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Analysis of the Application of Differentiated Learning in the Implementation of Merdeka Curriculum in Elementary Science Lessons

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Abstract: This study aims to analyze the application of differentiated learning in the implementation of Merdeka Curriculum in science lessons in grade 6 of Public Elementary School (SDN) 3 Pojok. This research uses a qualitative approach with a narrative method. The research subjects consisted of grade 6 teachers and students of SDN 3 Pojok. Data collection techniques include observation, interviews, and documentation. The results showed that the implementation of differentiated learning in the Merdeka Curriculum in science lessons in grade 6 at SDN 3 Pojok went well. Teachers use various differentiated learning strategies, such as providing various learning media and methods that are suitable for students' learning styles, providing varied tasks according to students' interests and abilities, and encouraging students to think critically and creatively. The results also show that differentiated learning is effective in improving students' understanding of the subject matter and accommodating diverse learning needs.

Keywords: Differentiated Learning, Merdeka Curriculum, Science, Elementary School.

1. Introduction

Education has a fundamental role in shaping the development of individuals and society. A quality education will produce a generation that is not only intellectually intelligent but also has a strong character and is able to contribute positively to society. In the Indonesian context, the government continues to make various efforts to improve the quality of education through various innovative policies and programs. One of the latest policies implemented is the Merdeka Curriculum. The Merdeka Curriculum is designed to provide freedom and flexibility to educators in designing a learning process that is more in line with the characteristics and needs of students. This is in line with the modern education paradigm that places students at the center of the learning process. Thus, teachers are expected to adapt their teaching methods to differences in students' learning readiness, interests, and learning styles (Naibaho, 2023).

In implementing Merdeka Curriculum, teachers are often faced with significant challenges. One of the main challenges is how to accommodate individual student differences in learning. Each student has different learning readiness, interests and learning styles, so uniform teaching approaches are often ineffective. Therefore, the implementation of differentiated learning is one of the potential solutions to overcome this challenge (Tomlinson, 2001). Differentiated learning is a teaching approach that customizes content, processes, products and learning environments based on students' readiness, interests and learning profiles. According to Tomlinson (2001) differentiated learning is a proactive, student-centered strategy that provides multiple ways to acquire content, process ideas, and develop products. In the context of primary education, the implementation of differentiated learning is crucial as it can improve student engagement and learning outcomes.

Although the existing literature shows the successful implementation of differentiated learning in various contexts, specific research related to its implementation in the Merdeka Curriculum in science lessons in elementary schools is still limited. This research aims to fill this gap by providing new insights that can help teachers implement differentiated learning more effectively. This research will analyze the implementation of differentiated learning in science lessons in

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grade 6 at SDN 3 Pojok, exploring the strategies used by teachers, the challenges faced, and the impact on students' understanding and motivation to learn.

In the context of modern education, differentiated learning approaches have been recognized as an effective strategy to address student diversity in the classroom. A configurative study by Eikeland & Ohna (2022) emphasizes that differentiation in education can be seen as a way to respond to student diversity to achieve the vision of a school for all. The study found that differentiation is a complex concept and appears in various forms, both as individualization and adaptation to specific groups. Furthermore, the review revealed that there are hardly any studies that go beyond the focus on teachers and classrooms to address the organizational or policy level.

This research is also supported by the findings of Rashidov (2020)which showed that the use of differentiated teaching technologies is effective in improving the methodological quality of mathematics teaching. In this study, Rashidov found that the correct organization of the educational process in mathematics teaching largely depends on the readiness of each student and their level of knowledge. External and internal differentiation is used to organize the educational process according to the individual abilities of students, which in turn increases the efficiency of learning.

Other than that, Olimov (2020) in his article highlights the importance of differentiation in education as an important factor in pedagogical technology. Olimov notes that one of the important aspects of educational development is differentiation, which allows the transition from homogeneous to differentiated education. This approach allows grouping students based on their intellectual abilities, which increases the opportunity for teachers to adapt teaching to students' learning readiness.

In the context of science learning, the application of differentiated learning is very relevant given the complexity of the material to be delivered and the diverse abilities of students in understanding scientific concepts. In grade 6 of SDN 3 Pojok, teachers are faced with the challenge of making science material that is often considered difficult more interesting and easily understood by all students. Differentiated learning offers a solution by providing multiple ways for students to access material, process information and demonstrate their understanding (Faiz et al., 2022).

This research aims to analyze how differentiated learning is implemented in science lessons at grade 6 SDN 3 Pojok. Through a qualitative approach, this research will explore the strategies used by teachers, the challenges faced, and the impact on students' understanding and motivation to learn. Thus, it is hoped that this research can contribute to improving the effectiveness of implementing Merdeka Curriculum and differentiated learning in primary schools.

