Jurnal Penelitian, Pendidikan dan Pengajaran (JPPP)
Vol. 6 No. 1, April 2025, pp. 62-67
ISSN: 2721-7795. DOI: 10.30596/jppp.v6i1.24210

Learning Styles in Differentiated Learning of Water Cycle Material for Grade V Elementary School

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ABSTRACT

This study explores the effectiveness of differentiated instruction based on students' learning styles visual, auditory, and kinesthetic in teaching the water cycle to fifth-grade elementary students. Utilizing a quantitative approach with a quasi-experimental design, the research involved 27 students and assessed their learning outcomes through achievement tests. The differentiated instruction was tailored to individual learning preferences, ensuring students received content in formats most suited to their cognitive tendencies. The results showed that the average score (83.89) significantly exceeded the Minimum Mastery Criteria (75), with 74% of students categorized as having met the learning objectives. The findings underscore the importance of adapting instructional strategies to diverse learning styles to enhance student engagement and academic achievement, especially within the framework of the Merdeka Curriculum. The study concludes that differentiated instruction, when aligned with learning styles, can serve as an effective pedagogical model for science education in primary schools.

Keywords: Learning Styles, Differentiated Instruction, Water Cycle, Elementary Education, Merdeka Curriculum, Student Achievement.

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1. INTRODUCTION

Education serves as one of the fundamental pillars in national development, playing a crucial role in producing high-quality human resources capable of competing globally. High-quality education is expected to support the sustainable advancement of the nation. To achieve this goal, the Indonesian government continues to implement educational reforms, one of which is the development of the Merdeka Curriculum, designed to be more flexible, adaptive, and contextual. This curriculum was introduced as a response to the learning crisis caused by the pandemic, as well as an effort to keep pace with the rapidly changing times (Kemendikbudristek, 2022). The Merdeka Curriculum and Merdeka Belajar program represent a transformation of the Indonesian education system towards a more proactive and student-centered approach (Putri & Yamin, 2023. The primary objective of the Merdeka Curriculum is to foster students who are adaptive, resilient, and possess lifelong learning skills. In addition, the curriculum aims to cultivate the Profil Pelajar Pancasila (Pancasila Student Profile), which includes six dimensions: moral character, creativity, independence, collaboration, global diversity, and critical thinking (Anugrah & Novitasari, 2023). One of the key learning approaches emphasized in the implementation of the Merdeka Curriculum is differentiated instruction. This approach allows teachers to tailor the teaching and learning process according to each student's needs, interests, and abilities (Yuono et al., 2023).

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The implementation of differentiated instruction still faces several challenges in the field. Some educational institutions have not fully developed or applied a flexible curriculum tailored to their students' specific needs (Marantika et al., 2023). In fact, differentiation in instruction involves four essential aspects: content (what is taught), process (how learning occurs), product (the outcomes of learning), and learning

environment (the conditions in which learning takes place) (Yuono et al., 2023). Therefore, teachers are expected to serve as facilitators who deeply understand their students' needs in order to provide optimal learning services.

2. DISCUSSION

2.1 Concept of Learning Styles

Learning styles refer to the preferred ways individuals process, understand, and retain information. These styles play a significant role in shaping how students engage with instructional content and respond to various teaching strategies. Among the most widely recognized categorizations of learning styles is the VAK model, which classifies learners into visual, auditory, and kinesthetic types. Visual learners prefer to process information through images and spatial understanding, auditory learners learn best through listening and verbal communication, while kinesthetic learners benefit from hands-on activities and movement-based learning experiences (Rahayu et al., 2023).

Understanding learning styles is crucial in the context of primary education, where students are at a developmental stage that requires tailored instructional methods. According to Nurhidayah and Sudrajat (2022), aligning instructional strategies with students' learning styles significantly enhances their engagement and academic performance. Their research on elementary school students revealed that those who were taught using methods aligned with their dominant learning style showed better comprehension and retention of material, particularly in science subjects.

Recent findings have also shown that learning styles are not fixed traits but flexible tendencies that can be developed and adapted over time (Ningsih et al., 2021). Therefore, teachers should not rigidly classify students into a single style but rather adopt a flexible approach that integrates various styles into the learning environment. This is particularly important in inclusive classrooms where students exhibit diverse learning preferences and cognitive abilities.

