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Implementation of Differentiated Learning to Improve Student Learning Results on Algebra Operations Material

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Abstract

Differentiated learning is an important strategy in the world of education to address the challenges of student heterogeneity, especially in algebraic operations material which requires a strong understanding of concepts and procedures. This research aims to analyze the implementation of differentiation learning in improving student learning outcomes in Mathematics subjects on the subject of Algebra operations. This research uses differentiated learning involving three elements, namely visual, auditory and kinesthetic. This research is classroom action research which is divided into two cycles and begins with a pre-cycle. Each cycle consists of planning, implementing actions, observing, evaluating, and reflecting. The research was carried out on class VIIA odd semester students at MTs Persis Benda for the 2024/2025 academic year. As for the results of research carried out on 31 students, in the pre-cycle activities the number of students who completed was 5 students (16.13%), while 26 students who did not complete it were 26 students (83.87%), with an average score of 51.16. In the first cycle, students experienced an increase, the number of students who completed was 17 students (54.84%) while 14 students who had not completed it were 14 students (45.16%) with an average score of 66.65. Then in cycle II there was a very high increase compared to the previous cycle, namely 28 students who had reached the KKM (90.32%), while 3 students who had not yet completed it, with an average score of 80.71. The results of this research show that the application of differentiated learning can improve Mathematics learning outcomes in algebraic operations material for class VIIA odd semester students at MTs Persis Benda for the 2024/2025 academic year.
Keywords: Algebraic Operations, Differentiated Learning, Learning Outcomes

Abstrak

Pembelajaran berdiferensiasi menjadi strategi penting dalam dunia pendidikan untuk menjawab tantangan heterogenitas siswa, terutama pada materi operasi aljabar yang memerlukan pemahaman konseptual dan prosedural yang kuat. Penelitian ini bertujuan untuk menganalisis implementasi pembelajaran berdiferensiasi dalam meningkatkan hasil belajar siswa pada mata pelajaran Matematika pokok bahasan operasi Aljabar. Penelitian ini menggunakan pembelajaran berdiferensiasi dengan melibatkan tiga unsur yaitu visual, auditori, dan kinestetik. Penelitian ini merupakan penelitian tindakan kelas yang dibagi menjadi dua siklus dan di awali dengan prasiklus. Setiap siklus terdiri dari perencanaan, pelaksanaan tindakan, observasi, evaluasi, dan refleksi. Penelitian dilaksanakan pada siswa kelas VIIA semester ganjil di MTs Persis Benda Tahun Pelajaran 2024/2025. Hasil penelitian yang dilaksanakan pada 31 siswa, pada kegiatan prasiklus jumlah siswa yang tuntas adalah 5 siswa (16,13 %), sedangkan siswa yang belum tuntas 26 siswa (83,87%), dengan nilai rata-rata 51,16. Pada siklus I siswa mengalami peningkatan, jumlah siswa yang tuntas 17 siswa (54,84%) sedangkan siswa yang belum tuntas berjumlah 14 siswa (45,16%) dengan nilai rata-rata 66,65. Pada siklus II mengalami peningkatan yang sangat tinggi dibandingkan dengan siklus sebelumnya yaitu siswa yang sudah mencapai KKM berjumlah 28 siswa (90,32%), sedangkan siswa yang belum tuntas berjumlah 3 siswa (9,68%) dengan nilai rata-rata 80,71. Hasil penelitian ini menunjukan bahwa penerapan pembelajaran berdiferensiasi dapat meningkatkan hasil belajar Matematika materi operasi aljabar pada siswa kelas VIIA semester ganjil di MTs Persis Benda Tahun Pelajaran 2024/2025.
Kata kunci: Hasil Belajar, Operasi Aljabar, Pembelajaran Berdiferensiasi.

INTRODUCTION

Student learning outcomes are one of the primary benchmarks for the success of the learning process. Learning outcomes not only reflect the extent to which students master the material but also indicate how well the teaching is designed and implemented by educators (Idrus, 2019). Learning outcomes refer to students' acquired abilities after undergoing the learning process, marked by positive changes in cognitive, affective, and psychomotor aspects (Haratua et al., 2024).

