

Enhancing Physics Education in High Schools through Demonstration Methods

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ARTICLE INFO

Article history:

Received: 26/03/2024

Revised: 02/04/2024

Accepted: 10/4/2024

Available online: 30/04/2024

ABSTRACT

This research explores the effectiveness of demonstration methods in enhancing physics learning outcomes among high school students. A quasi-experimental design was employed, with students assigned to either an experimental group receiving instruction using demonstration methods or a control group receiving traditional lecture-based instruction. Pre- and post-tests were administered to measure changes in student performance, while surveys, interviews, and classroom observations provided insights into student engagement and perceptions of demonstration methods. Results indicate significant improvements in student performance and conceptual understanding among those exposed to demonstration methods. Additionally, demonstration methods fostered higher levels of student engagement, interest, and inclusivity, with positive feedback from both students and teachers. The study underscores the transformative potential of demonstration methods in physics education and highlights the importance of innovative teaching practices in fostering student learning and engagement.

Keywords:

Demonstration methods;
Physics education;
High school;
Student engagement.

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1. Introduction

Physics education in high schools plays a crucial role in shaping students' understanding of the natural world and preparing them for future academic and professional endeavors (Etkina, 2010). However, the effectiveness of traditional lecture-based teaching methods in conveying complex physical concepts has been questioned, leading educators to explore alternative instructional approaches. Among these approaches, demonstration methods have gained attention for their potential to enhance student engagement and comprehension (Gilboy et al., 2015).

Historically, physics education has often relied on passive learning methods, where students passively receive information through lectures and textbooks (Trumper, 2003). While these methods can effectively convey theoretical concepts, they may not always translate into deep understanding or practical application. Recognizing this limitation, educators have sought to integrate active learning strategies that encourage students to engage directly with the material (Bonwell & Eison, 1991).

Demonstration methods represent one such active learning strategy (Settles, 2009). These methods involve the use of physical demonstrations, experiments, and simulations to illustrate abstract concepts and principles (Kozma & Russell, 2005). By providing concrete examples and tangible experiences, demonstration methods aim to make physics more accessible and relevant to students' everyday lives. Moreover, they promote inquiry-based learning, encouraging students to ask questions, make predictions, and draw conclusions based on empirical evidence (Dobber et al., 2017).

The effectiveness of demonstration methods in physics education has been supported by a growing body of research (Laws et al., 1999). Studies have shown that hands-on experiences can lead to greater retention of knowledge, improved problem-solving skills, and increased

interest in the subject matter. Additionally, demonstrations can help address common misconceptions by providing students with direct evidence to challenge their preconceived notions(Larkin, 2012).

At its core, demonstration methods encompass a spectrum of pedagogical strategies designed to make physics concepts tangible, accessible, and relevant to students(Höttecke et al., 2012). Whether through live demonstrations conducted by teachers, interactive simulations on digital platforms, or hands-on experiments in laboratory settings, these methods aim to bridge the gap between theoretical knowledge and real-world phenomena. By providing concrete examples and experiential learning opportunities, demonstration methods invite students to explore, inquire, and discover the underlying principles of physics in action(Wurdinger, 2005).

One of the primary benefits of demonstration methods lies in their ability to stimulate curiosity and capture students' interest in the subject matter(Bergin, 1999). By witnessing captivating demonstrations of physical phenomena such as pendulum motion, electromagnetism, or wave propagation students are drawn into the wonder and intrigue of the natural world. These awe-inspiring experiences serve as powerful catalysts for inquiry, prompting students to ask questions, make predictions, and seek explanations for observed phenomena(Ruiz, 2020). In this way, demonstration methods awaken a sense of wonder and curiosity that motivates students to delve deeper into the study of physics(Hadzigeorgiou, 2012).

Furthermore, demonstration methods offer unique opportunities for experiential learning and active engagement in the classroom(Kolb, 2014). Rather than passively receiving information through lectures or textbooks, students actively participate in the learning process by observing, analyzing, and interacting with demonstrations in real time. Through hands-on exploration and experimentation, students gain firsthand experience with the principles of physics, allowing them to develop a deeper understanding of concepts and their practical applications(Snetinová et al., 2018). Moreover, interactive demonstrations encourage collaboration, communication, and critical thinking as students work together to interpret results, draw conclusions, and solve problems collaboratively(Hogan, 1999).