According to Wijayanti et al. (2023), understanding learning styles plays a key role in differentiated instruction. Their research found that when teachers adjusted their teaching methods to accommodate students' preferred learning styles—particularly in science classes such as the water cycle topic—students' motivation and participation levels increased noticeably. This suggests that integrating learning style-based strategies can foster a more student-centered learning atmosphere and improve overall academic outcomes.

Moreover, the integration of learning styles into instructional planning has become increasingly relevant with the implementation of the Merdeka Curriculum in Indonesia. This curriculum emphasizes student autonomy, creativity, and differentiated learning tailored to individual needs (Putri & Yamin, 2023). In this context, learning styles offer a framework for teachers to design instruction that respects student differences while promoting active and meaningful learning.

However, it is also important to note that some scholars argue against overemphasizing learning styles, pointing out that empirical evidence supporting their effectiveness remains mixed. According to Setiawan et al. (2021), while accommodating learning styles can enhance classroom engagement, it should be combined with other evidence-based instructional strategies to maximize effectiveness. They recommend balanced pedagogical approaches that integrate learning preferences with solid content delivery and continuous assessment.

2.2 Differentiated Learning/Instruction

Differentiated instruction is an educational approach that recognizes and addresses the diverse learning needs, preferences, and readiness levels of students in a classroom. According to Tomlinson (2001), who popularized this concept, differentiated instruction involves proactive planning and adjustment of teaching content, processes, products, and learning environments to maximize each student's growth and individual success. In today's inclusive and heterogeneous classrooms, this approach has become increasingly essential.

According to Nafiah et al. (2024), differentiated instruction in the Indonesian elementary school context involves tailoring teaching strategies to students' readiness levels, interests, and learning profiles. This model is especially relevant under the Kurikulum Merdeka (Merdeka Curriculum), which promotes flexibility, creativity, and student-centered learning. Their study highlights that by modifying instruction based on these three elements—readiness, interest, and learning profile teachers can more effectively engage students and improve learning outcomes.

Differentiated learning is not about creating entirely separate lesson plans for each student but rather offering multiple pathways for students to explore content and demonstrate understanding. As stated by Aini, Nita, and Sugiarti (2024), effective differentiation can take the form of varied instructional materials, tasks with differing levels of complexity, flexible groupings, or even personalized project-based learning. Their findings suggest that when students are given learning experiences aligned with their strengths and preferences, they exhibit increased motivation and deeper conceptual understanding.

Furthermore, differentiated instruction enhances inclusivity by providing equitable access to education. According to Puspita, Paksi, and Sutaji (2023), applying differentiated strategies based on learning styles—such as visual, auditory, and kinesthetic approaches—helps teachers reach a broader range of students, particularly in

science content like the human respiratory system. Their research demonstrated improved academic performance and student engagement when instruction matched students' preferred learning modalities.

The integration of differentiated instruction also supports the development of Profil Pelajar Pancasila, a key goal of the Kurikulum Merdeka, which emphasizes character building, critical thinking, collaboration, and independence (Putri & Yamin, 2023). In this way, differentiation not only improves academic outcomes but also contributes to holistic student development.

Implementing differentiated instruction presents challenges, including time constraints, lack of teacher training, and limited resources. According to Setiawan et al. (2021), many teachers struggle to implement differentiation effectively due to the complexity of classroom management and the need for ongoing assessment. They argue for sustained professional development and institutional support to help educators transition from traditional one-size-fits-all methods to more responsive and flexible teaching.

2.3 Water Cycle Content in the Elementary School Curriculum

The water cycle, also known as the hydrological cycle, is one of the core topics in elementary school science education, particularly within the Indonesian Kurikulum Merdeka. This topic introduces students to essential environmental processes such as evaporation, condensation, precipitation, and collection, which help them understand the continuous movement of water on, above, and below the surface of the Earth. According to Andriyani et al. (2023), the water cycle is not only a foundational concept in natural sciences but also a contextually rich topic that enables students to relate science to everyday experiences.

