

DIFFERENTIATED LEARNING STRATEGIES AND THEIR RELATIONSHIP TO INTEREST AND MATHEMATICS LEARNING OUTCOMES AT SDN KALIWATUBUMI

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ABSTRACT

This study was conducted to identify gaps in the literature related to the application of differentiated learning strategies in mathematics subjects, especially at SDN Kaliwatubumi with suboptimal learning conditions. Although the importance of this strategy has been widely discussed, there are still mistakes in its implementation so that its effectiveness has not been maximized. The research method used is a qualitative method. Research activities are carried out by exploring information related to differentiated learning at the research location, disclosing specific and detailed field data. The data collection techniques in this study are interviews, observations, and documentation. Structured interviews are conducted with classroom teachers to obtain data. The study successfully developed a UN (Sustainably Differentiated Learning) scheme that involves continuous stages, such as needs analysis, action plans, teacher training, implementation, and reflection, designed to increase students' interest and learning outcomes in a sustainable manner. The findings show that the UN is effective in improving the quality of mathematics education, both at SDN Kaliwatubumi and at the level of basic education in Indonesia in general. The implication of this study is the need for continuous evaluation so that the implementation of the UN can be optimized. This scheme also makes a significant contribution to the development of adaptive and inclusive mathematics learning methodologies, so that it can be applied more widely in other schools with similar conditions.

KEYWORDS

Differentiated Learning Mathematics Learning; Basic Education; Continuous Learning



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INTRODUCTION

Mathematics at the elementary school level plays an important role in building the foundation of students' cognitive abilities. From an early age, mathematics helps children develop logical thinking, problem-solving, and critical reasoning skills that form the basis for future learning. This ability is not only limited to the mastery of mathematics itself, but is also relevant in other subjects as well as daily activities. Through mathematics learning, students are trained to

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analyze information, identify patterns, and draw logical conclusions, all of which are essential skills in understanding the world around them.

However, learning mathematics is considered difficult for many students, resulting in low interest and learning outcomes. When learners find it difficult, they may tend to stay away from these lessons, which ultimately affects their overall cognitive development. This is also explained by Sari (2019) that mathematics learning involves many concepts that are related to each other. The connection between these concepts makes students often consider mathematics as an abstract and difficult to understand subject. However, mathematics has an important role in many aspects of life. The mathematics learning process includes two main activities that cannot be separated, namely learning and teaching. These two activities are integrated in a learning process, where there is interaction between teachers and students, as well as between students themselves.

In addition to Nurulaeni & Rahma (2022) that as one of the basic sciences, mathematics has an important role in daily life, whether we realize it or not, especially in solving problems and performing mathematical operations. Therefore, understanding mathematics needs to be built from elementary school so that students can think practically, critically, and be able to solve various relevant problems. However, mathematics learning at the elementary school level is often a scourge for students, because it causes various obstacles in the learning process. These problems can come from various factors, not only from students, but also from teachers who may use learning methods that are not suitable for the situation, lack of use of interesting learning media, or monotonous teaching methods. Therefore, the Merdeka Learning program brings a breath of fresh air for educators, especially elementary school teachers, to develop more diverse and innovative learning instruments and media. This is expected to improve the quality of mathematics learning and reduce problems that often arise in the classroom.

According to PISA data, according to Ismawati et al. (2023), the reading score (marked with a yellow line) reached 42% in 2006, then increased to 46% in 2009, dropped to 45% in 2012 and 2015, and experienced a significant decrease to 22.9% in 2018. For science scores (marked with a blue line), Indonesia gained 38% in 2006, dropped to 35% in 2009, then to 34% in 2012, rose to 45% in 2015, and fell back to 40% in 2018. Achievement in mathematics (marked by a green line) was 34% in 2006, experienced a drastic decline to 23% in 2009, increased slightly to 24% in 2012, rose quite significantly to 32% in 2015, but declined again to 28.1% in 2018. This data shows that in the five times Indonesia has participated in PISA, this country has never achieved a score of 50% in reading, science, or mathematics.