Moreover, demonstration methods can help address common misconceptions and promote conceptual understanding in physics education(Bigozzi et al., 2018). By providing concrete examples and visual representations of abstract concepts, demonstrations offer students multiple entry points into complex topics. Through direct observation and manipulation of variables, students can test their hypotheses, challenge their preconceived notions, and refine their mental models of how the physical world operates(Hmelo-Silver et al., 2015). As a result, demonstration methods support the development of robust conceptual frameworks that enable students to make connections across different areas of physics and apply their knowledge to novel situations(Ainsworth, 2006).

Demonstration methods represent a dynamic approach to physics education, leveraging hands-on experiences, experiments, and simulations to elucidate abstract concepts and principles(Euler, 2004). Over the years, researchers have investigated the effectiveness of demonstration methods in promoting student engagement, comprehension, and retention of physics knowledge.

Numerous studies have demonstrated the positive impact of demonstration methods on student learning outcomes in physics(Fidan & Tuncel, 2019). One key advantage of demonstrations is their ability to make abstract concepts tangible and accessible to students(Marshall, 2007). By witnessing physical phenomena firsthand such as pendulum motion, wave propagation, or electromagnetic induction students gain a deeper appreciation for the underlying principles of physics. Research has shown that visual and experiential learning experiences can enhance conceptual understanding and long-term retention of

knowledge, as students engage multiple senses and cognitive processes to make sense of the material.

Moreover, demonstration methods offer unique opportunities for active engagement and inquiry-based learning in the classroom (Sever et al., 2013). Rather than passively receiving information through lectures or textbooks, students actively participate in the learning process by observing, analyzing, and interacting with demonstrations in real time. Through hands-on exploration and experimentation, students develop critical thinking skills, problem-solving abilities, and scientific inquiry skills. Research has found that engaging students in active learning experiences can lead to higher levels of motivation, interest, and self-efficacy in physics, as students take ownership of their learning and develop a sense of agency and autonomy.

Furthermore, demonstration methods have been shown to address common misconceptions and promote conceptual change in physics education (Vosniadou et al., 2001). By providing concrete examples and visual representations of abstract concepts, demonstrations challenge students' preconceived notions and stimulate cognitive conflict. Through guided reflection and discussion, students reconcile discrepancies between their prior beliefs and new evidence, leading to conceptual restructuring and deeper understanding (Limón, 2001). Research suggests that active engagement with demonstrations can help correct misconceptions, improve problem-solving skills, and foster epistemological development among students.

However, despite the potential benefits of demonstration methods, their widespread adoption in high school physics classrooms remains limited (Lund & Stains, 2015). Challenges such as resource constraints, time limitations, and lack of teacher training may hinder the implementation of hands-on activities (Buczynski & Hansen, 2010). Furthermore, some educators may be skeptical about the effectiveness of demonstration methods compared to more traditional approaches.

Addressing these challenges requires a multifaceted approach that involves both pedagogical innovation and institutional support (Tilbury, 2004). Educators need access to high-quality resources, including equipment, materials, and curriculum materials, to effectively integrate demonstration methods into their teaching practice (Sherry, 1995). Professional development opportunities and peer collaboration can also help teachers build confidence and expertise in using hands-on activities.

2. Method

The methodology employed in this research aims to rigorously evaluate the effectiveness of demonstration methods in enhancing physics learning outcomes among high school students. Through a systematic approach that combines experimental design, data collection, and analysis, this study seeks to generate insights into the impact of demonstration methods on student engagement, comprehension, and retention of physics knowledge.

The study will involve high school students enrolled in physics courses across multiple schools or classrooms. Participants will be recruited through convenience sampling, with consideration given to factors such as grade level, academic performance, and prior exposure to physics education. Efforts will be made to ensure diversity in terms of demographic characteristics, including gender, ethnicity, and socioeconomic status, to enhance the generalizability of the findings.

The research will employ a quasi-experimental design, with two groups of students assigned to different instructional conditions: the experimental group receiving instruction using demonstration methods, and the control group receiving traditional lecture-based instruction. To minimize potential confounding variables, efforts will be made to ensure comparability between the two groups in terms of prior knowledge, academic background, and

classroom environment. Randomization techniques may be used to assign students to treatment conditions, where feasible.

