ANALYSIS OF ELEMENTARY SCHOOL STUDENTS' LEARNING ACTIVITY IN DIFFERENTIATED MATHEMATICS LEARNING

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ABSTRACT

Learning activity enhances learning effectiveness, including in differentiated instruction. This study analyzes student learning activity in mathematics using a differentiated approach in elementary schools. The research employs a qualitative descriptive method with one mathematics teacher and 25 fifth-grade students at SD Negeri Tanjungharjo. Data were collected through observation, interviews, and document analysis, then analyzed through data collection, reduction, presentation, and conclusion drawing. Observations show that differentiated mathematics learning has been well implemented. Key strengths include the availability of diverse learning resources, which are widely accessible and effectively utilized, and the provision of personalized and constructive feedback that supports student learning. However, challenges remain in defining clear and adaptable differentiated learning objectives and managing time effectively during lessons. Student activity is most evident in listening, where students show full engagement, while writing activities are less prominent, and oral participation remains moderate. Interviews indicate benefits such as increased engagement and better concept comprehension. Challenges include limited teacher training, varying student abilities, and restricted time for personalized instruction. Documentation analysis confirms alignment with differentiated learning principles, though inconsistencies exist. Challenges include time constraints, student ability differences, and resource needs. Teachers should undergo further training and refine time management strategies to enhance student engagement effectively.

Keywords: differentiated approach, elementary schools, mathematics learning, student's learning activity

INTRODUCTION

Student learning activity is one of the important indicators in determining the success of the learning process. Learning activity is a process of teaching and learning activities in which the subject is intellectually and emotionally involved so that he or she really plays a role and actively participates in carrying out learning activities (Yarissumi, 2017). Learning activity is shown by the involvement of students in various activities such as asking questions, answering questions, daring to appear in front of the class, and exploring information from various sources (Meri et al., 2023). Some indicators of student learning activity include: enthusiasm for participating in learning, daring to ask questions, daring to answer questions, daring to present work results, being involved in discussions and never giving up in doing assignments (Rikawati & Sitinjak, 2020). Learning activity in the context of basic education reflects the extent to which students are physically, emotionally, and cognitively involved in learning activities. This activeness not only shows the motivation of students, but also how teachers manage to create a supportive learning environment. In mathematics learning, which is often considered difficult and challenging by many students, active learning is a challenge that requires special attention.

Referring to the results of the research, learning activity is one of the important factors that affect student learning achievement (Sudipa et al., 2022). It was also added that students who are active in learning tend to have better learning outcomes than passive students (Marzuqoh et al., 2020; Meri et al., 2023). Therefore, teachers need to strive for learning strategies that can increase student learning activity, such as the use of student-centered learning models (Pramudito et al., 2023; Prasetya et al., 2021). Differentiated math learning is an approach designed to accommodate a diversity of students' abilities, interests, and learning styles. This approach focuses on providing each student with a relevant and meaningful learning experience, so that they can learn in the most effective way for them. In differentiated learning,

teachers play the role of facilitators who design learning activities with a variety of methods, materials, and evaluations, so that each student can be optimally engaged.

Although differentiated learning has been widely promoted, research on its practical implementation in mathematics classrooms, particularly in elementary schools, remains limited. SD Negeri Tanjungharjo as the research location presents a unique context due to the diverse academic abilities of its students and the challenges faced by teachers in implementing differentiated learning effectively within the constraints of classroom settings. Teachers often struggle with time management, adapting learning objectives to varying student needs, and ensuring that all students remain actively engaged in learning. These challenges highlight the need for a deeper exploration of how differentiated learning is applied in real classroom settings and how it influences student learning activity.