In addition, responding to the above data, the results of Indonesia's mathematical achievement in PISA show significant fluctuations but are consistently below the 50% mark, even reaching a low of 23% in 2009. Although there was an increase to 32% in 2015, the figure fell again to 28.1% in 2018. This data reflects a major challenge in efforts to improve the quality of mathematics learning in Indonesia. This decline in mathematics scores shows that there is an urgent need to evaluate learning approaches and develop more effective strategies, both in terms of teaching methods and the use of technology, so that students can better understand and apply mathematical concepts in practice. This is very

important so that Indonesia is able to increase the competitiveness of students at the international level and prepare them for future challenges.

At SDN Kaliwatubumi, learning mathematics is often a challenge for students, especially when they are faced with story problems that require deeper analysis and understanding. Students often have difficulty understanding basic mathematical concepts, which causes them to be less able to solve problems that involve analysis. As a result, teachers have to work hard to repeat the explanation, in the hope that students can grasp the material being taught. However, the low interest of students in learning mathematics adds to the complexity of this problem. When interest in learning is low, students tend to be not actively involved in the learning process, so their understanding of mathematical concepts becomes limited.

To answer these challenges, a learning strategy is needed that is able to accommodate the basic needs of students in mathematics. This strategy must be designed to increase understanding of basic concepts, as well as attract students' interest to be more actively involved in the learning process. With the right approach, such as differentiated learning, it is hoped that students can gain a better understanding and be more confident in facing various types of questions, including story problems that require analysis. One of the strategies considered that is in line with 21st century learning is differentiated learning. According to the results of research from Onyishi and Sefotho (2020), differentiated learning involves using various approaches in the same classroom to meet the differences in talents, needs, and experiences of each student. By knowing that each student has different abilities, readiness, and interests, teachers can meet the needs of students with different skill levels in a single class.

Mendamenda from a philosophical point of view, according to Umayrah et al. (2024) that learning is different from the perspective of constructivist educational philosophy, related to what each student knows. Constructivism encompasses a learning process in which learners must build their knowledge through pre-existing knowledge and experience. In the learning process, teachers play a role in helping students to reconstruct information by presenting meaningful learning. This meaningful learning requires teachers to organize learning by considering the uniqueness of each student, because each student is a different individual. This approach is referred to as differentiated learning. The implication of this study is to provide knowledge to readers, especially teachers and prospective teachers, that the philosophy of constructivist education can be a guide in learning theory for the application of differentiated learning. Thus, it is hoped that it can help the quality of learning, which means improving human resources in Indonesia and supporting the achievement of national development goals.

In addition, according to Halimah et al. (2023) differentiated learning is an approach that offers different types of materials, resources, and learning activities in various ways. This method is rooted in the awareness that each student has a different learning style, interests, and expertise. Thus, the differentiated learning process is adjusted to the needs, interests, talents, and skills of each student. According to Insani and Munandar (2023), this strategy can help improve student learning outcomes. Differentiated learning is a new paradigm that involves creating a learning plan that suits the needs and characteristics of students within the framework of an independent curriculum. The learning process can be more effective by implementing one or more differentiated elements, such as content,

processes, products, and learning environments. Ultimately, this will improve student learning outcomes.

Differentiated learning is a method that meets the learning needs of students. Teachers act as facilitators and adapt teaching methods to the needs of each student because each student has different characteristics. As a result, the same treatment cannot be widely applied. Because differentiated learning is not just about providing different actions for each student or differentiating between good and poor performers, teachers must consider what strategies are appropriate to implement. Differentiated learning is beneficial for schools, classrooms, and especially students. Student needs can be hampered if they are not met (Amalia et al., 2023).

More specifically for mathematics learning, the results of research conducted by Syarifuddin and Nurmi (2022) show that the application of differentiated learning has succeeded in improving student learning outcomes. In this process, some students showed significant progress after learning in the second cycle. The application of this learning involves grouping students' abilities, developing materials that vary according to their respective ability levels, and a more intensive individual approach, so that it can encourage an increase in students' understanding of mathematics subjects. This is because content differentiation refers to the material that students understand and learn, which can be tailored based on their individual interests, abilities, and needs, so that teachers can offer appropriate variations in difficulty levels. Meanwhile, process differentiation focuses on the methods that learners use to acquire information and learn, including strategies such as group discussions and the use of technology that allows the exploration of the material in the way that works best for them. Finally, product differentiation has to do with the results that learners produce after studying the material, such as a project or presentation, that demonstrate their understanding of the concepts being taught.

