
IMPROVEMENT OF LABORATORY EXERCISES IN PHYSICS IN SECONDARY SCHOOLS

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Abstract:

This article shows how to improve the quality of education and achieve efficiency by developing experimental competence in students by improving laboratory work in physics in secondary schools.

Keywords: teaching physics, laboratory, experimental competence, experience, secondary school, class.

Introduction

PF-4947 of February 7, 2017, decrees PF-5847 of October 8, 2019 of approval of the concept of development of the higher education system until 2030, and PQ-2909 of April 20, 2017., The decisions of PQ-5032 "on measures to improve the quality of Education and the development of research in the field of physics" of March 19, 2021, as well as higher educational institutions and secondary schools in the implementation of tasks set out in other regulatory legal acts, carry out laboratory work in consistency. In particular, work is being carried out on the plan for 2023/2024 by Navoi State Pedagogical Institute, Faculty of Physics and Technology, Department of Physics and astronomy.

When performing laboratory training to students of the direction of teaching physics and Astronomy in pedagogical higher educational institutions, initially there are 25÷30 students in one guru, this guru is divided into 2 groups of 15. The standard of Education provides for the division of laboratory classes into 2 groups if the number of students in the group exceeds 12. Then they are taken by two teachers as group Students, and they work separately with small gurukhs. Every faculty member divides the students in his guru into smaller gurus (zvenos) again to conduct a laboratory. Students are allocated 4 hours on the science program, so if 2 hours are to get acquainted with the procedure for performing laboratory work, get theoretical data, experiment, get results, then the remaining 2 hours consist of mathematical processing of the results obtained, identifying errors and preparing a report. In this case, the effectiveness of training increases if 4 hours in a row are placed on the lesson schedule. In this case, Task 1 of the student is allowed to carry out Task 2, after passing an examination by the teacher, familiarizing himself with the purpose of the work, the necessary tools and equipment, studying theoretical information, the procedure for performing the work, preparing for theoretical questions. After obtaining a result in the group by students, he is assigned the task of finding answers to the theoretical questions posed in the laboratory development of mathematical processing, and the report is submitted to the teacher. After making sure that the laboratory work performed by the Professor or assistant is done correctly, a question and answer is carried out individually, and the reliability of its reports is checked and the work of this laboratory is determined to be completed. It is to this guru that every accomplished laboratory work is signed by the presiding professor, who first "did the work", and then, after submitting his complete theory of the work, "handed over", once again signs the student's

laboratory notebook. The Professor is lucky to be able to submit a laboratory work by a student. After that, further laboratory work is allowed and the work performed is evaluated.

Topics of laboratory classes in grades 7-11 in the 2023/2024 academic year in schools of general secondary education

Class	Number of laboratory works	Laboratory subject	Total hour
Class 7	1	Determination of the average speed of uneven movement	8
	2	Determination of the density of bodies of different shapes	
	3	Measurement of current strength and voltage in the electrical circuit	
	4	Study of Om's law	
Class 8	1	Electrical circuit assembly measuring current strength and voltage in its various parts	10
	2	Study of Om's law	
	3	Learning to connect conductors in series and parallel	
	4	Determination of the electrical power of the consumer(bulb)	
	5	Assembling the simplest electromagnet and studying its operation	
Class 9	1	Determination of the specific heat capacity of solids	8
	2	Comparison of heat quantities when water of different temperatures is mixed	
	3	Determination of the surface tension coefficient of the liquid	
	4	Determination of the relative humidity of the air	
Class 10	1	F of the sloping plain.I.K.determination of I	8
	2	Determination of free fall acceleration using a mathematical pendulum	
	3	The source of the vine is E.Y.K.determination of I and internal resistance	
	4	Volt-Ampere description study of semiconductor diode	
11-сиф	1	Study of the phenomenon of resonance in the alternating current chain	6
	2	Determining the wavelength of light using a diffraction grating	
	3	Dependence of illumination on the power of light	
Total	20	Laboratory work clock	40

It should be noted that the sequence in the composition of the laboratory conducting method, which is used to this day, contains:

- laboratory working topic;
- purpose of work;
- equipment and devices;
- brief theoretical part;
- the procedure for performing work;
- mathematical processing and calculation of errors in the results obtained in the experiment;

theoretical questions about this laboratory training.

Standard for conducting laboratory work in secondary schools

Scope of application

These standard requirements are valid for laboratory classes conducted in all departments of the general physics course in the direction of training teachers of physics and astronomy. These requirements determine the type of laboratory work and indicate the criteria for evaluating the work.