The implementation of differentiated learning in the Merdeka Curriculum is expected to bring positive changes in the teaching and learning process. This is because differentiated learning focuses not only on mastering material but also on developing critical thinking skills, creativity, and the ability to work collaboratively. Learning that is responsive to students' individual needs will create an inclusive and conducive learning environment for all learners (Gusteti & Neviyarni, 2022).

In this context, research conducted by Eikeland & Ohna (2022) found that differentiation is a complex and versatile concept that occurs under various disguises and with various terms and modes of operationalization. A key finding of the study is that differentiation can appear as individualization, adaptation to specific groups, adaptation within diverse classes, and in a systems perspective. The review also highlights that almost no study goes beyond the focus on teachers and classrooms to address the organizational or policy level.

In addition, Rashidov (2020) showed that differentiated teaching technologies used in mathematics teaching can improve the methodological quality of teaching and learning efficiency. Rashidov found that the correct organization of the educational process in mathematics teaching largely depends on the readiness of each student and their level of knowledge. External and internal differentiation is used to organize the educational process according to the individual abilities of students, which in turn increases learning efficiency.

In another study, Olimov (2020) highlighted the importance of differentiation in education as an important factor in pedagogical technology. Differentiation allows grouping students based on their intellectual abilities, which increases the opportunity for teachers to tailor teaching to students' learning readiness. This approach enables the transition from homogeneous to differentiated education, ultimately improving the quality of education.

In addition to differentiated learning, social collaborative learning approaches also make a significant contribution to basic education. Social collaborative learning models that involve communities, such as bamboo craftsmen, can help students develop life skills that are relevant to the local cultural context. Purbasari et al. (2022) showed that through collaboration with communities, students can learn practical skills while maintaining and preserving cultural heritage. This approach not only increases student engagement but also integrates learning with real life, providing meaningful experiences that link theory with practice. Thus, collaboration between schools and local communities can enrich the curriculum and provide a more holistic and contextualized learning environment.

In addition, research on the development of assessments for children with autism in inclusive PAUD by Madubala et al. (2023) showed the importance of differentiation in educational assessment. The study highlighted that the use of art therapy as an assessment tool was able to improve autistic children's concentration and creativity, which often cannot be achieved through conventional assessment methods. This approach provides insight into how innovative assessment methods can be tailored to the specific needs of children, ensuring that every student has the opportunity to demonstrate their abilities and potential to the fullest. By adopting more diverse and inclusive assessment techniques, teachers can better assess student development and provide constructive feedback that supports individualized learning.

Overall, this research offers new insights into the implementation of differentiated learning in the context of Merdeka Curriculum in Indonesia. The importance of this research lies in its contribution in providing practical recommendations that can be adopted by other schools to improve the quality of science learning. The results of the study are expected to serve as a reference for educational practitioners in implementing differentiated learning more effectively, so that the Merdeka Curriculum's goal of creating a more inclusive and quality education can be achieved.

Thus, this research is not only relevant for teachers and students at SDN 3 Pojok but also for other educational practitioners who seek to implement differentiated learning in the context of Merdeka Curriculum. Through in-depth and data-driven analysis, this research is expected to provide practical recommendations that can be adopted by other schools in their efforts to improve the quality of science learning and education in general.

The implementation of differentiated learning in the Merdeka Curriculum is expected to bring positive changes in the teaching and learning process. This is because differentiated learning focuses not only on mastering material but also on developing critical thinking skills, creativity, and the ability to work collaboratively. Learning that is responsive to students' individual needs will create an inclusive and conducive learning environment for all learners (Gusteti & Neviyarni, 2022).

Thus, this research emphasizes the importance of differentiated learning as an effective approach in Merdeka Curriculum. By continuing to develop and refine this method, it is hoped that education in Indonesia can become more inclusive and quality, giving every student an equal opportunity to succeed and develop according to their potential.

2. Methodology

This research uses a qualitative method with a narrative approach to explore the implementation of differentiated learning in science lessons in grade 6 of SDN 3 Pojok in an in-depth and comprehensive manner. The qualitative method was chosen because it allows researchers to understand the phenomena that occur in detail from the perspective of the participants, so that the results of the research can provide a more holistic and authentic picture of the learning process that takes place.

The subjects in this study were teachers and students of grade 6 of SDN 3 Pojok. This subject selection is based on the research objective to understand the application of differentiated learning from various perspectives, both from the side of the teacher who designs and implements learning, as well as from the side of the students who are the learners in the process. The teacher who became the research subject is an educator who has experience in teaching and has attended training on Merdeka Curriculum and differentiated learning. Meanwhile, students who are research subjects consist of various backgrounds in learning abilities, interests, and learning styles, so that they can provide a more diverse picture of the application of differentiated learning.