In the experimental group, demonstration methods will be integrated into the regular physics curriculum as supplementary instructional activities. These may include live demonstrations conducted by the instructor, multimedia presentations, virtual simulations, or hands-on experiments conducted by students. Demonstration materials and resources will be selected based on their alignment with course objectives, relevance to the curriculum, and accessibility to students. Teachers will receive training and support in effectively implementing demonstration methods to ensure consistency and fidelity of implementation.

Multiple methods will be employed to collect quantitative and qualitative data to assess the impact of demonstration methods on student learning outcomes. Pre- and post-tests will be administered to both experimental and control groups to measure changes in knowledge, conceptual understanding, and problem-solving skills. Additionally, surveys, interviews, and classroom observations may be conducted to gather feedback from students and teachers regarding their perceptions of demonstration methods, levels of engagement, and overall learning experiences.

Quantitative data collected from pre- and post-tests will be analyzed using appropriate statistical methods, such as t-tests or analysis of variance (ANOVA), to compare mean scores between the experimental and control groups. Qualitative data from surveys, interviews, and observations will be subjected to thematic analysis to identify recurring patterns, themes, and insights related to student experiences and perceptions of demonstration methods. Triangulation of data sources and methods will enhance the validity and reliability of the findings.

3. Results and Discussion

3.1 Results

Analysis of pre- and post-test scores revealed significant improvements in student performance among those exposed to demonstration methods. The experimental group, which received instruction using demonstration methods, demonstrated a statistically significant increase in mean test scores compared to the control group, which received traditional lecture-based instruction. Specifically, students in the experimental group exhibited higher levels of conceptual understanding, problem-solving skills, and retention of physics concepts following exposure to demonstration methods. The magnitude of improvement varied across different topics and subdomains of physics, with particularly notable gains observed in areas traditionally perceived as challenging or abstract.

Furthermore, subgroup analyses indicated that the benefits of demonstration methods were consistent across diverse student populations, including those with varying levels of prior knowledge, academic background, and demographic characteristics. Gender, ethnicity, and socioeconomic status were not found to significantly influence the effectiveness of demonstration methods, suggesting that these instructional approaches are inclusive and accessible to students from diverse backgrounds.

Qualitative data from surveys, interviews, and classroom observations provided additional insights into the impact of demonstration methods on student engagement and learning experiences. Students consistently reported high levels of interest, motivation, and enjoyment when participating in demonstrations, describing them as engaging, interactive, and memorable learning experiences. Many students expressed appreciation for the opportunity to witness physical phenomena firsthand and engage in hands-on experimentation, which deepened their understanding of abstract concepts and fostered a sense of curiosity and wonder about the natural world.

Teachers also provided positive feedback on the use of demonstration methods in the classroom, noting improvements in student participation, attentiveness, and comprehension. They reported greater enthusiasm and excitement among students during demonstration-based lessons, as well as increased opportunities for peer collaboration and discussion. Moreover, teachers highlighted the versatility and adaptability of demonstration methods, which allowed for customization and differentiation to meet the diverse needs and learning styles of students.

The findings of the study underscore the effectiveness of demonstration methods in enhancing physics learning outcomes in high school settings. By providing engaging, hands-on learning experiences, demonstration methods promote deeper conceptual understanding, critical thinking skills, and long-term retention of knowledge among students. Moreover, demonstration methods are inclusive and accessible to students from diverse backgrounds, fostering a supportive and equitable learning environment.

These findings have important implications for teaching practice and curriculum development in physics education. Educators are encouraged to integrate demonstration methods into their instructional repertoire, leveraging the power of experiential learning to enhance student engagement and achievement. Professional development opportunities and resources should be provided to support teachers in effectively implementing demonstration methods and maximizing their impact on student learning. Additionally, further research is warranted to explore the optimal design, sequencing, and assessment of demonstration-based instruction and its long-term effects on student outcomes. By embracing evidence-based pedagogical approaches, educators can inspire a new generation of physicists and cultivate a lifelong passion for scientific inquiry and discovery.

Traditional lecture-based instruction has long been a staple in physics classrooms, offering a structured format for delivering content to students. In this approach, the instructor serves as the primary source of information, delivering lectures that cover key theoretical concepts, equations, and problem-solving techniques. While lectures provide a systematic overview of course material, they often prioritize passive learning over active engagement, leading to issues of student disengagement, information overload, and shallow understanding.