The application of differentiated learning requires a holistic approach, starting from the introduction of student profiles, the preparation of relevant goals, the provision of various learning resources, to the use of appropriate assessment methods. Identification of student profiles is essential in differentiated learning, as teachers need to understand students' readiness, interests, and learning styles in order to tailor learning methods and materials to their needs (Evendi et al., 2023; Trisnani, Zuriah, et al., 2024). The formulation of learning objectives must also be tailored to the needs of students, not only focusing on the end result, but also on the process that allows students to develop according to their pace and learning style (Aprima & Sari, 2022; Rasdi et al., 2023). In addition, the provision of diverse learning resources, such as learning media, technology and additional materials, is important to support learning that suits the various needs of students. The management of diverse learning activities, such as discussions, projects, or practical exercises, can increase students' liveliness and allow them to participate more actively in learning (Alfath et al., 2023; Martiana, 2023; Rasdi et al., 2023). Finally, assessments that are appropriate to the student's learning profile are important to accommodate differences in students' styles and abilities, as well as provide constructive and personalized feedback to support further improvement and development(Alfath et al., 2023; Aprima & Sari, 2022; Herwina, 2021).

Differentiated mathematics learning provides opportunities for students to be more active in learning in a way that suits their needs and potential (Trisnani, et al., 2024). The diversity in teaching methods and activities provided allows students to explore learning materials in a more in-depth and meaningful way. Student activeness in differentiated mathematics learning can be realized through activities such as group discussions, independent problem solving, and the use of interactive learning technology.

The success of differentiated mathematics learning is highly dependent on the role of teachers in understanding students' learning profiles and their ability to manage diverse learning activities. Therefore, the two mains focus that are of concern to the researcher are: 1) how is the implementation of differentiated learning carried out by teachers?, and 2) how is the student's learning activity in the application of differentiated mathematics learning? By understanding the relationship between the implementation of differentiated learning and student learning activity, this research can provide practical recommendations to increase student engagement in mathematics learning. Furthermore, the results of this research are expected to contribute to the development of a more inclusive and student-centered learning model, thereby creating meaningful learning experiences and supporting the achievement of optimal learning outcomes.

METHODS

Type of Research

This study uses a qualitative descriptive approach to analyze the learning activities of elementary school students in differentiated mathematics learning, with the aim of exploring in depth their involvement and interaction in the classroom. The research design used was a case study, which focused on a class of fifth-grade students at an elementary school that applied differentiated learning in mathematics.

Research Subject

The research employs a qualitative descriptive method involving one mathematics teacher and 25 fifth-grade students at SD Negeri Tanjungharjo. The study participants selected using a purposive sampling technique to represent diverse learning profiles, including readiness, interests, and learning styles, as well as classroom teachers as informants. The following are the demographics of the research subjects.

Table 1. Summary of Demographic Characteristics of Research Participants

Category	Detail		
Number of Participants	25 students and one classroom teacher		
Learning Readiness	High (40%), Medium (40%), Low (20%)		
Learning Interest	Math (24%), Science (16%), Arts (16%), Sports (12%), Technology (16%), Language (16%)		
Learning Style	Visual (36%), Auditory (28%), Kinesthetic (24%), Visual-Kinesthetic Combination (12%)		
Student Gender	Male (48%), Female (52%)		
Student Age	10 years (60%), 11 years (40%)		
Classroom Teacher	Female, age 35, teaching experience 10 years, academic qualification: Bachelor Mathematics Education		

Data Collection

Data were collected using three main instruments: an observation checklist to record student engagement during lessons, semi-structured interview guidelines to gain insights from students and teachers, and documentation such as teaching modules and student work. Data collection was carried out for four weeks through classroom observations, interviews conducted after learning, and document analysis. Based on the modules designed according to the principles of differentiated learning (Tomlinson, 2017; Alfath et al., 2023; Martiana, 2023; Rasdi et al., 2023; Aprima & Sari, 2022; Herwina, 2021) and national curriculum guidelines, which ensure that every aspect of differentiated learning is comprehensively covered, the following are the expected activities for each differentiation aspect:

Table 2. Activities aspect in Differentiated Learning

Activities in Differentiated	Indicators	Item Number
Learning		
Opening Activities	- Identifying student profiles (readiness, interests, learning styles)	1,2,3
	- Setting differentiated learning objectives	4,5,6
Main Activities	- Providing diverse learning resources	7,8
	 Managing diverse learning activities 	9,10
	- Using learning strategies that consider learning styles	11, 12
	- Implementing assessments tailored to students' learning profiles	13, 14
Closing Activities	- Providing personalized and constructive feedback	15,16
	- Managing flexible learning time	17,18

The indicators of student learning activity used in this study are based on the frameworks proposed by Rikawati & Sitinjak (2020), Yarissumi (2017), and Meri et al. (2023). These indicators encompass various aspects of learning activity, including visual aspects, oral aspects, listening aspects, writing aspects, and practical aspects. Each of these components plays a crucial role in assessing students' engagement and participation in the learning process.

Data Analysis

Data analysis and interpretation are carried out through four stages: data collection, reduction, presentation, and conclusion drawn. Data collection involves classroom observations, interviews with students and teachers, and documentation analysis. The collected data is then reduced to identify information that is relevant to the focus of the analysis, namely the student's activeness in differentiated mathematics learning. The reduced data are presented in the form of tables, diagrams, and narratives to illustrate student involvement in classroom activities. The final stage is the drawing of conclusions that identify the factors that affect student activity and provide recommendations for further development in the application of differentiated learning.

Research Ethics

The research adheres to ethical principles, including obtaining consent from schools, parents, and participants, maintaining data anonymity and confidentiality, and ensuring voluntary participation throughout the research process.

RESULT AND DISCUSSION Result

The following is a table of percentage results of observation of the implementation of differentiated learning based on teaching modules that contain the principles of differentiated mathematics learning:

Table 3. Observation Results of Differentiated Learning Implementation

	Learning Aspects	Number of Activities Carried Out	Number Expected Activities	of Percentage of Implementation (%)
1.	Identify student profiles (readiness, interests, learning styles)	3	3	100%
2.	Preparation of differentiated learning objectives	2	3	67%
3.	Provision of diverse learning resources	2	2	100%
4.	Management of diverse learning activities	1	2	50%
5.	Assessments tailored to the student's learning profile	1	2	50%
6.	Providing personalized and constructive feedback	2	2	100%
7.	The use of learning strategies that pay attention to learning styles	1	2	50%
8.	Flexible learning time management	2	2	100%
	Total Average Percentage of Impl	ementation		80%

The observation results indicate that the implementation of differentiated mathematics learning has been carried out effectively, with an overall implementation percentage of 80%. Each

aspect of differentiated learning has been evaluated based on specific indicators to assess its effectiveness in supporting student diversity. The identification of student profiles, including readiness, interests, and learning styles, was fully implemented (100%), demonstrating that teachers have effectively recognized and adapted learning to student needs. However, the preparation of differentiated learning objectives achieved a 67% implementation rate, suggesting the need for improvements to ensure that learning goals are more aligned with student characteristics and the principles of differentiated instruction.

In terms of providing diverse learning resources, full implementation was achieved (100%), indicating that teachers successfully provided various materials to support diverse learning needs. However, the management of diverse learning activities and the use of learning strategies considering student learning styles were both implemented at only 50%, highlighting the need for more varied and engaging activities to accommodate different learning preferences. Assessments tailored to students' learning profiles also showed a 50% implementation rate, suggesting that improvements are needed to ensure assessments accurately reflect individual student abilities. Meanwhile, personalized and constructive feedback was fully implemented (100%), demonstrating teachers' ability to provide meaningful feedback to support student progress. Flexible learning time management also achieved full implementation (100%), showing that teachers effectively allowed flexibility in pacing to support student learning.