Data collection techniques in this research include observation, interviews, and documentation. Each of these techniques has an important role in obtaining rich and in-depth data.

Observation was conducted to directly observe the differentiated learning process implemented by the teacher in the classroom. The researcher conducted participatory observation, where the researcher was involved in classroom activities to get a more real picture of the interaction between teachers and students, as well as students' responses to the learning strategies applied. This observation allows the researcher to record various important aspects, such as teaching methods used, materials delivered, and student activities during learning. (Aprima & Sari, 2022).

Interviews were conducted with teachers and students to get more in-depth information about their experiences in the differentiated learning process. Interviews with teachers aim to understand how teachers plan, implement and evaluate differentiated learning. In addition, this interview also explores the challenges faced by teachers and the solutions applied to overcome these challenges. Interviews with students were conducted to find out their perceptions and experiences of differentiated learning, including how this strategy helps them in understanding science materials and increasing learning motivation.

Documentation was used to complement the data obtained from observations and interviews. Documentation data includes lesson plans (RPP), teaching modules, student work, and assessment notes. These documents were analyzed to see the consistency between planning and implementation of learning, as well as to identify evidence of the success of differentiated learning in improving student understanding. Data analysis was conducted through several stages, namely data reduction, data presentation, and conclusion drawing.

At this stage, data obtained from observations, interviews, and documentation are reduced or selected to select data that are relevant to the focus of the research. Irrelevant or redundant data is eliminated, so that only important and significant data is analyzed further.

The data that has been reduced is then presented in the form of descriptive narratives. Data presentation is done systematically and logically, making it easier for readers to understand the research findings. In presenting the data, researchers also included direct quotes from interviews to provide a clearer picture of the experiences and perceptions of research subjects. After the data was presented, the researcher drew conclusions based on the findings that had been analyzed. These conclusions were made with reference to the research objectives and research questions that had been previously set. In addition, the researcher also identified the implications of the research findings for classroom practice and provided recommendations for further development.

To ensure the validity of the data, this study used source and technique triangulation techniques. Source triangulation is done by comparing data obtained from various sources, such as teachers, students, and documents. Triangulation of techniques is done by using various data collection techniques, namely observation, interviews, and documentation. By using triangulation, it is expected that the results of this study have a high level of validity and reliability, so that they can be trusted and relied upon in making decisions related to the implementation of differentiated learning in elementary schools.

3. Result and Discussions

3.1 Research Results

The study conducted at SDN 3 Pojok has demonstrated the implementation of differentiated learning in the science curriculum with great success. Teachers at this school have adapted their teaching methods to meet students' individual needs using innovative and adaptive strategies, creating a dynamic learning environment that supports students' cognitive and emotional development (Eikeland & Ohna, 2022).

Differentiated learning at SDN 3 Pojok is designed to respond to different learning styles, which include visual, auditory and kinesthetic. This gives students the freedom to choose the learning methods that are most effective for them, which increases learning engagement and effectiveness. For example, visually dominant students are given the opportunity to learn science concepts through interactive diagrams, videos, and infographics, while kinesthetically inclined students are given the chance to participate in practical experiments that allow them to 'experience' science first-hand (Olimov, 2020).

Teachers have integrated technology into their lesson plans to add a new dimension to teaching. Modern tools such as computer simulations, learning apps and digital props are used to explain complex concepts in a more interesting and interactive way. The use of technology not only facilitates better understanding of the material but also captures the interest of students who may be less engaged with traditional teaching methods (Rashidov, 2020).

Evaluation of task customization based on students' individual interests and abilities is also an important part of differentiated learning strategies. Students are given challenging projects that match their interests, which motivates them to be more engaged and invested in the learning process. For example, students who show a strong inclination in science are given the opportunity to take part in small research projects that entail putting theory into practice through real experiments (Mulyanto et al., 2024).

In addition, this responsive teaching adaptation strengthened student engagement, as seen from increased participation in class discussions and other activities. Teachers observed that students were more active in asking questions and discussing the subject matter, demonstrating their increased engagement. This individualized approach not only increases learning motivation but also helps build students' self-confidence and value their ability to contribute to learning.

Furthermore, the results of interviews with students indicate increased enthusiasm and satisfaction in their learning experience. Students report that they feel more valued and supported in a learning environment that is mindful of their needs and preferences. This helps build positive relationships between teachers and students, which is key to creating a supportive and positive learning environment (Iskhaq et al., 2021).

