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Is Differentiated Instructional Strategy Worth to Try in Physics Lessons for High School Students? A Literature Review

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Abstract

This study investigates the feasibility and effectiveness of differentiated instructional strategies in high school physics education through a systematic literature review. The analysis encompasses 10 recent studies (2019–2024) that explore various implementations of differentiated learning in physics lessons. Results indicate that differentiated instruction enhances academic performance, critical thinking, and problem-solving skills by tailoring lessons to diverse student needs, including multiple intelligences and learning styles. Additionally, differentiated strategies facilitate student-centered learning and foster engagement, addressing the challenges of traditional teaching methods. However, resource intensity and technological gaps present significant barriers to implementation. Findings suggest that professional development and adaptive technologies are essential to supporting teachers in overcoming these challenges. This review underscores the transformative potential of differentiated instruction to democratize learning and meet the varied needs of modern classrooms, particularly in the context of post-pandemic educational recovery. The study concludes with recommendations for integrating differentiated instructional strategies into high school physics curricula to optimize both short-term and long-term educational outcomes.

Keywords: differentiated instruction, high school physics, student-centered learning, educational strategies, critical thinking

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INTRODUCTION

Differentiated learning strategies are widely discussed in the field of education nowadays. The classic model, in which teachers often use only one method for all students does not meet each

student's specific needs (Moallemi, 2023). Moreover, the inclusion of students with special needs are increasing at public school, which is good. The acceptance rate of those students shows that the educational system is trying to give the same opportunity for all (Eva et al., 2022). But it means that teacher must work harder to fully appreciate student's potential, we must evaluate the effectiveness of differentiated learning strategies through the lens of current educational demands and challenges.

Teachers should viewing individual differences not as challenges to overcome but as opportunities to democratize and enhance the learning experience. Policy-makers and researchers emphasize the importance of embracing diversity and refining instructional approaches to address the varied learning needs within the classroom (Stentiford & Koutsouris, 2020). The learning gaps caused by learning loss during covid-19 leads to create more diverse students (Donnelly & Patrinos, 2022). Differentiated instruction is crucial for bridging these gaps and ensuring that all students have equal opportunities to succeed.

Differentiated Instruction can be facilitated through technology by offering tasks and activities tailored to students' preferences and presenting the same content through diverse formats, such as videos, audio recordings, and PowerPoint presentations. These tools enable educators to develop effective learning profiles and experiences while fostering creativity that captivates students, ignites their curiosity for new knowledge, and encourages seamless transitions between tasks (Krishan & Al-rsa'i, 2023).

The pandemic has created a unique opportunity for educational changes that have been proposed before COVID-19 but were never fully realized, one of them is student-centered learning. Effective pedagogy must prioritize long-term benefits over short-term gains. Direct instruction, though often yielding immediate results, has been criticized for its "unproductive successes" and potential long-term drawbacks. To address these limitations, new models of teaching and learning should be adopted. These models, regardless of their format or name, must be student-centered, inquiry-based, authentic, and purposeful. They should emphasize student-initiated exploration of meaningful, real-world problems. By doing so, pedagogy can shift its focus from rote memorization of known solutions to fostering the skills necessary to navigate uncertainty and tackle unknown challenges (Zhao & Watterston, 2021).

By creating a student-centered and concept-based curriculum, teacher can tailor learning experiences to accommodate diverse needs while simultaneously encouraging critical thinking, collaboration, and adaptability. The differentiated instructional strategy enables students to develop self-regulation and autonomy, essential traits for navigating the complexities of the modern world. Through varied instructional strategies and rigorous learning opportunities, differentiation not only meets individual learning preferences but also cultivates the creativity and problem-solving abilities necessary for success in a rapidly evolving global landscape (Riordan & Convery, 2022).

Evaluating the effectiveness of these strategies is essential to ensure they not only meet immediate learning needs but also prepare students for long-term success in a rapidly changing world. Differentiated instruction must be continuously refined to cultivate autonomy, collaboration, and problem-solving skills, empowering students to navigate the complexities of the modern

landscape (Bhutoria, 2022). In this light, assessing the impact of differentiation is not just about improving teaching practices but about fulfilling the fundamental promise of education: to provide every learner with the opportunity to thrive. This study is trying to seeks the implementation of differentiated instructional strategies in physics lessons for high school students.

METHOD

This study using a systematic literature review method. The inclusion criteria required that the articles come from national or international journals and be published within the last 10 years (2019-2024). Initially, 480 articles were identified using the keywords "Differentiated" AND "physics" AND "high school" AND "Implementation". In the next phase, articles were filtered by evaluating their titles to ensure alignment with the research topic. This screening resulted in 25 articles. A thorough review of the content was then conducted to assess their relevance and quality in relation to the research topic. Ultimately, 10 articles were deemed highly relevant and selected for further analysis.