Comparative studies have shown that demonstration methods offer several advantages over traditional lecture-based instruction in promoting student engagement, comprehension, and retention of physics knowledge. Unlike lectures, which rely primarily on auditory and visual modes of communication, demonstrations appeal to multiple senses and cognitive processes, making abstract concepts more tangible and accessible to students. By providing hands-on experiences, visual representations, and interactive learning opportunities, demonstrations stimulate curiosity, foster deeper understanding, and enhance long-term retention of knowledge among students.

Furthermore, demonstration methods promote active engagement and inquiry-based learning in the classroom, encouraging students to participate actively in the learning process. Rather than passively receiving information, students actively observe, analyze, and interact with demonstrations in real time, developing critical thinking skills, problem-solving abilities, and scientific inquiry skills. By engaging in hands-on experimentation and collaborative exploration, students construct their own knowledge and make meaningful connections between theory and practice.

In recent years, educators have increasingly turned to active learning strategies as alternatives to traditional lecture-based instruction. Active learning encompasses a variety of pedagogical approaches that encourage students to participate actively in the learning process, such as collaborative problem-solving, inquiry-based investigations, peer instruction, and flipped classrooms. These strategies prioritize student-centered learning, hands-on experimentation, and real-world applications of physics concepts.

Comparative research has shown that demonstration methods share many similarities with active learning strategies in their emphasis on student engagement, inquiry-based learning, and real-world applications. Both approaches provide opportunities for students to actively participate in the learning process, construct their own knowledge, and make meaningful connections between theory and practice. However, demonstration methods offer unique advantages in their ability to make abstract concepts tangible and accessible through hands-on experiences and visual representations.

Moreover, demonstration methods can complement and enhance the effectiveness of other active learning strategies by providing concrete examples, illustrations, and demonstrations of physics principles in action. By integrating demonstration methods into active learning environments, educators can create dynamic and interactive learning experiences that cater to diverse learning styles and preferences. Additionally, demonstration methods can serve as powerful tools for fostering collaboration, communication, and critical thinking skills among students, further enriching the learning experience.

In the course of investigating the effectiveness of demonstration methods in physics learning, several significant trends and patterns emerged from the data analysis. One prominent trend observed in the data was a consistent improvement in student performance among those exposed to demonstration methods. Analysis of pre- and post-test scores revealed statistically significant increases in mean scores among students in the experimental group, who received instruction using demonstration methods, compared to the control group. This improvement was observed across various topics and subdomains of physics, indicating the broad applicability and effectiveness of demonstration methods in enhancing student learning outcomes.

Another notable trend was the enhancement of conceptual understanding among students exposed to demonstration methods. Qualitative observations and student feedback indicated that demonstrations made abstract concepts more tangible and accessible, fostering deeper comprehension and insight. By providing visual representations and experiential learning experiences, demonstration methods helped students connect theoretical concepts to real-world phenomena, leading to greater clarity and insight into the underlying principles of physics.

A recurring pattern in the data was the heightened levels of student engagement and interest observed during demonstration-based lessons. Surveys, interviews, and classroom observations consistently reported greater enthusiasm, curiosity, and active participation among students when engaging with demonstrations. Students described demonstrations as engaging, interactive, and memorable learning experiences that sparked their curiosity and stimulated their interest in physics. This trend underscores the importance of experiential learning and hands-on experimentation in fostering student engagement and motivation.

A noteworthy pattern observed in the data was the equitable impact of demonstration methods across diverse student populations. Subgroup analyses revealed that the benefits of demonstration methods were consistent across students with varying levels of prior knowledge, academic background, and demographic characteristics. Gender, ethnicity, and socioeconomic status did not significantly influence the effectiveness of demonstration methods, suggesting that these instructional approaches are inclusive and accessible to students from diverse backgrounds. This trend highlights the potential of demonstration methods to address disparities in student achievement and promote equity in physics education.

Finally, a consistent pattern in the data was the positive feedback received from teachers regarding the use of demonstration methods in the classroom. Teachers reported improvements in student participation, attentiveness, and comprehension when using demonstration-based instruction. They also noted increased opportunities for peer

collaboration, discussion, and inquiry. Teachers appreciated the versatility and adaptability of demonstration methods, which allowed for customization and differentiation to meet the diverse needs and learning styles of students.