Overall, while differentiated learning has been implemented well, with a solid overall percentage of 80%, certain areas, such as the preparation of differentiated learning objectives, the management of diverse activities, learning strategies, and assessments, require further refinement to maximize the effectiveness of differentiated instruction. Strengthening these aspects will help ensure that learning is truly personalized, engaging, and responsive to students' individual needs.

The following is a table summarizing the percentage of student learning activity based on aspects of learning activity which includes visual, oral, listening, writing, and practice aspects based on the results of observations made during 8 meetings:

Table 4. Percentage of Student Learning Activity

Aspects of Active	Number of Activities		xpected Percentage of
Learning	Carried Out	Activities	Activity (%)
1. Visual Aspects	4	5	80%
2. Oral Aspects	3	4	75%
3. Listening Aspect	3	3	100%
4. Writing Aspect	3	4	75%
5. Practical Aspects	4	5	80%
Total Average Percentage o	82%		

The observation results indicate varying levels of student engagement across different learning aspects. The listening aspect showed the highest level of participation, reaching 100%, which suggests that students were highly attentive and engaged in following instructions and absorbing the material presented by the teacher. The visual and practical aspects demonstrated strong engagement, each with an implementation rate of 80%. This indicates that students actively participated in visual-based activities, such as utilizing media or interpreting material through visual representation, as well as hands-on learning experiences where they applied concepts directly.

However, the oral and writing aspects showed relatively lower participation levels, with implementation percentages of 75% and 75%, respectively. The oral aspect suggests that some students were less active in verbal participation, such as discussions and answering questions. Similarly, the writing aspect, though moderately implemented, indicates that students had fewer opportunities to engage in structured writing tasks during the observed sessions.

Overall, the total percentage of student learning activity reached 82%, reflecting a generally good level of engagement. However, there is room for improvement, particularly in enhancing students' participation in oral and writing activities. To optimize student engagement, teachers can integrate more interactive discussions, encourage peer collaboration, and implement structured writing exercises that allow students to express their understanding more effectively.

Interviews with elementary school teachers aimed to explore the experiences, challenges, and strategies used in the implementation of differentiated mathematics learning. In preparation for learning, teachers emphasize the importance of paying attention to differences in students' learning profiles, such as readiness, interests, and learning styles. One of the teachers stated,

"I usually *start by identifying the student's learning style* at the beginning of the school year and then tailor the learning materials to make them accessible to all students."

However, teachers also admit that this adjustment process takes more time to prepare appropriate resources. In the application of learning methods, teachers use various approaches, such as small group learning, giving varied assignments, and using visual learning media. The teacher explained,

"I often break the class into small groups, assign different *assignments according to each student's ability*, and use pictures or diagrams to help students be more visual."

In addition, teachers also provide a variety of learning resources, including additional reference books, learning videos, and math apps that support differentiated learning. "I used videos that could show how to solve math problems visually, which was very helpful for *students who needed more in-depth explanations*," he added.

From the interviews, it is indicated that time management in differentiated learning is a challenge for teachers. Even though they have tried to provide enough time for each student, the limited duration of the lesson makes time management less than optimal. The teacher revealed, "I want to provide more opportunities for students to work according to their needs, but *the duration of the lessons is limited*." In addition, teachers face challenges in providing personalized and constructive feedback to each student with different abilities. Teachers hope that differentiated learning can continue to be developed, with the support of more complete training and resources to be better prepared to deal with it.

Furthermore, interviews with elementary school teachers to explore teachers' perceptions of student learning activity in the implementation of differentiated mathematics learning. Teachers stated that in general, students are more actively involved in learning when the approach used is in accordance with their learning style and level of understanding.

"I see that when I *adapt the material to various learning styles* of students, they are more involved in learning activities. For example, students who are more visual are more interested in using pictures and diagrams, while students who are more kinesthetic are more active when given practical assignments," said the teacher.