The successful implementation of differentiated learning at SDN 3 Pojok is also reflected in the quantitative data from test results that show significant improvements in students' understanding of the subject matter. This improvement is direct evidence of the effectiveness of differentiated learning in improving learning outcomes. This is in line with existing research that supports differentiated learning as an effective approach in educating a diverse student population.

Implementing differentiated learning requires a high degree of cooperation and coordination between teachers to ensure that all students have a rich and supportive learning experience. Teachers at SDN 3 Pojok regularly collaborate to share resources, strategies and feedback on best practices in teaching, strengthening their collective capacity to meet the needs of every student.

This collaboration also involves ongoing professional training for teachers, which is necessary to ensure that they stay abreast of the latest teaching methods and educational technology. This training not only helps teachers to be more effective in using differentiated learning but also gives them the tools to continue developing their professional skills.

Overall, the results of the research at SDN 3 Pojok show that differentiated learning, when implemented with effective strategies and adequate support, can be significant in enhancing students' learning experience. It provides a solid foundation for students to not only understand the material but also to apply their knowledge in meaningful and relevant ways. By continuing to adapt and refine this approach, other schools can follow the example of SDN 3 Pojok in creating a more inclusive and responsive learning environment that supports all students in achieving their potential.

Figure 1 Student Group Learning Activities

In the first photo, students are seen engaged in a group learning activity that supports the implementation of differentiated learning. These students are working together on the floor, using a variety of writing tools to collaborate on a poster. This activity reflects a student-centered approach where they are invited to actively interact and develop their understanding through discussion and teamwork. It shows how a supportive environment can enhance creativity and social interaction, while facilitating learning tailored to their needs and preferences.

Figure 2 Individual Student Learning Activities

The second photo shows a moment of individual learning in the classroom, where students are independently working on their assignments. This activity illustrates another aspect of differentiated learning, where students are given the freedom to work alone on tasks tailored to their abilities. This allows teachers to identify and adjust teaching methods based on each student's pace and learning style, ensuring that each student gets the right support to maximize his or her learning potential.

Figure 3 Teacher Interview Activity

The third photo captures the moment of the teachers' interview, which is an important part of the evaluation and development of differentiated learning. In this session, teachers discuss learning strategies and outcomes, sharing experiences and challenges faced in their teaching practices. This activity is important for continuous professional development and ensuring that learning approaches are continuously adjusted to meet the changing needs of students.

Such discussions also help strengthen collaboration and communities of practice among teaching staff, which are crucial to maintaining a responsive and inclusive learning environment.

3.2 Discussion

The implementation of differentiated learning at SDN 3 Pojok in the context of Merdeka Curriculum has brought about significant transformations in teaching and learning. With an approach that focuses on the individual needs of each student, teachers at this school have successfully created a supportive environment for both students' academic and socio-emotional development, demonstrating deeper engagement and increased educational effectiveness.

Differentiated learning strategies have transformed the teaching and learning process by integrating various methods that accommodate different learning styles-visual, auditory and kinesthetic. Visually inclined students are enriched with graphic and video-rich learning materials, while those who are kinesthetic gain hands-on experience through practical experiments (Utami et al., 2024). This not only enhances their understanding of scientific concepts but also allows them to be actively involved in the learning process.

The use of modern technologies such as computer simulations and educational apps has helped explain complex concepts in an engaging and accessible way, providing additional stimulus for students who may struggle with traditional methods. The application of these tools facilitates deeper understanding and allows for more interactive and engaging teaching (Rashidov, 2020).

The customization of tasks based on students' individual interests and abilities also shows a positive impact. By customizing projects and assessments, teachers have successfully encouraged students to be more engaged in the learning process. Research projects designed according to their interests have helped develop analytical and research skills, while providing opportunities to apply theory in real practice, strengthening understanding and engagement in the subject matter (Eikeland & Ohna, 2022).

Interviews with students showed a high level of satisfaction and enthusiasm for the new learning approach. Students feel that they are valued and their opinions are taken into account in the learning process, which strengthens the relationship between teachers and students and creates a supportive and positive learning environment. Classroom observations also showed increased student interaction and participation, indicating greater engagement and deeper interest in the material being taught.

Improvements in test scores and performance assessments reflect the effectiveness of the differentiated learning method. This approach not only supports students' academic needs but also develops critical and creative skills that are essential for success beyond the school environment. These skills, developed through research projects and student initiatives, prepare them for future challenges and help them become independent and innovative thinkers (Herwina, 2021).