RESULTS AND DISCUSSION

Analysis of 14 articles explaining the application of differentiated learning is shown in Table 1

Table 1. Literatures Analysis

Author(s)	Journal's Name	Title	Research Method	Research Results
Putri et al. (2023)	International Journal of Current Educational Research	Implementation of Project-Based Learning (PjBL) with Differentiation Approach	Quantitative Research	PjBL with differentiation improved students' critical thinking skills, with a significant N-gain value of 0.72. (Putri, Rachmadiarti and Kuntjoro, 2023)
Patriot et al. (2023)	Transformasi: Jurnal Pengabdian Masyarakat	Enhancing the Skills of Physics MGMP Teachers in Making Differentiated E-modules	Participatory Action Research (PAR)	N-gain of 0.82 in teachers' skills, 86% participants strongly agreed the training enhanced skills. (Patriot *et al.*, 2023)

Author(s)	Journal's Name	Title	Research Method	Research Results
Syarqia et al. (2024)	Asian Journal of Science Education	Implementing Differentiated Learning Using Problem-Based Learning (PBL)	One-group Pretest-Posttest Design	Improvement in problem-solving skills with posttest scores significantly higher than pretest scores (Syarqia, Suyatna and Suana, 2024).
Toledo (2023)	International Journal of Multidisciplinary: Applied Business and Education Research	Differentiated Instruction for an Enhanced Students' Academic Performance in Physics	Quasi-experimental	Differentiated instruction improved performance, particularly among students with intrapersonal intelligence (Toledo, 2023).
Salar & Turgut (2021)	Science Education International	Effect of Differentiated Instruction and 5E Learning Cycle on Academic Achievement	Matching Pretest/Posttest Control Group	Differentiated instruction increased academic achievement; no difference in self-efficacy scores between groups. (Salar and Turgut, 2021)
Santoso et al. (2022)	Education Sciences	Physics Teachers' Perceptions about Their Judgments within Differentiated Learning	Phenomenological Study	Teachers identified the need for technological support to enhance equitable judgments in differentiated settings. (Santoso,

Author(s)	Journal's Name	Title	Research Method	Research Results
				Istiyono and Haryanto, 2022)
Prihandono et al. (2023)	Jurnal Penelitian Pendidikan IPA	Analysis of Differentiated Learning with Classroom Action Research to Improve Physics	Classroom Action Research	Differentiation based on VAK styles improved activities by 20.14% and outcomes by 25% (Prihandono *et al.*, 2023).
Sinaga et al. (2023)	Jurnal Pendidikan Fisika dan Teknologi	The Effect of Practicum Tools with Differentiated Learning Strategies on Learning	Quasi-experimental	Differentiated strategies using practicum tools significantly improved learning outcomes (Sinaga *et al.*, 2023).
Fajaryati et al. (2023)	Journal of Research in Science Education	Differentiated Learning as an Effort to Improve Students' Learning Outcomes in Physics	Paired Samples T-test	Significant improvement in learning outcomes, with posttest scores much higher than pretest (Fajaryati, S and Karolina, 2023).
Damanik et al. (2024)	JPPI: Jurnal Penelitian Pendidikan Indonesia	Exploring Student Learning Outcomes in Physics Using PBL with a Differentiated Approach	Pre-Experimental Design	PBL with differentiation improved learning outcomes and engagement significantly (Damanik, Nabilla and Sani, 2024)

Differentiated instructional strategies have emerged as transformative tools for enhancing high school physics education. The studies reviewed collectively provide compelling evidence supporting the implementation of differentiated learning in this context. This section explores the

benefits, challenges, and practical implications of using differentiated strategies in high school physics classrooms.

Benefits of Differentiated Instruction Strategy

Differentiated instruction aligns seamlessly with the diverse learning needs of high school students, as demonstrated in the studies. For instance, the significant academic improvements reported by Toledo (2023) illustrate how tailoring lessons to multiple intelligences fosters deeper understanding and engagement. Similarly, Putri et al. (2023) emphasized that differentiated project-based learning not only improved critical thinking but also catered to individual learning styles, creating a more inclusive classroom environment.

Another key benefit is the enhancement of problem-solving skills. Syarqia et al. (2024) demonstrated that using problem-based learning (PBL) with differentiation significantly improved students' abilities to tackle complex physics problems, an essential skill for success in the subject. These findings underscore the potential of differentiated strategies to equip students with higher-order thinking skills, preparing them for real-world challenges.

Challenges of Implementation

While the advantages are evident, implementing differentiated instruction poses significant challenges. A recurring theme in several studies is the resource-intensive nature of these strategies. Teachers need time and training to design and deliver effective differentiated lessons, as highlighted by Patriot et al. (2023), who found that even experienced educators required extensive support to create differentiated e-modules.

Technology gaps also hinder effective implementation. Santoso et al. (2022) identified the need for technological tools to assist teachers in making equitable judgments about diverse learners. Without adequate resources, achieving the full potential of differentiated instruction may remain an elusive goal.

Practical Implications and Recommendations

Despite these challenges, the studies provide actionable insights for overcoming barriers. Professional development programs, like those described by Patriot et al. (2023), are crucial for equipping teachers with the skills needed to implement differentiated strategies effectively. Additionally, integrating technology, such as adaptive learning platforms, can help address the logistical hurdles associated with personalized instruction.

Furthermore, collaboration among educators can foster the sharing of best practices and resources. Salar and Turgut (2021) suggested creating classroom-level groups to manage differentiation effectively, ensuring that all students benefit from tailored instruction.

CONCLUSION

Based on the collective evidence, differentiated instructional strategies are undeniably worth trying in high school physics lessons. They offer substantial benefits in improving academic performance, critical thinking, and problem-solving skills. However, to maximize their potential, it is essential to address the challenges of resource intensity and technology gaps. By investing in teacher training and technological support, educators can create more inclusive and effective learning environments, paving the way for greater success in physics education.

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