

IMPROVING STUDENTS' PROBLEM-SOLVING SKILLS IN PHYSICS THROUGH
STRUCTURED INSTRUCTIONAL APPROACHES

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Abstract: *Problem solving is a fundamental component of physics education, yet many students experience difficulties in interpreting problem statements and applying appropriate solution strategies. This study examines the effectiveness of a structured instructional approach designed to improve students' problem-solving skills. A quasi-experimental design was implemented involving 120 secondary school students divided into experimental and control groups. The intervention lasted four weeks and covered key topics including units and conversions, uniform motion, displacement, and uniformly accelerated motion. The experimental group was taught using a step-by-step structured method, while the control group followed traditional instruction. The results demonstrated a substantial improvement in the experimental group (90%) compared to the control group (30%). The findings suggest that structured instructional approaches significantly enhance students' analytical thinking, reduce cognitive difficulties, and improve overall learning outcomes in physics education.*

Key words: *physics education, problem solving, structured learning, teaching methodology, secondary education*

Introduction

Physics education plays a crucial role in developing students' analytical thinking, logical reasoning, and problem-solving abilities. However, one of the most persistent challenges in physics learning is students' difficulty in solving problems effectively. Many learners struggle not because of a lack of formulas, but due to their inability to interpret problem statements and translate them into meaningful physical models.

Traditional teaching methods often emphasize formula memorization and mechanical calculations rather than conceptual understanding. As a result, students tend to rely on surface-level strategies, such as matching given values with familiar formulas, instead of analyzing the underlying physical processes. This leads to low performance and reduced confidence in physics learning.

Recent educational approaches highlight the importance of structured learning, where students are guided through systematic stages of problem solving. Such approaches help learners break down complex tasks into manageable steps, thereby reducing cognitive load and improving comprehension. The purpose of this study is to investigate the effectiveness of a structured instructional approach in improving students' problem-solving skills in physics. The study focuses on whether guiding students

through clearly defined steps can significantly enhance their understanding and performance compared to traditional teaching methods.

Methodology

2.1 Research Design

This study employed a quasi-experimental design involving an experimental group and a control group. Both groups were assessed before and after the intervention to measure learning outcomes.

2.2 Participants

A total of 120 secondary school students participated in the study:

- Experimental group: 60 students
- Control group: 60 students

The participants were selected based on similar academic backgrounds to ensure comparability.

2.3 Instructional Procedure

The intervention was conducted over four weeks and included the following topics:

- Units and conversions
- Uniform motion
- Distance and displacement
- Uniformly accelerated motion

Each topic was taught over two academic hours.

The experimental group was instructed using a structured problem-solving approach consisting of five stages:

1. Identifying given information
2. Determining the required quantity
3. Selecting the appropriate physical model
4. Performing calculations
5. Verifying the result

In contrast, the control group received traditional instruction focused primarily on formula application and direct problem solving.

2.4 Data Collection

Data were collected using:

- Pre-test (before the intervention)
- Post-test (after the intervention)

The tests included multiple problem-solving tasks designed to assess students' understanding and application of physics concepts.

Results

The results revealed a significant difference between the experimental and control groups.

- Experimental group: **90% success rate**
- Control group: **30% success rate**

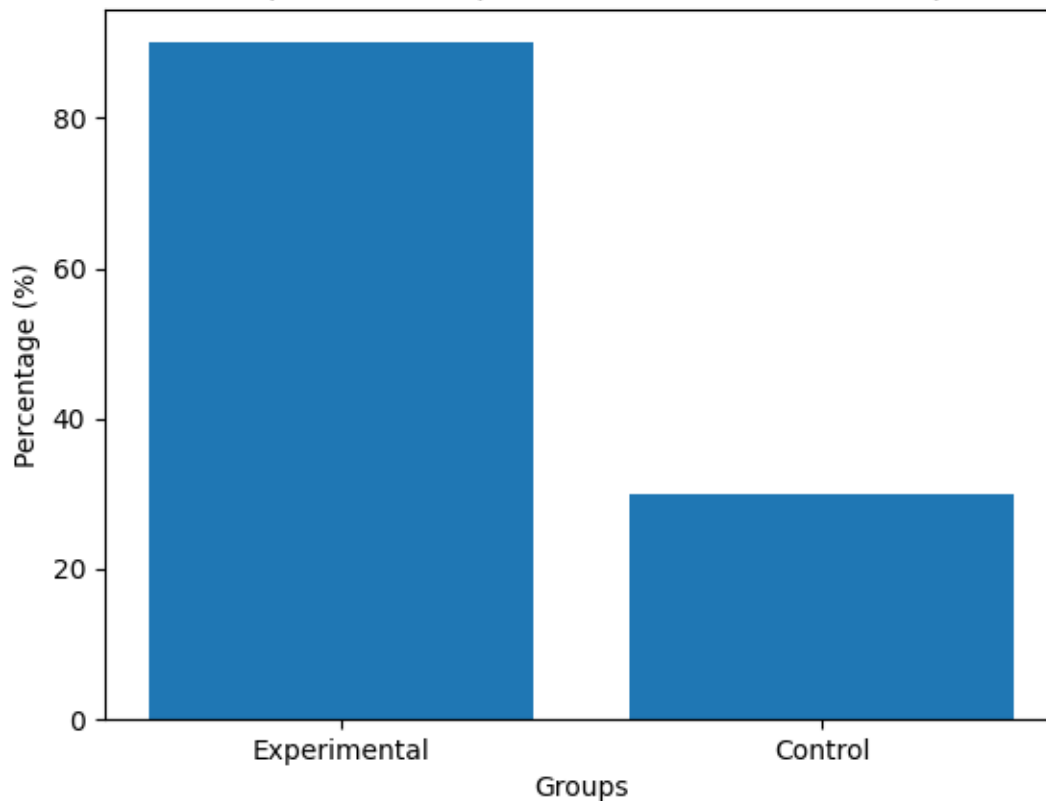
Students in the experimental group demonstrated improved ability to:

- analyze problem statements
- construct appropriate models
- perform accurate calculations

Additionally, the structured approach helped students develop a clearer understanding of the logical

Development of Problem-Solving Skills

Comparison of Experimental and Control Groups



sequence involved in problem solving.

These findings indicate that structured instruction leads to substantial improvement in learning outcomes.

Discussion

The findings of this study confirm that structured instructional approaches significantly enhance students' problem-solving skills in physics. The improvement observed in the experimental group can be explained by several factors.

First, the structured approach reduces cognitive load by breaking down complex problems into smaller, manageable steps. This allows students to focus on one aspect of the problem at a time, leading to better understanding.

Second, guiding students through a systematic process improves their ability to interpret problem statements. Many students struggle at the initial stage of understanding the problem, and structured instruction directly addresses this issue.

Third, the approach promotes logical thinking and builds students' confidence. When learners understand how to approach a problem, they are more likely to engage actively and persist in solving it.

These results align with modern educational theories that emphasize the importance of guided learning and active engagement. The study demonstrates that even relatively simple instructional changes can lead to significant improvements in student performance.

Conclusion

This study demonstrates that structured instructional approaches have a strong positive impact on students' problem-solving abilities in physics. The method helps students develop a clear understanding of problem structure, enhances analytical thinking, and improves learning outcomes. The findings suggest that educators should incorporate structured problem-solving strategies into their teaching practices. Such approaches can make physics more accessible and reduce students' difficulties.

Future research may explore the application of this method in different educational contexts and subjects.

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