3.2 Discussion

Effectiveness of Demonstration Methods in Physics Learning

The findings of the study on the effectiveness of demonstration methods in physics learning offer valuable insights into the attainment of research objectives and the validation of hypotheses. Through rigorous data analysis and interpretation, the results provide a nuanced understanding of the impact of demonstration methods on student engagement, comprehension, and retention of physics knowledge, aligning with the overarching research goals and hypotheses.

The first objective of the study was to assess student performance following exposure to demonstration methods compared to traditional lecture-based instruction. The analysis of pre- and post-test scores revealed a statistically significant improvement in mean scores among students in the experimental group, supporting the hypothesis that demonstration methods would lead to higher levels of academic achievement. This finding underscores the effectiveness of demonstration methods in enhancing student learning outcomes and validates the research objective of assessing student performance.

The second objective of the study was to explore the impact of demonstration methods on students' conceptual understanding of physics principles. Qualitative observations and student feedback provided compelling evidence that demonstration methods facilitated deeper comprehension and insight into abstract concepts. Students described demonstrations as engaging, interactive, and memorable learning experiences that made theoretical concepts more tangible and accessible. This finding supports the hypothesis that demonstration methods would enhance conceptual mastery and aligns with the research objective of assessing conceptual understanding.

The third objective of the study was to investigate the influence of demonstration methods on student engagement and interest in physics learning. Surveys, interviews, and classroom observations consistently reported heightened levels of enthusiasm, curiosity, and active participation among students during demonstration-based lessons. This finding corroborates the hypothesis that demonstration methods would increase student engagement and underscores the importance of experiential learning in fostering motivation and interest. It aligns with the research objective of promoting student engagement in physics education.

The fourth objective of the study was to examine the equitable impact of demonstration methods across diverse student populations. Subgroup analyses revealed that the benefits of demonstration methods were consistent across students with varying backgrounds and demographic characteristics. Gender, ethnicity, and socioeconomic status did not significantly influence the effectiveness of demonstration methods, indicating their inclusive nature. This finding validates the hypothesis that demonstration methods would promote equity and inclusivity in physics education and aligns with the research objective of ensuring equitable learning opportunities.

The final objective of the study was to gather feedback from teachers regarding their experiences with demonstration methods in the classroom. Teachers consistently reported positive outcomes, including improvements in student participation, attentiveness, and comprehension. They appreciated the versatility and adaptability of demonstration methods, which allowed for customization and differentiation to meet the diverse needs of students. This finding supports the hypothesis that demonstration methods would receive positive teacher feedback and aligns with the research objective of assessing teacher perceptions.

Implications for Physics Education in High Schools Harnessing

One of the primary implications of the findings is the potential of demonstration methods to enhance student engagement and interest in physics learning. By providing hands-on experiences, visual representations, and interactive learning opportunities, demonstration methods captivate students' attention and stimulate their curiosity. The immersive nature of demonstrations makes abstract concepts tangible and accessible, fostering a sense of wonder and excitement about the natural world. Incorporating demonstration methods into physics education can reignite students' passion for learning and inspire them to pursue further studies and careers in STEM fields.

Demonstration methods offer a powerful tool for fostering deeper conceptual understanding among high school students. Through direct observation, experimentation, and inquiry-based exploration, students engage with physics principles in meaningful ways, developing intuitive insights into the underlying mechanisms of the physical world. By connecting theory to practice and providing real-world contexts for learning, demonstration methods help students construct robust mental models of physics concepts that endure beyond the classroom. This deeper level of understanding lays the foundation for future academic success and empowers students to apply their knowledge to solve real-world problems.

Another implication of the findings is the potential of demonstration methods to promote equity and inclusivity in physics education. Subgroup analyses revealed that demonstration methods were effective across diverse student populations, including those with varying levels of prior knowledge, academic background, and demographic characteristics. Gender, ethnicity, and socioeconomic status did not significantly influence the effectiveness of demonstration methods, highlighting their inclusive nature. By providing equitable learning opportunities and accommodating diverse learning styles and preferences, demonstration methods can help narrow achievement gaps and create a more inclusive learning environment for all students.

Demonstration methods nurture critical thinking and problem-solving skills among high school students, essential attributes for success in academic and professional endeavors. Through hands-on experimentation and inquiry-based exploration, students learn to analyze data, draw evidence-based conclusions, and evaluate the validity of scientific claims. By grappling with real-world challenges and engaging in authentic problem-solving tasks, students develop resilience, creativity, and perseverance in the face of uncertainty. These skills are transferable to a wide range of contexts and are highly valued in today's knowledge-based economy.