Teachers also noted that small group learning has a positive impact on student activity. "In small groups, students are more free to discuss and ask questions. They feel more comfortable to talk and share their understanding without embarrassment," the teacher added. However, teachers also admit that there are challenges in maintaining the activeness of all students, especially for those who have higher or lower abilities than the class average. "Students who are already quick to grasp the material tends to be less engaged in activities designed for them, while students who struggle need more attention," she explained.

Regarding assessment, teachers feel that students' activeness can also be seen through the way they respond to feedback.

"I give *personal feedback to each student*, and I see that they are more motivated to improve when the feedback is specific and constructive," the teacher said.

Overall, the interviews indicate that differentiated mathematics learning enhances student engagement, but challenges such as time constraints and maintaining equal participation remain.

The documentation results of the lesson plans created by teachers before the implementation of differentiated learning can be seen below.

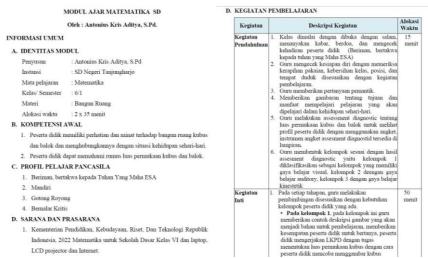


Figure 1. Differentiated Lesson Plan

The documentation analysis of the differentiated lesson plan developed by teachers before the learning implementation shows that the planning process has considered various aspects of student diversity. The lesson plans include differentiated learning objectives, learning activities tailored to student readiness, interests, and learning styles, as well as assessment strategies aligned with students' individual profiles. Additionally, teachers have prepared diverse learning resources and structured flexible time management to accommodate varying student needs. However, some areas, such as the explicit integration of learning strategies based on student profiles and the detailed implementation of differentiated assessments, still require further refinement to optimize the effectiveness of differentiated instruction.



Figure 2. Student Learning Activity

The documentation of student learning activity during differentiated learning implementation indicates varying levels of engagement across different aspects. Students actively participated in visual, auditory, and hands-on learning activities, demonstrating their involvement through observation, discussion and practical application. However, the level of participation in oral and written activities varied, with some students showing reluctance to express ideas verbally or complete writing tasks. The documented learning activities align with the observation and interview results, reinforcing that differentiated instruction enhances student participation. However, some discrepancies were noted, particularly in the implementation of writing-based activities, which showed lower engagement. This suggests the

need for further instructional adjustments to ensure balanced student involvement across all learning aspects.

Discussion

Based on the observation results, it can be seen that the implementation of differentiated mathematics learning in elementary schools has been carried out well, although there are several aspects that still need improvement. The aspects that show the best implementation is the provision of diverse learning resources (90%) and the provision of personalized and constructive feedback (87.5%), which indicates that teachers are quite successful in providing materials and providing feedback that suits the individual needs of students. This is in line with the opinion that emphasizes the importance of providing various learning resources to accommodate students' differences in learning styles and abilities (Tomlinson, 2001). By paying attention to differences in learning styles and abilities, educators can create a more conducive learning environment, which in turn can improve student motivation and learning outcomes (Ismail & Allaq, 2019; Whitley et al., 2021). Furthermore, research shows that students who have access to a variety of learning resources tend to be better able to adjust their learning strategies, which contributes to improved academic outcomes (Khan & Samad, 2024; Wu & Wu, 2024).

The need for improvement is shown in the aspects of differentiated learning goal preparation (70%) and flexible learning time management (75%). Research suggests that many teachers feel unprepared to implement DI due to inadequate training and resources, and this hinders their ability to tailor differentiated learning goals to individual student needs (Dixon et al., 2014; Sakellariou et al., 2018; Valiandes, 2015). Obstacles similar to the aspect of learning time management occur, where teachers report that the need for careful planning and flexible management of learning time can be overwhelming, especially when they are also in charge of assessing student progress and adjusting their teaching accordingly (Papanthymou & Darra, 2023; Pasino & Elihami, 2021). In this case, teachers need to be more careful in setting learning goals that truly reflect the needs and characteristics of students, as well as being wiser in managing time so that each student gets the opportunity to develop according to their needs.