Each student has different characteristics, such as intelligence levels, talents, interests, learning needs, readiness, and learning styles. These differences require teachers to consider individual variations to ensure effective learning (Muktamar et al., 2024). For example, in a mathematics class, some students may grasp algebraic operations more easily through visual approaches like diagrams, while others prefer hands-on exploration using concrete manipulatives such as algebra tiles (Hidayat, Imami, Liu, Qudratuddarsi, and Saad, 2024). Some students understand concepts better through group discussions or interactive Q&A sessions. Teachers can group students based on their learning styles and design diverse activities to ensure each student has an optimal learning experience (Ridwan, 2021). For instance, teachers can provide different assignments for visual and kinesthetic learners, ensuring all students feel engaged and valued in the learning process. Traditional teaching methods, which often overlook these variations, need to be reevaluated, prompting teachers to enhance their skills by adopting various instructional approaches to meet the diverse learning needs of students (Dhanesti et al., 2024).

One approach that can be used to tailor learning to students' individual needs is differentiated learning. Differentiation in education refers to adjusting instruction to align with students' learning styles (Wulandari, 2022). This approach allows teachers to design flexible and adaptive learning strategies so that each student can learn according to their potential. The implementation of differentiated learning has been proven to offer more meaningful progress compared to conventional learning in developing students' mathematical problem-solving abilities (Afdillah et al., 2024).

Differentiated learning is recognized as an effective approach to aligning educational processes with diverse student learning styles, helping to overcome common learning barriers (Masrukhah et al., 2024). This approach aims to accommodate student differences by modifying learning content, processes, and products. It not only groups students based on ability but also encourages their active involvement in learning according to their interests and learning styles. Differentiated learning also provides teachers with the opportunity to better understand each student's potential and needs (Ananda et al., 2024). Understanding students' strengths and weaknesses individually allows teachers to design more relevant and challenging learning activities without neglecting students with special needs (Aprisal, Supriadi, and Anaguna, 2024). This approach can help bridge gaps in students' understanding of fundamental concepts, especially in algebraic operations, which often pose challenges for many learners.

Mastery of algebraic operations and mathematical modeling positively influences students' ability to solve linear equations in two variables (Antari et al., 2024). Thus, mastering algebraic

operations is crucial for students, as it serves as a prerequisite for several other mathematical topics. Algebraic operations are an essential part of the mathematics curriculum at the secondary school level and play a crucial role in developing mathematical problem-solving skills (Rasiman & Asmarani, 2016).

Considering the importance of algebraic operations and the challenges of student diversity in the classroom, this article aims to analyze the implementation of differentiated learning to improve student learning outcomes in algebraic operations. This study also evaluates how well this approach can address classroom diversity challenges while providing effective solutions for optimizing mathematics learning. With a student-centered approach tailored to individual needs, it is expected that not only will learning outcomes improve, but a more enjoyable learning environment will also be created.

METHOD

The subject of this classroom action research is the seventh-grade students (Class VIIA) at MTs Persis Benda during the odd semester of the 2024/2025 academic year, consisting of 31 male students. This research is divided into two cycles, beginning with a pre-cycle stage, followed by Cycle I and Cycle II, spanning a total duration of three weeks. The pre-cycle stage was conducted on Monday, October 28, 2024, while Cycle I took place on Monday, November 4, 2024, and Cycle II was carried out on Thursday, November 21, 2024. The research was conducted at MTs Persis Benda, focusing on the topic of Algebraic Operations.

Referring to the model developed by Kemmis and McTaggart (Suwartiningsih, 2021), there are four stages in Classroom Action Research (CAR): planning, implementation, observation, and reflection. In the planning stage, the first step is to carefully and thoroughly design the research. This process involves three fundamental activities: identifying existing problems in learning, clearly formulating those problems, and planning appropriate solutions. Each of these activities includes sub-activities that support the completeness of the planning stage. Once the planning is completed, the next stage is implementation. In this phase, the researcher applies the planned strategies within the classroom context. The purpose of this implementation is to execute the learning strategies designed in the planning stage. The next stage is observation, where the researcher collects data to evaluate the effectiveness of the implemented actions in achieving learning objectives. Observation is conducted by recording the types of data collected, as well as the methods and instruments used, such as tests, questionnaires, or direct observation. Finally, the reflection stage involves reassessing what has been carried out during the research cycle. In this reflection process, the researcher contemplates the experiences and evaluates the results. This process is similar to looking into a mirror to understand the weaknesses and shortcomings of the actions taken. Consequently, the outcomes of this reflection serve as a foundation for improving and developing further actions in the next cycle. Below is an illustration of the four steps of CAR conducted by the researcher.