In the Kurikulum Merdeka, science education—referred to as IPAS (Ilmu Pengetahuan Alam dan Sosial) encourages the integration of scientific thinking with social awareness and problem-solving. The teaching of water cycle material in Grade V is structured to promote inquiry-based learning, where students are encouraged to observe phenomena, ask questions, conduct simple experiments, and draw conclusions (Kemendikbudristek, 2022). This approach aims to develop scientific literacy and ecological awareness from an early age.

According to Fitria and Dewi (2024), effective teaching of the water cycle requires more than textbook-based instruction. Their study demonstrated that using differentiated and hands-on methods, such as experiments and simulations, significantly improved students' understanding and retention. When students are given opportunities to observe evaporation through simple activities or create models that visualize precipitation and runoff, they are more likely to grasp the complex interactions within the cycle.

Moreover, the water cycle offers an opportunity for interdisciplinary learning. Teachers can integrate literacy by asking students to explain the process in writing, or use visual arts by having students draw diagrams or construct models. Menurut Puspita et al. (2023), combining science content with visual or kinesthetic activities based on students' learning styles enhances engagement and comprehension. This aligns with the goals of differentiated instruction in the Kurikulum Merdeka, which promotes personalized learning experiences to meet diverse student needs.

Teaching the water cycle also reinforces environmental values. According to Pratiwi and Nugroho (2021), incorporating environmental education into science topics like the water cycle fosters a sense of responsibility toward natural resources and introduces students to issues such as water conservation and climate change. This not only enhances cognitive understanding but also shapes attitudes and behaviors toward sustainable living.

Despite its importance, several challenges remain in delivering water cycle content effectively. Some students struggle with abstract processes like condensation or the invisible nature of evaporation. According to Astuti and Wijayanti (2022), the use of multimedia tools and interactive digital simulations can address these difficulties by providing visual representations of otherwise intangible phenomena

3. RESEARCH METHODOLOGY

This study aimed to determine students' learning achievement in the IPAS subject. The data were obtained through the measurement of learning evaluation results, which were then analyzed using descriptive and statistical methods. The presentation of the results includes the classification of scores, the level of mastery based on the Minimum Mastery Criteria (KKM), as well as statistical analysis to examine data distribution and the significance of students' learning achievement.

The research results are presented in table format to facilitate interpretation and understanding of the data. Descriptive analysis was used to determine the distribution of scores and the number of students in each grade category, while inferential analysis was carried out using the Kolmogorov-Smirnov test and the One-Sample t-Test to assess data normality and the differences between the average scores and the benchmark standard.

Table 4.1 Value Classification Results

Number of Students	Predicate	Description
10	A	Very Good

6	B	Good
4	C	Enough
7	D	Poor

The majority of students received an "Excellent" (A) grade, with 10 out of a total of 27 students achieving this level. This indicates that more than one-third of the students demonstrated very high academic achievement in the assessment. However, there were still 7 students (approximately 26%) who received a "Poor" (D) grade, suggesting the presence of a group of students who may require guidance or further learning interventions. This distribution reflects a significant variation in student achievement.

Table 4.2 KKM Criteria for Science Subjects

Minimum Completion Criteria	Number of Students	Information
>75	20	Tuntas
<75	7	Tidak Tuntas

Out of a total of 27 students, 20 of them (approximately 74%) succeeded in achieving scores above the Minimum Mastery Criteria (KKM), which is more than 75. This indicates that the majority of students have reached the expected level of learning mastery according to the established standards. Meanwhile, there are 7 students (approximately 26%) who have not yet met the KKM, and therefore require special attention through mentoring, reinforcement of learning materials, or more suitable learning strategies in order to achieve optimal learning outcomes. These findings highlight the need to evaluate the teaching methods used to ensure an even improvement in student achievement.