1. Regulatory documents

These standard requirements are based on the National Training Program of the Republic of Uzbekistan, the law on education, the concept of development of the higher education system of the Republic of Uzbekistan until 2030 and other educational and regulatory documents.

1. General concepts

3.1. Laboratory training can be carried out in a variety of forms, taking into account the specific aspects of the subjects taught as a type of training, and this training serves to improve the competence of the learners, i.e., knowledge, skills and qualifications, ensuring the harmony of practice in theory Ham.

Laboratory work is a teaching task performed in a laboratory session on a specific topic of the studied science.

3.2. The purpose of laboratory training.

Mastering the basics of Science studied by students at the level of DTS requirements using special tools

3.3. Laboratory training tasks.

Mastering the experience of solving Real practical and occult research issues based on the theoretical data studied.

- Having experience conducting experiments. Science to acquire new experimental techniques in a given area of technology and technology.
- Techniques and software tools to generate skills and skills in the operation of devices in ham.
- Formation of skills for processing research results on the basis of modern Informational Technologies.
- Formalize the results of the obtained research and present them on the basis of modern Informational Technologies.
- Application of the acquired knowledge in the formation of an independent logical thinking ability.

3.4. Functions of laboratory work.

- Giving knowledge
- Nurture
- Development

3.5. According to the classification of assignments performed by students, laboratory work is divided into the following types.

- Introducing: laboratory work carried out to consolidate and concretize the theoretical knowledge learned.
- Analytical laboratory work, which serves to obtain new information using formal methods.

- Creative laboratory work-laboratory work performed on the basis of an independent approach to solving a given issue.

3.6. Taking into account the features of the science under study in the forms of Organization of laboratory work, laboratory classes are divided into the following types. Одатий ва маълум вазиятлар учун хос вазифаларни ҳал қилиш.

- Experiment.
- Realistic task modeling training.
- Design game.
- Production, service and organization of excursions to Bashkir organizations.
- Selection Sessions.

Whatever the training style when performing laboratory work, achieving a general didactic goal is the main issue.

4. Requirements for conducting laboratory training

4.1. Laboratory classes are held after a lecture is given in which the theoretical information necessary for their performance is given. In some cases, a laboratory session can be held before the lecture to facilitate the study of theoretical material. It should include theoretical training and literature, and a record and statement of laboratory work.

4.2 the basis for conducting laboratory training is the following:

- DTS and qualification requirements;
- educational science working program;
- training schedule.

4.3 material provision and conditions of conduct of laboratory training.

4.3.1. Laboratory training should be carried out in a special laboratory and computer classes, with the implementation of sanitary and hygienic and technical safety requirements.

4.3.2. The number of equipped laboratory seats is necessary to achieve the set goal and should be sufficient for those who receive education.

4.3.3. During laboratory training, procedures and discipline in accordance with the rules of internal order of the OSCE should be maintained.

4.3.4. The material and technical support of the laboratory must comply with the modern requirements of Science and technology.

4.3.5. The software of the laboratory should correspond to the working program of educational science.

4.3.6. Requirements for the methodological support of laboratory training.

Laboratory work carried out in laboratory sessions should be provided with instructions that include the complex of necessary methodological instructions, publications of the OSCE, the structure of the report, the content and the requirements for formalization.

4.5. Duties and responsibilities of professors.

4.5.1. The head of the department and the heads of the department are able to provide laboratory equipment at the required level and staff the laboratories.

4.5.2. In order to conduct a laboratory session, a qualified professor is able to demand the necessary material, software in a timely manner, as well as to conduct the training, at the required level.

4.5.3. The professor has the right to choose laboratory work, methods of conducting, which serve to improve the quality of the educational process.

4.5.4. The implementation of laboratory work by the Professor should be taken into account in current and intermediate controls.

4.6. The student's right, responsibility and obligations.

4.6.1. In laboratory classes, the student has the right to ask the laboratory assistant and teacher questions about the content of the training and the methodology for performing the work.

4.6.2. The student is allowed to perform laboratory work in the original method of his choice only if the safety conditions are met on the basis of the consent of the teacher.

4.6.3. The student can perform the missed laboratory work at an agreed time with the teacher for an excuse.

4.6.4. The student must arrive on time, preparing for laboratory classes. It is allowed only those students who have the necessary theoretical training to perform laboratory work and have passed the teacher's test on it.