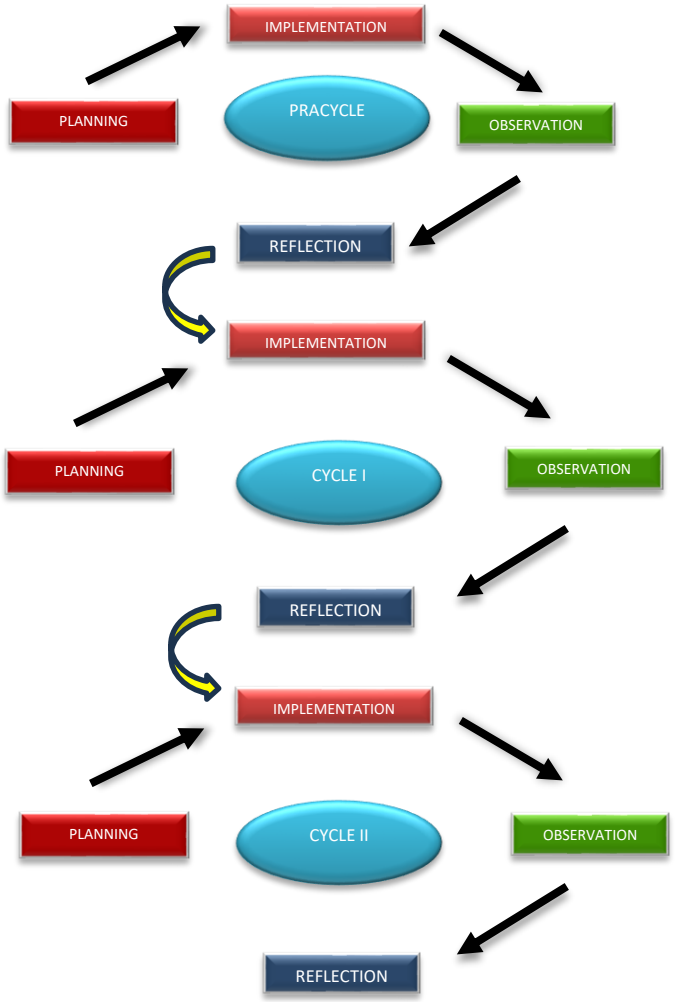

Figure 1. PTK implementation flow refers to the Kemmis and Taggart model

RESULT

1. Pre-cycle Learning Outcomes

Pre-cycle results based on the results of pre-cycle learning formative tests on 31 students, the results were far from expectations, because there were still many students whose results were still below the KKM. The completeness that students must achieve is 70 as can be seen in Table 1

Table 1. Pre-cycle Student Learning Outcome Data

No	Aspect	Description
1	Total Students who took the Test	31 Students
2	Complete	16.13% (5 Students)
3	Not Complete	83.87 % (26 Students)
4	Total Score	1586
5	Lowest Value	20
6	The highest score	82
7	Average value	51.16

Table 1 illustrates the students' test results, showing that the highest score achieved was 82, while the lowest score was 20. The overall average score of the students was 51.16, indicating that most students had not yet met the minimum mastery criteria. This is evident from the dominance of students who did not achieve mastery, totaling 26 students (83.87%), compared to only 5 students (16.13%) who met the criteria.

According to Herwina (2021), the low learning outcomes are suspected to be due to students' lack of attention to the lessons delivered by the teacher. To improve students' understanding of mathematics, particularly algebraic operations, corrective measures are necessary through the implementation of differentiated learning (Wulandari, 2022). This differentiated instruction is designed to accommodate the diverse learning needs of students. The learning improvements were carried out through Classroom Action Research (CAR), which consisted of two stages: Cycle I and Cycle II. Each cycle aimed to gradually enhance students' learning outcomes through a more adaptive and interactive approach.

2. Cycle I Learning Results

After learning was carried out in the pre-cycle, it was seen that students' mathematics learning outcomes had improved in the first cycle with the application of differentiated learning. This strategy allows each student to learn according to their abilities and needs, so that the learning process becomes more effective and focused. The following are the results of cycle I student mathematics learning using the application of differentiated learning.

Table 2. Cycle I Student Learning Outcome Data

No	Aspect	Description
1	Total Students who took the Test	31 Students
2	Complete	17 Students
3	Not Complete	14 Students
4	Total Score	2066
5	Lowest Value	43
6	The highest score	86
7	Average value	66.65

In the first cycle, observations indicated that the implementation of differentiated learning began to have a positive impact on students' learning outcomes. This approach allowed students to choose learning methods that suited their needs and abilities. According to Taylor (2015), differentiated learning is one way to demonstrate how educators can integrate teaching strategies to meet students' needs, interests, and learning styles by focusing on content, process, and product in instruction. In this study, the researcher applied differentiation in three main aspects: (1) Content, by providing varied learning materials; (1) Process, by assigning tasks based on individual abilities; and (3) Product, by offering interactive learning media options such as videos, group discussions, and creative worksheets.

