Volume 1 Issue 4 (August,2024)
Jurnal of Pedagogi : Jurnal Pendidikan
ISSN: : 3046-9554 (Online)

The Implementation of Differentiated Instruction in Mathematics Learning to Overcome Differences in Students' Cognitive Styles

Grafika Saraswati[1✉], Dian Septi Nur Afifah[2], Setyo Hartanto[3]
[1,2,3]Mathematics Education, Universitas Bhinneka PGRI

Abstract
Differentiated instruction has emerged as a crucial issue in education to address the varying needs of students in the classroom, specifically in mathematics subjects at the junior high school level. This approach highlights the importance of tailoring learning strategies to meet the distinctive needs of each student, taking into account their cognitive style, interests, and level of learning readiness. This study aimed to describe the implementation of the differentiated instruction model. This study employed a descriptive-qualitative approach, with an observation sheet as an instrument for data collection. Data analysis involved data reduction, data presentation, and drawing conclusions, along with validity testing using triangulation techniques. The results showed that the teacher's implementation of differentiated instruction increased significantly between the first and second meetings, with the percentage of implementations increasing from 85.71% to 92.86%. Students demonstrated various responses based on their cognitive styles: reflective students showed a high level of organization and self-confidence; impulsive students were prompt in providing answers but less accurate; and slow-inaccurate students required more time to process information and frequently made mistakes. The implementation of the differentiated instruction strategy at State Junior High School (SMPN) 2 Sumbergempol has been proven to improve the quality of mathematics learning. This approach can serve as a valuable model for other schools seeking to improve their teaching methods. It was suggested that further research could be carried out over an extended period with long-term impact evaluations, as well as additional training for teachers to implement differentiated instruction strategies effectively.
Keywords: *Cognitive Style; Differentiated Instruction; Mathematics;*.

✉ Corresponding author : Grafika Saraswati[1✉]
Email Address : grafika.saraswati@gmail.com
Received July 2024, Accepted August 2024, Published August 2024

A.INTRODUCTION

The approach of differentiated instruction has gained significant importance in the field of education, particularly in addressing the varied needs and abilities of students within a classroom setting (Faigawati et al., 2023). This approach highlights the importance of tailoring learning strategies to meet the distinctive needs of each student, taking into account their cognitive style, interests, and level of learning readiness (Santoso et al., 2022). Various challenges encountered by students and teachers in junior high school mathematics subjects can be overcome through the implementation of differentiated instruction.

However, the implementation of differentiated instruction is not without challenges. In their study, Afifah and Fatmawati (2024) highlighted the increasing demands placed on teachers to design fun learning activities for their students. Moreover, the current Merdeka Curriculum has implemented differentiated instruction, a learning approach that is capable of accommodating a

DOI: https://doi.org/10.62872/k3d5gd27

variety of student abilities in terms of content and process, as well as student learning styles (Mastuti et al., 2022). Furthermore, Iryani et al. (2023) explained that differentiated instruction tailors education to students' individual needs, including their interests, passions, learning styles, and learning readiness, with the aim of enhancing learning outcomes. Through the implementation of differentiated instruction, students' mathematical abilities are expected to improve.

Each student's mathematical abilities vary depending on how they process information, which is often reflected in their cognitive style (Mubarok & Kurniasari, 2019). According to Maiti and Pardi (2023), cognitive style has a significant impact on how students comprehend mathematical concepts. Furthermore, cognitive style refers to the individualized approach that students employ to process information and solve problems, which can vary across different students (Aisy et al., 2021). The variations in the difficulties faced by students in comprehending and using the information they receive can be attributed to the influence of cognitive style. According to Rismen et al. (2020), there are various types of cognitive styles, including reflective, impulsive, and slow-inaccurate cognitive styles. Specifically, reflective, impulsive, and slow-inaccurate cognitive styles play an important role in students' learning and comprehension of learning materials. Students who possess a reflective style demonstrate a tendency to carefully think through their responses, taking their time to avoid making mistakes by double-checking their answers. Despite the fact that they are frequently able to provide more accurate answers, they may be slow to complete assignments. In contrast, students who possess an impulsive style demonstrate a tendency to provide answers quickly without sufficient consideration, leading them to often make mistakes. They may demonstrate quick assignment completion but lack accuracy in providing answers. In addition, students who possess a slow-inaccurate style require more time to comprehend information and still tend to make mistakes, which presents them with the difficult task of dealing with both slowness and inaccuracy in completing assignments (Simamora & Akhiruddin, 2022).

Various adapted strategies and techniques can be employed to address these differences in cognitive styles through the implementation of differentiated instruction in mathematics (Lestari et al., 2023). The use of educational technology, such as interactive software and learning applications, enables students with a reflective learning style to evaluate and check their answers prior to completing their assignments. Moreover, project-based learning and cooperative learning methods can effectively encourage students with an impulsive style to collaborate in groups and acquire knowledge from their peers, thereby minimizing the mistakes they make. Furthermore, additional support, such as individualized tutoring and extra time, can help students who possess a slow-inaccurate style increase their speed and accuracy in solving mathematical problems.