Interviews with teachers provide a more in-depth picture of the experiences and challenges faced in implementing differentiated learning. Teachers revealed that adjusting the material according to the student's learning style is an important step in maintaining student activity and engagement. Teachers who use various strategies such as small group learning and the use of visual media have succeeded in increasing student activity, especially for those with visual and kinesthetic learning styles. This is in accordance with what was stated by Slavin (2009) who suggested the use of various methods to adapt learning to the characteristics of students. However, interviews with teachers also acknowledged that time management is a major challenge in differentiated learning, where limited time often hinders the provision of optimal opportunities for students with different abilities. The limited time available for lesson planning and classroom teaching can result in teachers feeling stressed, which can further hinder their ability to effectively implement differentiated strategies (Safrizal et al., 2021).

According to the results of the study, students' learning activity in differentiated mathematics learning showed significant variations in various aspects. In general, the listening, visual, and practical aspects were recorded with fairly high results, while the oral and written aspects showed lower activity. According to Slavin (2014), students' activeness in learning can be influenced by various factors, including how the material is delivered and how teachers adjust the method to the student's learning style. This can be seen from the results of the interviews, where teachers stated that adjusting learning according to students' learning styles, such as using visual media for more visual students or providing practical assignments for kinesthetic students, can increase their involvement in learning.

The listening aspect recorded very good results, namely 100%, which showed that students were active in listening to the material presented. Listening in the early learning process will help students build a mental picture of the world around them (Başkale et al., 2009; Bayraktar

& Okumuşlar, 2017). Listening is indeed a basic step in building conceptual understanding. However, even though the listening results are very good, the activeness of speaking and writing still needs to be considered. Oral activity recorded at 75% and writing activity at only 62.5% showed that there were some students who were less involved in discussion and writing. According to Vygotsky, social interaction through speaking and discussion is an important component of the learning process. With this interaction, students can gain deeper knowledge, collaborate with peers, and hone critical thinking skills that are needed to learn optimally (Pahlevansadegh, 2019; Stenberg et al., 2024).

Challenges faced by teachers, such as students who have higher or lower abilities, can also affect activeness in the oral and written aspects. This is in line with the differentiation theory expressed by Tomlinson (2001), which suggests that in differentiated learning, teachers need to pay more attention to students with different levels of ability. Students who are already more proficient tend to be less engaged in activities that are not challenging for them, while students who are struggling need more support to remain active participants. To address this, teachers need to provide more opportunities for students to speak and write, as well as provide constructive and personalized feedback. The results of interviews with teachers who stated that specific feedback can increase student motivation are also in accordance with the theory of Hattie and Timperley (2007), who emphasized that clear and relevant feedback can encourage students to improve themselves and become more active in the learning process.

Overall, although students' learning activity in differentiated mathematics learning is quite good, especially in the aspects of listening, visual, and practical, there are several aspects that need to be improved. Teachers need to provide more opportunities for students to speak and write, as well as utilize more appropriate strategies to increase their engagement in all aspects of active learning.

CONCLUSION

This study shows that the implementation of differentiated mathematics learning in elementary schools has gone quite well with an average implementation of 80%, and student learning activity of 83.5%. This learning successfully accommodates the diversity of students through the provision of diverse learning resources, the provision of personalized feedback, and strategies that are appropriate to the student's learning profile, although some aspects, such as the preparation of learning objectives and time management, require improvement. These findings make a significant contribution to the development of knowledge about the effectiveness of differentiated learning, especially in the context of basic education. Scientifically, this study emphasizes the importance of adapting learning approaches to students' learning styles and needs to improve engagement and learning outcomes. Further applications could include the development of intensive training for teachers and increased curriculum flexibility to support the optimal implementation of differentiated learning.

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