Although there was an increase in the average score to 66.65 compared to the pre-action stage, students' understanding of algebraic concepts still varied significantly. This indicates that the learning strategy needs further refinement, especially in assisting students who have not yet

achieved mastery. Efforts in the next cycle will focus on increasing student engagement more actively and facilitating a deeper understanding of the material.

3. Cycle II Learning Results

After conducting the learning process in Cycle II, the following are the students' learning outcomes in Cycle II with the implementation of differentiated instruction on the topic of algebraic operations. The application of this strategy helps students gain a deeper understanding of algebraic operations according to their learning styles and levels of comprehension.

Table 3. Cycle II Student Learning Outcome Data

No	Aspect	Description
1	Total Students who took the Test	31 Students
2	Complete	28 Students
3	Not Complete	3 Students
4	Total Score	2502
5	Lowest Value	54
6	The highest score	100
7	Average value	80.71

The table 3 shows that student learning outcomes in cycle I have increased, although not yet optimal. The highest score achieved by students was 86, while the lowest score was 43, with an overall average score of 66.65. Of the total 31 students, 17 students (54.84%) were declared complete, while 14 students (45.16%) had not yet achieved completeness.

To achieve better results, more focused learning improvement steps are needed in the next cycle. The focus of improvement will include deeper teaching strategies and personalization of learning so that all students, especially those who have not yet completed, can understand the material better. One of the teaching and personalized learning strategies is the Individual Learning Strategy carried out by Intan and Kamaliah (2024). The results of their research show that the application of individual learning strategies can improve student learning outcomes. The differentiated learning strategy that researchers implemented at MTs Persis Benda is one of the efforts made to meet the diverse learning needs of students, both in terms of abilities, interests and learning styles. Through this differentiation, each student is given the opportunity to learn according to their individual potential, so that they can more easily understand the material being taught. This approach not only increases students' understanding, but is also expected to help them achieve optimal learning outcomes and increase overall learning completion to close to 100%.

DISCUSSION

Referring to the stages of cycle activities, the results of this research can be described as follows.

1. Planning

At the planning stage, the application of differentiated learning for the subject of algebraic operations was chosen as a strategy to overcome differences in student abilities in class. This learning is designed to provide various ways for students to understand new information, both in terms of accessing content, building understanding, and developing learning products and

assessments. This approach aims to ensure that all students, with diverse ability backgrounds, can learn effectively in inclusive classrooms.

2. Implementation

Implementation of learning based on the teaching modules that have been prepared is carried out by following predetermined procedures to achieve learning objectives optimally. At the pre-cycle stage, learning activities tend to be dominated by a teacher-centered teaching approach, where the teacher is the main center for delivering material. Students only act as passive listeners and recipients of information through classical teaching methods without involving much active interaction. This condition results in limited student involvement in the learning process, so that learning is less able to explore students' potential as a whole. This approach is felt to be less effective in meeting the diverse learning needs of students, so it becomes an important basis for designing more inclusive and interactive learning strategies at the next stage.

In cycle I, students are given the opportunity to observe slides and videos displayed via an LCD projector (content differentiation), followed by independent practice for students who already understand the material and small group discussions with teacher guidance for students who face difficulties (process differentiation). However, in cycle I, students still tended to be passive in participating in these activities, and product differentiation could not yet be seen. However, in cycle II, after observing slides and videos regarding algebraic operations and their applications in everyday life, almost all students were actively involved in this activity, and the class atmosphere even became more lively and dynamic. Differentiation of content, processes and products has been carried out well in cycle II.

3. Observation

Based on the analysis of the data that has been collected, conclusions are obtained regarding student learning outcomes. A recapitulation of student learning outcomes in each cycle using differentiated learning methods is presented in the following table. Table 4 depicts significant developments in students' achievement of learning mastery from the first cycle to the second cycle, which shows the effectiveness of this learning method in increasing students' understanding.

