics, then it can be both a method and a form of teaching physics. If we consider laboratory work as a method of teaching, then we can say that it is a method of strengthening the theoretical material on the subject, in which students perform tasks according to a strictly defined plan and under the guidance of the teacher. In this case, laboratory work includes research. Babansky Yu.K. considers laboratory work as a teaching method, in which the main task is to create control and self-control in the learning process [2.3]. In this, he considers organizational-cognitive, motivational, motivational, and regulatory activities as additional and no less important functions. Laboratory work was considered by V.A. Slastenin as a method of controlling the effectiveness of the pedagogical process. If we consider laboratory work as a form of education, then we can say that it is aimed at acquiring practical skills and qualifications with the help of equipment. Acquisition of new knowledge and their strengthening, formation of practical skills and qualifications were the goals set by T.I. Shamanova in performing laboratory work. The task of laboratory work can be classified as follows.

The task of laboratory work: Application of knowledge in practice, Formation of necessary practical knowledge and skills in life and work, Assist in guiding students to the profession. Polishing personal qualities, Development of students' interest in physics and their cognitive activity The following functions of laboratory work are distinguished:

1) teaching function - is manifested in accelerating the process of mastering the material; 2) the development function is aimed at developing imagination, memory, attention, creative and spatial thinking; 3) the educational function affects various character traits; 4) the motivational-encouraging function creates conditions for engaging students in cognitive activities; 5) the reflection function helps the student to be aware of himself in his work compared to others, to control and analyze his actions, to find and correct mistakes, to evaluate the results of his actions, and to develop the ability to make corrections to them; 6) the diagnostic function allows the teacher to determine the specific characteristics of the student's personality and the level of mastery of his knowledge and skills.

These skills can be acquired as a result of independent work focused on one goal. A characteristic feature of laboratory training is the partial independence of the students, which gradually becomes almost independent not only in assembling the device and taking measurements but also in preparing for measurements, in the process of performing the work, processing the results, and compiling a report. should become full, active conscious work.

Classification by organizational characteristics is the most common and most common. The latest classification allows us to consider the experience from the point of view of teaching methodology, to correctly determine the place of each of its types in the system of physics lessons, and to choose the educational equipment wisely.

Frontal laboratory work - in the process of conducting it, students independently measure physical quantities, as well as observe and reproduce physical phenomena using the necessary laboratory equipment. Students are taught practical skills and abilities, the importance of which is their gradual acquisition. The simplest skills and competencies are formed when performing frontal laboratory work, as simple equipment is used. In this regard, frontal laboratory work partially solves the problem of developing students' skills in working with modern laboratory equipment. Frontal laboratory work is carried out during the study of the relevant material. Depending on what characteristics are used in the classification of frontal laboratory work, the following can be distinguished: quality and quantity work; short-term and whole-class work; and so-called creative works. However, from the point of view of the theory of

teaching physics, the most profound and effective classification is according to the didactic goals of the work. On this basis, the following professions are distinguished:

1. Observation and study of physical phenomena; 2. Familiarity with measuring instruments and measurement of physical quantities; 3. Getting to know the structure and principle of operation of physical devices and technical devices; 4. Determination or verification of quantitative laws; 5. Determination of physical constants, characteristics of substances, and processes.

As mentioned above, tasks for practical laboratory work differ significantly in complexity from frontal work. In this regard, the time to perform them increases to two training sessions, but there are also cases of performing this type of work in one lesson. To perform practical work, more sophisticated and modern equipment is required because its tasks cover the entire studied area. covers lim or course.

The last type of laboratory work considered during the research is the home experiment. It is laboratory work done by students at home. Students begin to perform tasks using household items and self-made devices according to the teacher's instructions.

ANALYSIS AND RESULTS: The purpose of laboratory work is, first of all, to teach, educate, and develop personal competencies that allow students to independently search for information, methods, and methods of completing assigned tasks, evaluate their quality, and apply the acquired knowledge in practical activities.

When planning laboratory work, it should be taken into account that, along with the main didactic goal, students will develop practical skills and competencies in working with laboratory equipment, as well as research skills. Laboratory sessions must be conducted under the supervision of the teacher and in compliance with all safety rules. Before doing the work, the teacher gives detailed safety instructions, each student signs a special journal. The teacher is responsible for ensuring that students follow the rules[5.6].

While preparing for the lesson, the teacher should organize the laboratory work in an ideal way and take all measures to form students' practical skills in working with laboratory equipment. Students will be provided with all the necessary materials in the previous lesson to conduct the laboratory lesson. The materials must be presented in writing and include the following: the name of the work, the purpose, tools and materials, visual aids, the work assignment and procedure, control questions, rules for working with laboratory equipment, and technical and fire security measures. Before starting laboratory work, students must obtain permission to work after checking the sequence of work and mastering the control questions and safety measures specified in the assignment. Laboratory work must be done individually. There are 2-3 students at

the table, and each of them independently performs the work and reports. For each completed work, the student receives a grade after submitting a report and testing his knowledge.

During laboratory work, students develop the skills to explain the nature of the observed processes and events, process and analyze the results obtained during the study, and form conclusions necessary for further work and training. They develop a creative approach to research work and learn to choose the right equipment and experimental methods [5.6].