4.6.5. A small group of 2-3 students in laboratory work will prepare a report based on the results obtained. The report is prepared by each student individually. In agreement with the teacher, the report can be submitted electronically.

After the performance of the laboratory work, the student must present and protect the report to the teacher.

4.6.6. At the end of the laboratory session, the teacher checks the report and evaluates the work after the protection of the student.

4.6.7. The student is responsible for:

1. Leaving laboratory training for an unapologetic reason.
2. Not preparing for laboratory work.
3. Failure to submit and protect the report on laboratory work on time.
4. Violation of laboratory equipment and causing material damage.
5. Hacking installed software.

4.6.8. Under the established regulation for current and intermediate controls, students who do not perform laboratory work in higher education institutions and do not re-master it until the deadline for final supervision are not included in the final examinations in the relevant discipline.

5. Composition of laboratory training.

5.1. Laboratory training consists of introductory, basic and final parts.

5.2. The introductory part of the training ensures that the students are ready for the performance of the work. It includes:

- The topic of laboratory work, its purpose and significance in the professional training of the student are explained.
- The composition and specifics of laboratory work torshiriks, the methods of performing the work are explained.
- Descriptions of the requirements for the results of the work.
- Provide technical safety instructions when using technical equipment
- To make sure that the student is ready to do the work.
- Control the results obtained by students.

5.1.2. The main part of the training consists in performing laboratory work, preparing a report (calculating the results, drawing the appropriate graphs and drawings) and performing the work. In

this process, misunderstandings that arise when performing work, analysis of the results obtained, answers to questions, current control are carried out.

- 5.1.3. The final section includes:
 - - Completion of training.
 - - Assessment of student results.
 - - Answers to student questions.
 - - Give instructions for strengthening knowledge.
- 5.2. The introductory and final part of laboratory training can be conducted frontal, and the main part can be conducted individually or collectively according to the form of training.
- 6. Criteria for assessing laboratory training.
 - 6.1. Criterion for assessing the content of laboratory training.
 - - Compliance of the content and topic of training with the science program and plan.
 - - Accuracy of training goals and tasks.
 - - The unity of theory and practice in solving concrete issues.
 - - Reliability of the data obtained.
 - - Professional orientation of training.
 - The combination of assignments with other audiences or independent work assignments.
 - Implementation of science departments and interdisciplinary linking.
 - 6.2. Assessment of the methodology for conducting laboratory training.
 - The form of training and the justification of the conducting methodology.
 - Separation into the components of training.
 - Justification of the composition of work assignments.
 - Open and clear demand for work results.
 - The logic of methodological instructions is the reliability of the theoretical foundations of the work.
 - Demonstration of the methods of execution of assignments.
 - The transition of students from supervised completion of tasks to independent execution.
 - The use of methods of strengthening the information obtained during training.
 - Compliance with the regulation in the training process.
 - Differentiated approach to the completion of laboratory work.
 - An individual approach to each student.
 - Rational harmonization of students ' methods of collective and individual work.
 - 6.3. Criteria for assessing the organization of laboratory training.
 - The size and subject of the lesson allocated to the session is consistent with the thematic plan and study schedule.
 - It is in time for the start and end of training.
 - Student attendance.
 - Student preparation for the lesson.
 - Rational distribution of the vaccine to the lesson.
 - The presence of technical equipment, devices, measuring instruments in the lesson.
 - The presence of feedback with students.
 - 6.4. Criteria for assessing the leadership of student work in laboratory training.
 - Provide students with assistance in completing the work.
 - To carry out current control in the execution of assignments and the preparation of reports.

- Timely elimination of difficulties faced by students.
 - Differential assessment of student work according to the completion of assignments.
- 6.5. Criteria for assessing the professional qualities of a teacher.
- Knowledge of science, adequacy of professional competence.
 - The competence of the teacher to attract the audience and be able to organize a creative environment in training.
 - The attitude of the teacher to students (attention, demand, indifference, indifference).
 - The attitude of students to the teacher (attention, demand, indifference, indifference).
 - Discipline.
- The culture of speech, discussion.
- 6.6. The effectiveness of laboratory training.
- The level of implementation of the goals and objectives of the work.
 - The level of completing assignments.
 - The degree of compliance of work results with demand.
 - The formation of the necessary qualifications and skills in students.
 - Level of educational influence on students.
 - Informational cognitive value of the lesson.

Today, the need to revise laboratory hours of physics in secondary schools and improve it is clearly felt for the rapid development of technical scanners in the country to create a school of inventors in our republic.

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