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Research Article

# NEW LABORATORY WORK, VISUAL DEMONSTRATIONS, AND THE USE OF PROBLEMS AND EXERCISES TO STUDY THE PHYSICAL FOUNDATIONS OF ENERGY-SAVING TECHNOLOGIES

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## ABSTRACT

This article analyzes the importance of laboratory work, visual aids, and problem-solving in studying the physical foundations of energy-saving technologies. The research findings show that laboratory exercises and practical models help students develop practical skills and deepen their knowledge of energy efficiency. Additionally, through problems and exercises, students gain the opportunity to understand practical methods of energy-saving.

## KEYWORDS

Energy efficiency, laboratory work, visual aids, problem-solving, technological approach.

## INTRODUCTION

In the 21st century, the issue of efficient energy use has become a global concern. As energy consumption increases, the need for energy-saving technologies grows due to limited energy resources and their harmful effects on the environment. In modern education, understanding these technologies has become essential not only for technical specialists but also for professionals in various fields. Understanding the physical foundations of energy-saving technologies forms the basis for developing and improving such technologies in the future.

In physics education, new pedagogical approaches are necessary to enhance the effectiveness of teaching energy-saving technologies. In particular, the

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introduction of laboratory work, visual and demonstrative models, as well as problems and exercises, play a significant role in deepening students' knowledge and improving their practical skills. This article explores the role of laboratory work and visual aids in teaching the physical foundations of energy-saving technologies and examines how to use them effectively.

## METHODS

The methodological basis of the study includes the following approaches:

1. "Literature Review" – Scientific-technical literature and educational materials were analyzed to assess how pedagogical methods are currently used to explain the physical foundations of energy-saving technologies. In particular, the role of laboratory work, models, and exercises in the educational process was studied.

2. "Experimental Methods" – New laboratory work and visual models related to energy-saving technologies were developed and tested in the teaching process. These experiments observed the impact of laboratory work and models on the learning process.

3. "Questionnaires and Surveys" – Surveys were conducted among physics teachers and students to assess the effectiveness of new laboratory work and visual aids. The results provided insights into the efficiency of these teaching tools in enhancing students' knowledge and skills in energy-saving technologies.

4. "Theoretical Analysis" – The role of problems and exercises related to energy-saving technologies in the educational process and how they reinforce students' knowledge was theoretically analyzed.

## RESULTS

The study revealed that laboratory work, visual aids, and problem-solving significantly contribute to improving students' knowledge. Below are detailed descriptions of these results:

**1. "Laboratory Work":** New laboratory work was developed and tested in the study of energy-saving technologies. This laboratory work focused on measuring the efficiency of solar panels, studying the impact of thermal insulation, and understanding the working mechanisms of wind turbines. For example, during the laboratory work on measuring the efficiency of solar panels, students practically observed how photovoltaic cells work and how electricity is generated through them.

**"Laboratory Work on Thermal Insulation"** – In this experiment, students observed the processes of heat transfer in practice. They compared the thermal conductivity of different materials and determined which materials are more suitable for saving energy in buildings. This experiment allowed students to gain a deeper understanding of the physics of heat and how energy-saving techniques can be applied in real-life situations.

**"Laboratory Work on Wind Turbines"** – Students observed how wind turbines work, their role in generating electricity, and how efficient they are in energy production. This laboratory work helped them understand the practical application of wind energy and its ecological and economic benefits.

**2. "Visual and Demonstration Models":**Visual and demonstration aids proved to be effective in explaining the physical foundations of energy-saving technologies to students. Using visual learning tools

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plays a crucial role in deepening students' understanding and simplifying complex technological processes. Through the use of models, students were able to visualize how these technologies are applied in real life.

**"Solar Panel Model"** – Through a model showing how solar panels work, students were able to see the process of converting solar energy into electrical energy. This helped them understand how solar energy is generated and the ways to use it effectively.

**"Wind Turbine Model"** – The model explaining the principles of wind turbine operation helped students gain a practical understanding of how wind energy can be used. They saw how the turbine converts wind flow into electrical energy and observed the ecological and economic advantages of wind energy.

**"Heat Pump Models"** – Models demonstrating how heat pumps improve the energy efficiency of buildings and conserve heat helped students better understand thermal insulation and energy efficiency.

**3. "Problems and Exercises":**Problems and exercises aimed at improving energy efficiency became an important source of practical knowledge for students. These exercises allowed them to solve problems related to energy saving and find various solutions for improving energy efficiency.

**"Heat Transfer Problems"** – Students solved problems related to calculating the thermal conductivity of different materials and assessing the efficiency of thermal insulation, practically understanding how to increase energy efficiency in buildings.

**"Exercises on Calculating Solar Panel Efficiency"** – These exercises helped students mathematically calculate the efficiency of generating electricity through solar panels. They gained a deeper understanding of how photovoltaic cells work and developed skills in calculating energy production processes.

**"Exercises on Wind Turbine Efficiency"** – Students solved exercises related to calculating the efficiency of wind turbines in generating electrical energy. Through these exercises, they learned to analyze wind energy efficiency and its impact on energy-saving strategies.

## DISCUSSION

The results of the study demonstrate that interdisciplinary and practice-based teaching methods are highly effective in teaching energy-saving technologies. In physics education, laboratory work, visual aids, and models play a crucial role in comprehensively studying the physical foundations of energy-saving technologies. Research has shown that these methods significantly enhance students' knowledge and skills in energy-saving practices.

**"Laboratory Work"** – Students had the opportunity to strengthen their knowledge through conducting experiments on energy-saving practices. For example, in the study of thermal insulation, students observed heat transfer processes and learned about practical ways to save energy in real life.

**"Visual Aids"** – Using demonstration models and visual aids to explain energy-saving technologies helped deepen students' understanding. By visualizing the processes of complex technologies, students found it easier to comprehend the content, making it both engaging and effective.

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**"Problems and Exercises"** – Solving problems and exercises related to energy efficiency encouraged students to think critically and realize the practical importance of these technologies. This also contributed to their understanding of the physical principles behind energy-saving technologies.

## CONCLUSION

The use of new laboratory work, visual aids, models, and problem-solving exercises has proven to be a highly effective method for deepening students' understanding of the physical foundations of energy-saving technologies. These pedagogical approaches not only enhance students' knowledge and skills in improving energy efficiency but also play a crucial role in involving them in scientific research.

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