This study aims to identify gaps in the literature related to the application of differentiated learning strategies in mathematics subjects, especially in schools with suboptimal learning conditions. Although various studies have addressed the importance of differentiated learning, there are still few studies that specifically examine how this strategy can be implemented effectively in the context of mathematics learning at the primary school level, particularly at SDN Kaliwatubumi. By filling this research gap, this research is expected to provide new insights into best practices that can be applied in the field.

In addition, this study also aims to develop a scheme for the implementation of differentiated learning strategies that are relevant and practical for mathematics subjects at SDN Kaliwatubumi in a sustainable manner. With a systematic and structured approach, it is hoped that this scheme will not only increase students' understanding of the material, but also increase their interest and motivation in learning. The novelty resulting from this research will make a significant contribution to the development of a more inclusive and adaptive mathematics learning methodology, and can be used as a reference for other schools with similar challenges on a sustainable basis.

RESEARCH METHOD

This study applies a qualitative research methodology, which is a method of organizing data that produces output in the form of textual narratives, as explained by Creswell (2007). The research focuses on gathering in-depth information on differentiated learning, with an emphasis on the disclosure of specific and detailed field data.

The main purpose of the study is to analyze and understand various phenomena related to the implementation of differentiated learning at the elementary school level (Given, 2008). In the context of this qualitative research, the researcher plays the role of the main instrument in observing and analyzing the implementation of differentiated learning in the school environment (Sugiyono, 2017).

The methodology used is qualitative descriptive, which aims to systematically describe the learning conditions at the research site and present them in the format of a scientific report. The research was conducted at SDN Kaliwatubumi involving two key respondents: a teacher and a principal.

Data collection is carried out through three main methods: interviews, observations, and documentation. Structured interviews with teachers and principals are conducted to obtain information about the planning and implementation of differentiated learning. This study specifically examines three aspects of differentiated learning: content, process, and product, including observation of the implementation of these three aspects by teachers in learning activities.

To ensure the validity of the data, the study uses qualitative data analysis which includes three stages: data reduction, data presentation, and conclusion drawn. This process is complemented by data triangulation to increase the validity of research results.

RESULT AND DISCUSSION

Differentiated learning can be an effective solution to increase students' interest and learning outcomes in mathematics, especially at SDN Kaliwatubumi which faces challenges in understanding basic mathematical concepts. In these schools, the condition of mathematics learning is often poorly understood by students, especially when they are faced with story problems that require in-depth analysis. As a result, teachers must repeatedly explain the material for students to understand, which often leads to boredom and lack of motivation.

In situations like these, the use of differentiated learning approaches can help create a more engaging and relevant learning atmosphere for students. By adapting the teaching approach to the needs and characteristics of students, teachers can provide materials that are more varied and according to each student's level of understanding. This can not only increase students' interest in math but also help them understand the basic concepts needed to understand math well. As a result, differentiated learning allows SDN Kaliwatubumi to improve the quality of mathematics education by maximizing students' potential and improving their overall learning outcomes.

Differentiated learning is very important to explore students' potential, especially in mathematics subjects. With this approach, teachers can tailor teaching methods to suit each student's unique needs, learning styles, and abilities. This not

only helps students understand math material more easily, but also gives them room to develop according to their respective talents and interests. In addition, according to Dikdas (2021) that elementary school students have unique characteristics, with an age range of 6 to 12 years that are in an important developmental stage. In implementing differentiated learning, teachers need to understand students' initial abilities, thinking skills, and psychomotor aspects. In addition, socio-cultural backgrounds as well as personality differences, such as feelings, attitudes, and interests, must also be considered to support effective learning.

In addition to developing students' potential, differentiated learning is also important to increase interest in learning mathematics. Interest in learning plays a big role in the learning process, because students who are interested are more likely to be active and motivated to understand the material. By adjusting the learning approach according to the needs and interests of students, teachers can create a more attractive environment, so that students are more interested in exploring mathematics and achieving better learning outcomes. Therefore, according to Naldi et al. (2023), the learning process will be more effective if it is supported by student interests. Interest in learning can affect learning outcomes, so it is very important for teachers to design learning that suits students' interests and needs. In addition to using differentiated learning, interest can be increased through various activities, such as applying learning methods that suit students' preferences, for example through play activities while learning.

