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Applying the IBL Method to Enhance Heuristic and Research Skills in Lyceum Students

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ABSTRACT

This study explores the effectiveness of the Inquiry-Based Learning (IBL) method in teaching the ideal gas law ($PV = \frac{m}{M}RT$) to talented 10th-grade students in Azerbaijani lyceums. The main objective is to demonstrate how the IBL approach enhances conceptual understanding and critical thinking in physics education.

A total of 48 students from two lyceums participated in the study. The intervention involved a sequence of eight structured IBL stages: (1) identifying the relevance of the inquiry question (e.g., "How do pressure, volume, and temperature relate in gases?"), (2) formulating the research question, (3) hypothesizing possible relationships between variables, (4) planning the investigation using simulations and experimental setups, (5) conducting the inquiry using group activities and real-time data collection, (6) analyzing the data using graphical and mathematical tools, (7) presenting findings in student-led presentations, and (8) engaging in reflective discussions.

A pre-test and post-test were administered to measure learning outcomes. Paired sample t-test analysis revealed a statistically significant improvement in students' understanding of the gas law ($p < 0.01$), confirming the positive impact of the IBL methodology. Effective tools included PhET simulations, interactive whiteboards, and guided lab worksheets.

The study concludes that the IBL approach fosters inquiry skills and deeper comprehension among talented students, making it a recommended practice in lyceum-level physics education.

Keywords: gas law, inquiry-based learning, lyceum, physics education, student research