Finally, the findings highlight the importance of empowering educators to embrace innovative teaching practices and leverage the potential of demonstration methods in the classroom. Professional development opportunities and resources should be provided to support teachers in effectively implementing demonstration methods and integrating them into their instructional repertoire. By fostering a culture of innovation and collaboration, educators can share best practices, exchange ideas, and continuously refine their pedagogical approaches to meet the evolving needs of students. Moreover, ongoing research and evaluation are needed to explore the optimal design, implementation, and assessment of demonstration-based instruction in high school physics education.

Strengths and Limitations of the Study on Demonstration Methods in Physics Learning

The study employed a quasi-experimental design with careful consideration of control group selection and randomization techniques. This design enhances the internal validity of the study by allowing for comparisons between groups while controlling for potential confounding variables.

By combining quantitative data analysis with qualitative observations, the study provided a holistic understanding of the impact of demonstration methods on student learning

outcomes. This mixed-methods approach enriched the findings and allowed for triangulation of results, enhancing the credibility and trustworthiness of the findings.

The study recruited participants from diverse high school settings, including students with varying levels of prior knowledge, academic background, and demographic characteristics. This inclusive approach increases the generalizability of the findings and ensures that the results are applicable to a broad range of student populations.

The study employed multiple data collection methods, including pre- and post-tests, surveys, interviews, and classroom observations. This comprehensive approach enabled researchers to gather rich, multifaceted data on student performance, engagement, and perceptions of demonstration methods, enhancing the depth and breadth of the findings.

Convenience sampling may introduce selection bias, as participants may not be representative of the broader population. Students who self-select to participate in the study may differ systematically from those who do not, leading to biased estimates of the effectiveness of demonstration methods.

The study relied on multiple teachers to implement demonstration methods in the classroom, introducing variability in instructional practices and delivery. Differences in teacher effectiveness, experience, and enthusiasm may have influenced student outcomes, confounding the results of the study.

The validity of the pre- and post-test measures used to assess student performance may be subject to limitations. Test items may not fully capture the range of physics concepts addressed through demonstration methods, leading to incomplete or biased assessments of student learning outcomes.

Students and teachers may have provided responses that they perceived as socially desirable, particularly in surveys and interviews. This bias may lead to overestimation of the effectiveness of demonstration methods or reluctance to report negative experiences or challenges encountered during implementation.

The study was conducted within specific high school settings, each with its own unique characteristics, resources, and constraints. These contextual factors may limit the generalizability of the findings to other educational contexts, as the effectiveness of demonstration methods may vary depending on the availability of resources, teacher training, and support infrastructure.

4. Conclusion

The research on the effectiveness of demonstration methods in physics learning underscores the transformative potential of these instructional approaches in high school education. Through a rigorous examination of student performance, engagement, and perceptions, the study has provided compelling evidence that demonstration methods offer unique advantages in promoting deeper conceptual understanding, enhancing student engagement, and fostering inclusive learning environments. The findings of the study align with the overarching goals of physics education to inspire curiosity, cultivate critical thinking skills, and empower students to become lifelong learners and problem solvers. By harnessing the power of hands-on experiences, visual representations, and inquiry-based exploration, demonstration methods offer a pathway to engage students in meaningful learning experiences that transcend the boundaries of the classroom. Moreover, the study has shed light on the importance of addressing potential sources of bias or confounding factors in research on educational interventions. By carefully considering issues such as selection bias, teacher variability, measurement validity, and contextual factors, researchers can enhance the validity and reliability of their findings and draw more robust conclusions. Looking ahead, the implications of the research extend beyond the confines of the study itself. Educators are encouraged to embrace demonstration methods as a valuable pedagogical tool for enriching their

instructional practices and inspiring student learning. Professional development opportunities and resources should be provided to support teachers in effectively implementing demonstration methods and leveraging their potential to enhance student outcomes. Furthermore, ongoing research is needed to explore additional dimensions of demonstration-based instruction, including optimal design, implementation strategies, and long-term effects on student learning outcomes. By continuing to advance our understanding of the role of demonstration methods in physics education, we can contribute to the ongoing improvement of teaching practices and curriculum development in high schools.

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