In addition, a study by Aprima, D., & Sari, S. (2022) shows that the application of differentiated learning in mathematics subjects at the primary school level has been very effective, as shown by the improvement of students' understanding of each indicator assessed in the study. In addition, differentiated learning has proven to be more engaging than alternative methods, as it uses a variety of teaching media that are specifically designed to suit each student's unique learning style. This leads to increased student involvement in the learning process. This differentiated learning strategy can be applied effectively at SDN Kaliwatubumi. The findings from the systematic review show that the application of this method has great potential to increase students' interest and achievement in mathematics. This is especially relevant at SDN Kaliwatubumi, where there is a need to increase students' interest in mathematics and their understanding of basic concepts.

Differentiated Learning Strategy Implementation Scheme

After conducting in-depth data analysis through *systematic review*, this study reveals the urgent need to develop and implement differentiated learning strategies in the context of mathematics learning at SDN Kaliwatubumi. These findings show that while the strategy has great potential, its success requires sustained efforts to ensure its effective and maximum implementation. Thus, a systematic and sustainable implementation scheme is needed to increase students' interest and learning outcomes, as well as to create a more inclusive and adaptive learning environment. Below is a scheme for the implementation of differentiated learning strategies in the form of concept development secured as Sustainable Differentiated Learning (PBB).

In the context of Sustainable Differentiated Learning (UN), the role of teachers is vital, especially in utilizing classroom action research as a tool to improve learning effectiveness. Through classroom action research, teachers can identify and analyze the needs and challenges faced by students in the implementation of differentiated learning. This approach not only provides in-depth insights into how best to tailor teaching to students' diverse learning styles, but also serves as a means to continuously develop learners' abilities and improve their learning outcomes. Thus, the UN based on classroom action research is expected to create an adaptive and responsive learning environment to the individual needs of students.

According to Yamin et al. (2024), classroom action research (PTK) can be effectively applied to almost all teaching methods and models to improve the quality of learning. This can be measured through student participation, student creativity, and learning outcomes achieved. The importance of PTK cannot be overlooked, especially when it comes to learning methods designed to improve the quality of teaching and produce good learning outcomes. By conducting PTK, teachers can identify the most effective approaches and continuously adapt teaching strategies to meet the needs of students and achieve higher educational goals.

In addition, because of their responsibilities as educators, teachers are required to improve their taught knowledge, better teaching abilities, and skills in the use of technology. Therefore, teachers must be trained to maximize the implementation of the UN plan. The results of research conducted by Imawan and Ismail (2020) show that teachers are an important component in supporting the educational process in Indonesia. However, without a deep understanding of the importance of updating learning insights, teachers will be stuck in an era of disruption. In addition, the need for learning media facilities for students continues to increase every year. In addition, teachers still lack the use of technology. This is due to the lack of knowledge about the learning technologies necessary to support an effective learning process. As a result, the purpose of this training is to improve mathematics teachers' understanding of learning applications in the Learning Era 4.0 and beyond.

In addition, in addition to PTK capabilities and teacher training, an understanding of the *Sustainable Development Goals* 2030 (SDGs 2030) also needs to be known as an effort by the world, including Indonesia, to advance the education sector in all regions of the Republic of Indonesia. Therefore, according to Ramadan (2023), Sustainable Development Goal (SDGs) No. 4 focuses on ensuring inclusive, equitable, and quality education, as well as promoting lifelong learning opportunities for all. SDGs No. 4 aims to create a safe and comfortable learning environment for all students, including children, individuals with disabilities, and women, by emphasizing the importance of educational facilities that are free from violence and discrimination. In addition, this goal encourages increased access to student scholarships for students from developing countries and strengthening the number of qualified teachers through international cooperation. Thus, SDGs No. 4 has a crucial role in advancing education, as it helps create an education system that is not only quality, but also able to meet the needs of diverse students, promote social justice, and support sustainable development in Indonesia.