The teacher chooses the method of performing laboratory work based on the best option for him. The following factors influence the choice of the work execution method: the suitability of the chosen method to the purpose of the lesson, the level of preparation of the students to learn the studied material at this stage, and the content of the experiment. When choosing a method of work, the teacher follows the requirements of the program, i.e. Student preparation requirements must be met based on the development of each student.

The reproductive method is a method of performing laboratory work, in which students should develop skills in performing work. This method does not ensure students' independence in doing the work, because already known facts are repeated with the direct help of the teacher. When using this method, work begins with repeating the possible methods of measuring the materials used and the physical quantities used. Then the progress of the work is discussed and the students begin to assemble the device. The next step is to carry out the necessary measurements process the results and draw appropriate conclusions [2.7.10].

This method is aimed at repeating existing experiments with the help of a specific algorithm, which makes students lose their independence, but at the same time strengthens their skills and competencies in working with laboratory equipment. The partial search method involves the teacher guiding the practical actions of the students, giving them consistent instructions, and then, with the help of questions, directing them to analyze the results obtained during the study, which were previously unknown to them. helps to form conclusions about existing laws.

This method helps students acquire knowledge independently during laboratory work. It is appropriate to use this method if the students have already mastered the necessary actions to perform the work and can perform them independently. The partial search method is used in works aimed at observing physical phenomena and establishing relationships between physical quantities [7.11.12].

The research method is a method that implies the complete independence of students. To use this method, the teacher must prepare the task correctly. Students

independently determine the progress of the assignment, and then complete the research steps. The research method of performing laboratory work is applied to the most successful students who participate in projects and research activities. The difference between the methods from the previous ones is that before performing laboratory work, students are invited to independently think of methods of indirect measurement of any quantity and to determine the necessary equipment to carry out the research. All proposals are discussed by the student group and the most optimal option for completing the work is determined. All work is done independently by the students, the teacher only controls the actions of the students [6.7.8.9.10].

CONCLUSION: A literature analysis was conducted on the use of problem-based teaching technology in the organization of students' laboratory work in physics classes at higher educational institutions. The main structural features of laboratory work are determined and developed using problem-based learning technology. Carrying out laboratory work helps students to consciously acquire knowledge skills, develop their thinking ability and interest in physics, cultivate labor skills, and increase their sense of observation and professional competence.

REFERENCES

1. M Djo'rayev Fizika o'qitish metodikasi o'quv qo'llanma. Toshkent 2015 y
2. Белова Е.К. «Лабораторные работы, их роль в учебном процессе и особенности проектирования» [Электронный ресурс]. Режим доступа: <http://zavantag.com/docs/3209/index-86129.html>
3. Использование цифровых лабораторий на уроках физики и химии: Учебно-методическое пособие / Авторы: Кунаш М.А., Телебина О.А. – Мурманск: ГАУДПО МО «Институт развития образования». – 2015. – 66 с.
4. Методические рекомендации по составлению «Методических указаний к лабораторным работам и практическим занятиям» [Электронный ресурс]. URL: <http://xn---10-vedu.xn--p1ai/doc/metod10.pdf>
5. Esirgapovich, Karshiboev Shavkat. "IMPROVING THE METHODOLOGY OF USING SOFTWARE IN ORGANIZING VIRTUAL LABORATORY COURSES IN PHYSICS." *International Journal of Pedagogics* 3.11 (2023): 17-26.
6. Каршибоев Ш. Fizika fanidan laboratoriya mashg'ulotlarini zamonaviy tashkil etish metodikasi //Общество и инновации. – 2023. – Т. 4. – №. 8/S. – С. 94-101.
7. Шайкина О.И. Открытые образовательные ресурсы на основе смешанного обучения в Томском политехническом университете // Азимут научных исследований: педагогика и психология. 2016. Т. 5. № 1 (14). С.134-136.

8. Karshiboyev S. E., Suvanova I. X., qizi Shukrulloeva F. R. FIZIKA FANINI O‘RGANISHDA LABORATORIYA MASHG ‘ULOTLARINING NAZARIY ASOSLARI //Educational Research in Universal Sciences. – 2024. – T. 3. – №. 4. – C. 38-47.

9. Shavkat K. IMPROVING THE METHODOLOGY OF ORGANIZING AND CONDUCTING LABORATORY TRAINING THROUGH DIGITAL TECHNOLOGIES //INTERNATIONAL JOURNAL OF EUROPEAN RESEARCH OUTPUT. – 2024. – T. 3. – №. 3. – C. 74-82.

10. Shavka K. et al. Use of Virtual Laboratories in Education //International Journal of Formal Education. – 2024. – T. 3. – №. 1. – C. 169-172.

11. Karshiboyev S. KREDIT MODUL TIZIMIDA FIZIKADAN LABORATORIYA MASHG ‘ULOTLARINI RAQAMLI TEXNOLOGIYALAR ASOSIDA TASHKIL ETISH KVANT FIZIKASI BO ‘LIMI MISOLIDA //Interpretation and researches. – 2023. – T. 1. – №. 19.

12. Shavkat K., Matluba N., Zaxriddin R. Pedagogika oliy o‘quv yurtlarida fizikadan virtual laboratoriya ishlari //O ‘zbekiston Respublikasi Adliya vazirligi huzuridagi intellektual mulk agentligi № DGU 29267 raqamli mualliflik guvohnomasi. – 2023. – T. 15.