METHODOLOGY FOR TEACHING THE LAWS OF ILLUMINATION IN GENERAL SECONDARY SCHOOLS AND ACADEMIC LYCEUMS BASED ON STEAM EDUCATION

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Abstract: *This article presents effective methods for teaching the topic "laws of illumination" based on STEAM education in general secondary schools and academic lyceums. A lesson organized within the STEAM approach develops not only students' physical knowledge but also their technical thinking, practical experience, artistic perception, and mathematical analytical skills. The article provides a detailed laboratory activity recommended for deep understanding of the topic through practical experiments.*

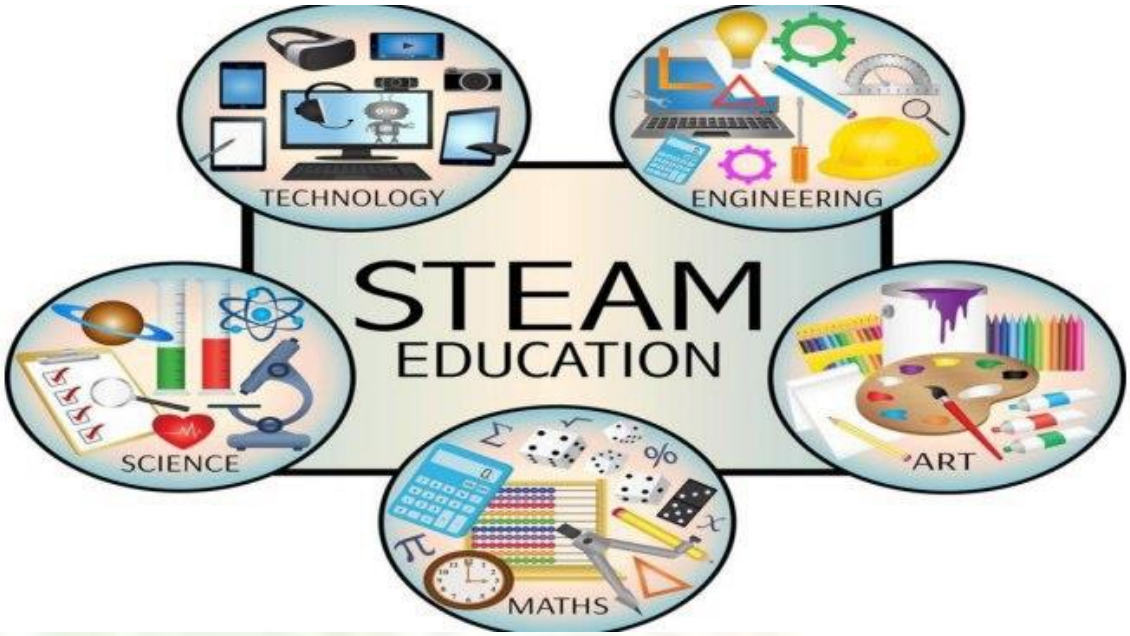
Keywords: *STEAM, illumination, light, physics, practical experiment, laboratory,methodology.*

Introduction

In recent years, the STEAM approach has gained great importance in physics education. This approach integrates science, technology, engineering, art, and mathematics into a single learning process. The main purpose of STEAM is not to give students ready-made knowledge, but to teach them how to use knowledge, discover it on their own, conduct experiments, and solve real problems.[1]

The laws of illumination are one of the topics most suitable for the STEAM approach. Concepts such as light intensity, light sources, interior lighting, and energy efficiency can be explained to students through real-life examples. In this topic, technology, engineering, and mathematics naturally come together. For instance, calculating classroom lighting is an engineering task; measuring the decrease in light intensity involves the use of technology; suggesting lamp placement includes elements of art and design; analyzing the reduction of illumination is related to mathematics.[2]

Therefore, this topic creates an ideal opportunity for organizing STEAM-based lessons.



Methods Used

The following methods are effective when teaching the laws of illumination based on STEAM:[3]

1. Starting with real-life examples.

Students observe lighting problems around them: which part of the classroom is brighter, whether their desk has enough light, why street lights do not illuminate evenly. This naturally creates scientific questions.

2. Use of technology.

Lux meter applications on mobile phones make the measurement process interesting for students. They can see and compare real values.

3. Engineering approach.

Students not only measure but also develop suggestions for improving lighting: at what height the lamp should be installed, how many lamps are needed, and which lamp types are energy-efficient. This becomes a small project.

4. Artistic element.

Short discussions about light design develop students' aesthetic understanding: not only the amount of light, but also its pleasant distribution is important.

5. Mathematical analysis.

Students compare the values they measured and observe at which distance the illumination decreased more. No complex calculations are required — simple comparison is enough. These methods make the lesson lively, engaging, and deeply instructive.

Laboratory Activity: "How does illumination change with distance?"

This laboratory activity is designed in a simplified form suitable for STEAM education and understandable for all students[4].

Purpose:

To demonstrate in practice that illumination decreases as the distance from a light source increases and to measure this process using technological tools.

Required materials:

Mobile phone flashlight or small LED lamp

Lux meter application (via mobile phone)

Measuring tape

A room with controllable lighting

Procedure:

1. Place the light source in one position.

The room should have a uniform lighting condition, and other lamps should be turned off.

2. Activate the lux meter application on the phone.

This technological element actively engages students in the lesson.

3. Measure illumination at a distance of 20 cm.

Students observe that the light is very strong at this point.

4. Increase the distance to 40 cm, then 60 cm, then 80 cm.

At each step, record how the illumination decreases. Students can also see this visually.

5. Students compare their results and explain the reason.

They explain that light spreads out as the distance increases.

6. As a final engineering task:

Ask the question: “What is the best lighting plan for the classroom?”

Groups prepare short suggestions: lamp height, number, placement, etc.

Conclusion:

The experiment enables students to understand the dependence of illumination on distance not by memorization, but by observing, measuring, and analyzing it. STEAM elements — technology, engineering, and art — make the laboratory activity richer and more meaningful.

Conclusion:

Teaching the laws of illumination based on STEAM ensures that students understand not only theoretical concepts but also their application in real life. Using technology makes the lesson dynamic, and the engineering approach turns the student into a thinking, analytical individual.

Teaching this topic based on STEAM is an effective method that integrates the physical properties of light with design aesthetics and mathematical analysis, guiding students toward modern thinking.

REFERENCES

1. The national physics curriculum of the Republic of Uzbekistan.
2. G‘ulomov A. “Physics”. – Tashkent, 2019.
3. STEAM Education methodological guide, 2022.
4. Collection of physics laboratory activities for teachers, 2020.