Discussion of the Scheme for the Implementation of Sustainable Differentiated Learning Strategies

Analysis of school needs and conditions is a crucial first step in designing differentiated learning at SDN Kaliwatubumi. This process begins with data collection through surveys or interviews involving teachers, students, and parents. The goal is to identify specific challenges and needs in mathematics learning, such as limited facilities, student interests, or learning obstacles experienced. After that, an evaluation of current strengths and weaknesses is carried out, where positive aspects such as students' enthusiasm can be identified along with weaknesses such as lack of interesting teaching materials. This information is an important basis for developing the right learning strategy, ensuring that the efforts made are aligned with the real needs in the field.

After analyzing the needs, the next step is the preparation of an action plan. In this stage, teachers need to set clear and specific learning goals in the context of mathematics learning using differentiated strategies. The designed learning plan must include a variety of diverse methods and activities, so that it can meet the needs of diverse students. For example, teachers can provide assignments of different difficulty levels, visual aids, and small group activities to encourage collaboration. The preparation of this action plan is important so that all students can actively participate and obtain learning experiences that suit their respective learning styles.

Teacher training is an important element in the implementation of differentiated learning strategies. In this stage, workshops and training are held to equip teachers with knowledge and skills in designing learning that is interesting and in accordance with the needs of students. During the training, teachers can learn about different teaching approaches, the use of technology in learning, and how to adapt teaching materials. Additionally, encouraging teachers to share their best practices creates a supportive learning community, where one teacher's experience can provide inspiration and solutions for other teachers in facing challenges in the classroom.

Implementation in the classroom is the phase in which differentiated learning strategies are applied directly. This learning method should be applied gradually, starting with the formation of small groups for practice and discussion. Through this approach, students can be actively involved in the learning process and learn from each other. Monitoring and evaluation are also very important at this stage, by conducting regular evaluations to monitor student progress. The use of flexible assessment rubrics allows teachers to assess students' understanding and progress more accurately, as well as adjust learning based on the results of the evaluation.

After each learning cycle, collecting feedback from students and teachers is no less important. This feedback provides insight into the effectiveness of the methods used and areas that need improvement. Conducting a joint reflection session is also an integral part of this process, where teachers can discuss their experiences, share successful practices, and observe the challenges faced. This process of reflection allows teachers to learn from their own experiences as well as support continuous professional development.

Continuous improvement is the stage where the learning plan that has been implemented is revised based on the feedback and evaluation that has been carried

out. This aims to increase the effectiveness of the strategies implemented, so that learning can continue to be improved. In addition, the development of teaching materials that are more varied and in accordance with the needs of students is also the main focus. This can include the use of the latest technology, educational games, or additional relevant learning resources. By making continuous improvements, teachers can ensure that students' learning experiences are always updated and more relevant to the latest developments.

Long-term development includes efforts to build learning communities that support math learning outside of the classroom. Teachers and parents can join online discussion groups or regular meetings to share information and experiences. In addition, planning extracurricular activities such as math competitions, workshops, or math clubs can encourage students to delve deeper into the lesson outside of school hours. Classroom action research can also be encouraged to be carried out by teachers, the results of which can be published as a reference for other schools. With this long-term development approach, it is hoped that a sustainable and innovative educational ecosystem can be created, which contributes to the progress of mathematics learning at SDN Kaliwatubumi.

Once all the stages are in place, this differentiated learning scheme can be repeated and reapplied to other classes, other teachers, and even other schools. This process creates a continuous cycle in which the experience and results gained from one class can be the basis for application in the next class. In this way, every teacher can contribute to improving the quality of education in their school, while also sharing best practices with peers at other institutions. Through the repetition of this scheme, it is hoped that a dynamic and responsive learning ecosystem will be created to the needs of students, as well as support sustainable efforts in advancing education in Indonesia.

CONCLUSION

This study shows that the application of differentiated learning can be carried out effectively in mathematics learning at SDN Kaliwatubumi to increase students' interest and learning outcomes. This research contributes to offering new insights into best practices that can be applied in the field.

In addition, this research also succeeded in developing the concept and scheme of sustainable differentiated learning (PBB) which includes steps to analyze school needs and conditions, prepare action plans, train teachers, implement in the classroom, feedback and reflection, continuous improvement, and replication and dissemination of models. This scheme is designed to be used sustainably, so that it can ensure the quality of mathematics education at SDN Kaliwatubumi and also basic education in Indonesia. With a systematic and structured approach, it is hoped that this scheme will not only improve students' understanding of mathematics material, but also motivate them to learn more actively and enthusiastically.

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