Table 4. Recapitulation of Student Learning Results

Description	Complete Students		Students incomplete		Average
	Frequency	%	Frequency	%	
Precycle	5	16.13	26	83.87	51.16
Cycle I	17	54.85	14	45.16	66.65
Cycle II	28	90.32	3	9.68	80.71

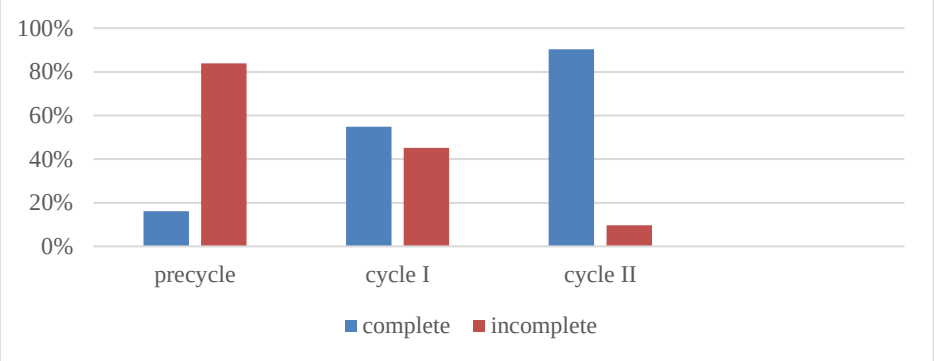

Figure 2. Comparison diagram of Pre-Cycle, Cycle I and Cycle II

Based on Diagram 2, it can be seen that at the pre-cycle stage, only 5 students (16.13%) achieved learning completeness, while 26 students (83.87%) had not yet completed it, with an average score of 51.16. In Cycle I, there was an increase, where 17 students (54.84%) succeeded in achieving completeness, while 14 students (45.16%) still did not complete it, with an average score of 66.65. A more significant increase occurred in Cycle II, with 28 students (90.32%) achieving completion, and only 3 students (9.68%) who had not yet completed, with the average score increasing to 80.71.

After implementing differentiated learning, student learning outcomes showed a significant improvement. This is in line with the results of research conducted by Nopiani et al. (2024) which shows that the implementation of the Problem Based Learning learning model with a differentiated learning approach is able to improve student learning outcomes as evidenced by the increase in student learning completion results, namely from pre-cycle 30%, then in cycle 1 there was an increase of 56% and cycle 2 an increase of 93%. Differentiated learning strategies allow teachers to present material in a way that is more adaptive to students' abilities and needs, thereby increasing their understanding. In this research, it is proven by an increase in the average student score at each stage. In the pre-cycle, the average value of 51.16 increased to 66.65 in Cycle I, and finally reached 80.71 in Cycle II. Based on these findings, it can be concluded that the implementation of differentiated learning in algebraic operations material has succeeded in improving student learning outcomes significantly from cycle to cycle.

4. Reflection

In the pre-cycle, student activities are still very minimal, with learning centered on the teacher. In Cycle I, student activities began to show development, although they were still limited to observing slides and videos delivered by the teacher via an LCD projector. However, student interaction in group discussions and active participation in learning activities is starting to appear, although it is not yet optimal.

Some students have started doing independent practice based on the material they watched on slides and videos with direction and guidance from the teacher. In Cycle II, apart from observing slides and videos, students start working on problem solving questions by developing concepts they have previously understood. In fact, in this cycle, students begin to produce products, such as summaries made by students during learning activities and portfolios containing completed assignments.

From a reflection perspective, the main challenge faced is the need for more time to design differentiated learning and align the strategies used with the applicable curriculum. The significant increase in learning outcomes shows the effectiveness of this learning approach, which is very relevant to the demands of the Independent Curriculum which prioritizes attention to the diversity of students' abilities in the classroom. Differentiated learning is the right solution to ensure that every student gets a learning experience that suits their potential and needs.

CONCLUSION

Based on the research results, it can be concluded that the implementation of differentiated learning proceeds through structured planning, implementation and evaluation stages. At the planning stage, teachers design learning by adapting content, processes and products according to student needs. The implementation stage is carried out by grouping students based on abilities and learning styles to provide relevant and meaningful learning experiences. This approach includes three main elements, namely content, process and product to suit student learning styles. This research was conducted using the classroom action research (PTK) method which was carried out in two cycles, starting with the pre-cycle. Each cycle involves the stages of planning, implementing actions, observing, evaluating, and reflecting. In terms of grades and results, it shows that at the pre-cycle stage, only 5 students (16.13%) achieved completion, while 26 students (83.87%) did not complete, with an average score of 51.16. In Cycle I, the number of students who achieved completeness increased to 17 students (54.84%), with an average score of 66.65. In Cycle II, a significant increase occurred, with 28 students (90.32%) reaching the minimum completion criteria (KKM), while only 3 students (9.68%) had not yet completed, and the class average score reached 80.71. These results prove that differentiated learning strategies are effective in improving student learning outcomes, especially in understanding algebraic operations material.

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