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LABORATORY WORK IN OPTICS

CHARACTERISTICS OF CLASSIFICATION

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Abstract: Laboratory work plays an important role in teaching the theoretical foundations of optics. With the help of these practical exercises, students will have the opportunity to deepen their understanding of scientific knowledge, develop technical skills and apply theory to practice. Classification of laboratory work helps to increase the efficiency of the educational process. This article discusses the main features of the classification of optical laboratory work and its impact on the educational process.

Keywords: classification, laboratory, optics, assessment, experience, virtual, individual.

Classification (differentiation) of laboratory work in optics is important for the effective organization of the educational process and deepening of students' knowledge. Basic concepts such as refraction and reflection of light are taught in the early stages, while complex experiments such as interference, diffraction and laser technology are explored in later stages.

Below are the main features of this classification:

1. Adaptation to the level of preparation of students.

Depending on the level of knowledge of students or students, the tasks are classified according to complexity. The main purpose of laboratory work is to strengthen theoretical knowledge. For example, when the topic of geometric optics is taught, experiments such as light passing through a prism or working with lenses are carried

out. It teaches students to apply their knowledge in practice. Basic concepts and experiences are provided in the beginning levels, and more complex problems are solved in the advanced levels.

2. Choosing methods suitable for the topic.

Laboratory work in the field of optics is provided with proper methods and equipment. For example, experiments are conducted on topics such as light refraction, reflection, interference and diffraction. For each topic, it is necessary to explain to the students the content of the topic and show the methods of their application.

3. Combining theoretical and practical knowledge.

Students' theoretical knowledge is strengthened in practice during laboratory sessions. For each laboratory work there will be a pre-prepared theoretical part and an independent part.

4. Use of visual aids and modern equipment.

It is important to use modern equipment such as lasers, spectrum analyzers and optical benches to motivate students. The teacher explains complex processes in a simple way through demonstration experiments. Modern laboratory work requires the use of modern equipment and tools. With the help of equipment such as lasers, spectrum analyzers, optical fibers and interferometers, students get closer to scientific research processes.

5. Development of creative thinking.

Problems and experiments in laboratory work are directed to the development of students' independent thinking and creativity. It is necessary to obtain results by different methods, compare them and analyze them. Laboratory training should develop students' creative thinking and independent research skills. It is necessary to analyze and draw conclusions on the result of each case. For example, the practice of determining the

physical properties of colors using the results of observing light spectra requires creativity.

6. Monitoring and evaluation system.

Students are taught to evaluate their work in laboratory work and analyze the results. The results of the exercises are checked by control questions or by documenting the results of the experiment. The assessment system is of particular importance in the process of classification of laboratory work. Specific expected results and criteria are defined for each job. Students document their results and answer control questions while doing the work.

7. Team and individual approach.

Some laboratory work is done in groups, while others are done individually. This allows students to develop cooperation skills and work independently.

Differentiation of laboratory work in optics increases the quality of the educational process. Students consolidate theoretical knowledge and develop technical skills by applying it to practice. At the same time, students will have the opportunity to choose jobs that suit their interests.

The concept of differentiation and its importance.

Classification of laboratory work means organization of practical training at different levels, taking into account the level of training, interests and theoretical knowledge of students. This approach:

- Students participate in training according to their capabilities;
- Systematic formation of knowledge through issues of increasing complexity;
- It is aimed at mastering topics of interest to students.
- The effect of differentiation on the educational process

- Classification of laboratory work in optics leads to the following results:

The classification of laboratory work from optics leads to the following results:

1. Deepening of students' knowledge - through training with an increased level of complexity, students master scientific concepts perfectly.

2. Formation of practical skills - students learn to apply theoretical knowledge to life issues based on practical experiences.

3. Increased motivation - tasks that match the interests and abilities of students increase their interest in lessons.

Classification of laboratory work in optics is an integral part of the educational process. This approach helps to systematically develop students' knowledge and skills, to apply theoretical knowledge to practice, and to form creative thinking. Properly organized laboratory training not only strengthens knowledge, but also prepares students for future research activities.

The classification of laboratory works is based on the following didactic principles:

1. The principle of gradualism.

It is based on the development of students' knowledge and skills through tasks of gradually increasing complexity. First, simple experiments are taught, such as light passing through a lens, and then complex experiments on interference and diffraction are added.

2. The principle of independence.

Each laboratory session is aimed at increasing students' ability to work independently. Basic theoretical knowledge is provided for independent work, and manuals for laboratory work are provided.

3. The principle of activity and creativity.

To increase students' interest, they are given the opportunity to perform experiments with their own personal approach. For example, tracing and graphically representing complex trajectories of light requires creativity.

The role of technologies and virtual laboratories.

Today, in addition to traditional laboratory work, the possibility of using virtual laboratory work is expanding. Advantages of virtual laboratories:

- Safety: Allows experiments to be performed without hazardous conditions (for example, working with high-energy lasers).
- Scalability: The ability to repeat different experiments using simulations and observe the results by changing the conditions.
- Preparation: Before coming to the laboratory, students study the procedure of experiments in a virtual environment.

For example, complex experiments such as laser interferometry or Fraunhofer diffraction observation in optics will be easy and understandable in a virtual environment. Role of teamwork in skill development. Organization of collective laboratory work develops cooperation and communication skills among students. Team members share experiences and analyze results by working together. For example, one team member performs the experiment, another records the results, and a third member performs the analysis and calculations. This approach saves time when performing complex experiments and teaches students to work responsibly.

Foydalanilgan adabiyotlar

1. Абдурахимов А. Т., Хайдаров А. А. "Оптика". – Тошкент: Фан нашриёти, 2019.

(Оптика фанининг асосий тушунчалари ва лаборатория ишларига оид маълумотлар)

2. Бородулин В. И. "Основы физической оптики". – Москва: Высшая школа, 2017.

(Физик оптика, интерференция ва дифракция мавзулари бўйича материаллар)

3. Назаров Р. С., Ғанихонов Б. Ш. "Физика курслари учун лаборатория ишланмалари". – Тошкент: Университет нашриёти, 2020.

("Оптика" бўйича лаборатория машғулотлари методикаси)

4. Муртазаев М. "Лаборатория работ по физике: Учебное пособие". – Москва: Дрофа, 2018.

(Физикада тажрибавий ишлар ва уларни бажариш усуллари)

5. Jenkins, F. A., White, H. E. "Fundamentals of Optics". – New York: McGraw-Hill, 2019.

(Оптика назарияси ва амалиётига оид асосий қўлланма)

6. Born, M., Wolf, E. "Principles of Optics". – Cambridge University Press, 2020.

(Замонавий оптикани ўрганиш учун асосий қўлланма)

7. Халқ таълими вазирлиги. "Физика ўқув қўлланмаси: Оптика бўлими". – Тошкент: Ўқитувчи нашриёти, 2021.

("Оптика" бўйича мактаб дастурлари ва лаборатория ишлари)

8. Толибов Ш. "Замонавий физика ва оптик қурилмалар". – Тошкент: Янги аср авлоди, 2022.

("Оптика" фанининг амалиётда қўлланилишига бағишланган адабиёт)

9. VirtualLab Fusion. "Modern Optics Simulation Software". – https://www.lighttrans.com.

("Виртуал лаборатория ишланмалари ва симуляция дастурлари")

10. Laser Institute of America. "Laser Fundamentals and Applications". – Orlando: LIA Publishing, 2021.

(Лазер технологиялари ва уларнинг лаборатория ишларида қўлланилиши)