The implementation of differentiated learning has also contributed to the establishment of an inclusive learning environment where every student, regardless of ability or background, has the opportunity to succeed. This approach is particularly important in the modern educational context, where adaptability and diversity are key to educational success.

Teachers at SDN 3 Pojok have shown tremendous commitment to inclusive education. They have been pioneers in the implementation of strategies that not only support academic needs but also enrich the overall learning experience. Continuous professional development has enabled them to stay up-to-date with the latest technology and innovative teaching strategies, ensuring that they continue to thrive as educators and are effective in teaching their students (Purnawanto, 2022).

Differentiated learning at SDN 3 Pojok has proven its effectiveness in supporting students' academic success and social development. With a responsive and inclusive approach, this school has successfully created a supportive environment where every student is given the opportunity to develop according to their potential. It sets a model for other schools in adopting a similar approach, with the potential to radically change the way we approach education in the modern era.

4. Conclusion

This research provides strong evidence that the application of differentiated learning in the implementation of Merdeka Curriculum in science lessons in grade 6 at SDN 3 Pojok is very effective in improving student understanding and accommodating diverse learning needs. The results show that through diverse and flexible strategies, teachers can create a learning environment that is responsive to students' individual differences. This success is inseparable from teachers' creativity and expertise in designing adaptive and innovative lesson plans.

Teachers at SDN 3 Pojok have shown great ability in providing a wide range of learning media and methods that can reach students with various learning styles, whether visual, auditory or kinesthetic. For example, for students with visual learning styles, teachers provide materials in the form of pictures, diagrams and videos that help them understand scientific concepts better. Meanwhile, for students with kinesthetic learning styles, teachers provide simple experiments that can be done in the classroom, so they can learn through hands-on experience. This approach not only improves students' understanding of the material, but also makes learning more interesting and fun.

Providing tasks that vary according to students' interests and abilities has also proven effective in increasing students' motivation and engagement in the learning process. For example, students who have a high interest in science

are given small, challenging research projects, while students who need more guidance are given additional exercises that match their level of understanding. This approach ensures that each student gets the attention and guidance appropriate to their needs, which in turn improves their learning outcomes.

In addition, the differentiated learning approach also encourages students to develop critical and creative thinking skills. In many cases, students are invited to be actively involved in the learning process, ask questions and find solutions to problems encountered. For example, through research projects and experiments, students are encouraged to think critically and find creative solutions to problems. This not only improves students' understanding of scientific concepts, but also develops critical and creative thinking skills that are essential in facing the challenges of the 21st century.

Critical and creative thinking skills developed through differentiated learning are essential in shaping students who are independent and able to think *out-of-the-box*. In a world that is constantly changing and full of new challenges, these skills become invaluable. Students who are able to think critically and creatively will be better equipped to deal with various situations and find innovative solutions to the problems they face.

However, to achieve more optimal results, teachers need to continuously develop their skills in designing and implementing differentiated learning. Continuous professional development and intensive training in differentiated learning strategies should be a priority. Teachers need to understand the various techniques and strategies that can be used to accommodate diverse learning needs. This training should also include the use of technology in differentiated learning, so that teachers can utilize the various tools and resources available to improve the quality of learning.

In addition, teachers must also be supported with adequate resources, both in the form of learning materials and educational technology, so that they can continue to innovate and improve the quality of learning. For example, access to technological devices such as computers, tablets and adequate internet access will enable teachers to integrate technology in learning and provide a variety of interesting and interactive learning resources for students. Support from the school and government is also crucial in providing these resources and ensuring that teachers have adequate access to continue to innovate in learning.

The development of teachers' skills in differentiated learning should also be supported by collaboration and cooperation between teachers. Teachers can share experiences, ideas and effective strategies in implementing differentiated learning. For example, teachers can work together in teams to design flexible and varied lesson plans, and share learning resources that can be used in learning. This collaboration not only reduces the workload of individual teachers, but also improves the quality of learning provided to students.

Overall, this research emphasizes the importance of differentiated learning as an effective approach in Merdeka Curriculum. By continuing to develop and refine this method, it is hoped that education in Indonesia can become more inclusive and quality, giving every student an equal opportunity to succeed and develop according to their potential. Differentiated learning allows teachers to accommodate diverse learning needs, create an inclusive and supportive learning environment, and develop students' critical and creative thinking skills that are much needed in the 21st century.

With the right support and cooperation between teachers, differentiated learning can help create a more inclusive and quality education. The implementation of Merdeka Curriculum with differentiated learning strategies is expected to create a more inclusive and quality education, giving every student an equal opportunity to succeed and develop according to their potential. This research provides strong evidence that with the right strategies, teachers can create more effective, enjoyable and meaningful learning experiences for all students.

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