One-Sample Kolmogorov-Smirnov Test

		NILAI_IPAS
N		27
Normal Parameters[a,b]	Mean	83.8889
	Std. Deviation	14.95720
Most Extreme Differences	Absolute	.193
	Positive	.141
	Negative	-.193
Test Statistic		.193
Asymp. Sig. (2-tailed)		.110[c]

The Kolmogorov-Smirnov test was conducted to determine whether the IPAS score data of the students followed a normal distribution. The significance value (Asymp. Sig.) of 0.110 > 0.05 indicates that the IPAS scores are normally distributed. This means that parametric statistical analysis can be used for further data processing. The average IPAS score is 83.89 with a standard deviation of 14.96, indicating that while the scores are fairly varied, they remain concentrated aroundthe mean.

One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
NILAI_IPAS	29.143	26	.000	83.88889	77.9720	89.8058

Based on the results of the One-Sample t-Test, the average IPAS score of the students was 83.89, compared to the assumed benchmark score of 75. If the test results show that the significance value (p-value) is less than 0.05, it can be concluded that there is a statistically significant difference between the students' average score and the benchmark score. However, if the significance value is greater than 0.05, then there is no statistically significant difference, even though the descriptive data may indicate a higher student average.

The results of the One-Sample t-Test indicate that the students' average IPAS score of 83.89 is higher than the assumed benchmark of 75. This reflects generally strong academic achievement. If the significance value of the test is less than 0.05, it can be stated that this difference is statistically significant. Therefore, overall, the students have demonstrated academic performance that exceeds the minimum standard, indicating that the learning outcomes have been successfully achieve.

Based on the results of the One-Sample t-Test, the average student score was 83.89, indicating learning outcomes that exceed the Minimum Competency Criteria (KKM) of 75. This shows that, in general, students have achieved good learning outcomes. This result is further supported by descriptive data showing that 74% of students met the criteria for mastery, while only 26% did not. The high average score indicates that the majority of students not only understood the material but also mastered it well.

In relation to learning theory, this achievement demonstrates a positive effect of instructional approaches that align with students' needs. One approach that has proven effective in improving learning outcomes is differentiated instruction, as explained by Nafiah et al. (2024), who stated that this strategy involves adjusting the content, process, and product of learning based on students' readiness, interests, and learning styles. In this context, students' success reflects the likelihood that the instructional strategy used has considered their individual needs.

A similar point was made by Fitria and Dewi (2024), who found that implementing differentiated learning through the Discovery Learning model significantly improved student outcomes in circulatory system material. In their study, student performance increased markedly from cycle I to cycle II, with learning mastery rising from 60.61% to 90.91%. This finding reinforces the importance of approaches that account for individual learning styles visual, auditory, and kinesthetic—in achieving optimal learning outcomes.

Meanwhile, Aini, Nita, and Sugiarti (2024) emphasized the importance of differentiated learning strategies in supporting overall student achievement, especially when students are engaged in learning processes that match their styles and interests. This approach allows students to feel more actively involved and comfortable in learning.

Puspita, Paksi, and Sutaji (2023) also showed that differentiated instructional strategies based on student learning styles can enhance engagement and achievement in IPAS (Science, Environment, and Social Studies) material on the human respiratory system. In that study, students who learned through approaches aligned with their preferred learning styles demonstrated significant improvement in content understanding.

Therefore, the high scores and dominant mastery levels observed in this study reflect the success of instructional strategies that address student diversity. Differentiated instruction allows teachers to create learning environments that are responsive to individual student needs, and this has proven effective in improving the quality of instruction (Nafiah et al., 2024; Fitria & Dewi, 2024; Puspita et al., 2023; Aini et al., 2024).

4. CONCLUSION

Differentiated instruction tailored to students' learning styles visual, auditory, and kinesthetic has proven effective in enhancing student learning outcomes on the water cycle topic in fifth-grade elementary education. By aligning content, process, and product with individual student characteristics, the majority of learners were able to exceed the Minimum Mastery Criteria (KKM), with an average score of 83.89. The data indicate that 74% of students achieved mastery, demonstrating improved conceptual understanding and higher engagement in learning. These findings highlight the importance of teachers designing responsive instructional strategies that cater to diverse learner needs, particularly within the framework of the Merdeka Curriculum, which emphasizes flexibility and student-centered learning. Although some students did not reach the minimum threshold, the overall results suggest that differentiated instruction based on learning styles offers a promising approach to improving the quality of science education at the primary level.

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