This study investigated the implementation of differentiated instruction in mathematics teaching at the junior high school level, with a specific focus on accommodating students with reflective, impulsive, and slow-inaccurate cognitive styles. Additionally, this study investigated the implementation of differentiated instruction practices and their impacts on students. Therefore, the aim of this study was to provide a comprehensive description of the implementation of differentiated instruction at the junior high school level. Moreover, the findings of this study were expected to serve as a valuable resource and contribute to the development of the learning model, ensuring that it aligns with the current curriculum and effectively meets the desired learning outcomes. In addition to that, this study was expected to serve as a valuable resource for gaining insight into the extent of these issues and can be used as a basis of reference for future research related to differentiated instruction.

Through a comprehensive understanding and implementation of differentiated learning that is tailored to students' cognitive styles, mathematics teachers can foster a more inclusive and effective learning environment. In addition to increasing students' motivation and confidence in studying mathematics, it will also facilitate their achievement of better learning outcomes. The successful implementation of differentiated instruction is expected to serve as a model for other schools aiming to improve the quality of education and academic achievement of students.

B. RESEARCH METHODS

This study is descriptive research. The analysis was conducted exclusively at the descriptive level, which involved analyzing and presenting data systematically. Moreover, this study employed

DOI: https://doi.org/10.62872/k3d5gd27

a qualitative approach. This study analyzed and presented the data systematically in accordance with the actual occurrences in the field. The research subjects were 8th grade students from State Junior High School (SMP Negeri) 2 Sumbergempol. Moreover, this study employed the Matching Familiar Figure Test (MFFT) to divide students into groups based on their cognitive style test results. The research subjects were categorized according to the specified criteria for group boundaries:

Table 1. Cognitive Style Criteria

Criteria		Cognitive Style
Time (t)	**True frequency (f)**	
> 7,28 menit	≥ 7 soal	Reflective
≤ 7,28 menit	≤ 7 soal	Impulsive
> 7,28 menit	≤ 7 soal	Slow-inaccurate

An observation sheet serves as the research instrument. The data collection methods employed in this study involved direct observations of both the teacher and students. The data were presented in the form of a short description. Based on the data presented, an analysis was conducted, leading to the drawing of conclusions that address the research problems. Conclusions were drawn based on the results of the data analysis obtained from observations conducted during the field research. In addition, level of trust (credibility) was used as the criterion for assessing the validity of the data, and technical triangulation was used for the data checking technique.

C.RESULT AND DISCUSSION

This study's findings are based on observational data collected directly in the field. Each type of research data is explained as follows:

1. Differentiated Instruction Implemented by Teachers

The implementation of differentiated instruction in class 8A was conducted in two meetings with a total of 34 students. During this differentiated instruction process, observations of both a teacher and students were conducted. The observations of the teacher were rated "very good' and showed a 7.15% increase in the implementation of differentiated instruction steps, increasing from 85.71% at the first meeting to 92.86% at the second meeting. This increase indicates that the implementation of differentiated instruction improved from one meeting to the next. This is in line with research conducted by Rompis (2023), who found that there was an increase in teacher activity in differentiated instruction from the first meeting to the second meeting.

The observation results of each step activity of differentiated instruction conducted by the teacher in two meetings are presented in Table 2:

Table 2. Observation Results of Differentiated Instruction Conducted by the Teacher

Differentiated Instruction Steps	Activities Carried Out by Teachers	Percentage
Mapped the students' needs	Group students based on predetermined cognitive styles.	87.5%
Planned differentiated instruction	Determined the learning material that students must master.	100%
	Determined learning objectives.	100%
	Identified students who have mastered the material in each group.	75%
	Provided an approach for students who have not mastered the material.	62.5%
Implemented differentiated instruction	Developed teaching modules and learning media that will be used according to needs.	87.5%
	Conducted learning activities according to the specified learning outcomes.	100%

DOI: https://doi.org/10.62872/k3d5gd27

	Accuracy in determining differentiation strategies (content, process, product) in teaching modules.	75%
	The allocation of implementation time aligned with the plan.	100%
	Provided a different treatment for each student based on their cognitive styles.	75%
	Created an engaging and enjoyable learning environment.	100%
Evaluation and reflection	Asked questions to understand any deficiencies when learning.	100%
	Provided feedback on the learning process and results.	100%
	The learning process was in accordance with the planning steps in the teaching module.	87.5%

The teacher employed differentiated instruction as an approach to address the students' varying learning needs in the classroom. Based on the findings of this study, it was discovered that the teacher who implemented differentiated instruction was more inclined to pay attention to several important aspects. Initially, the teacher conducted an analysis of each student's specific needs. Subsequently, the teacher developed flexible and varied learning plans according to the students' cognitive styles. Second, employing a variety of learning methods and media is critical for implementing differentiated instruction. The teacher employed a combination of lecture methods, group discussions, project assignments, and the integration of technology to cater to the diverse cognitive styles of students. This fosters the development of an inclusive and engaging learning environment for all students. Thirdly, continuous and varied assessment was implemented to measure student progress. The teacher employed a variety of assessment methods, including written tests, performance assessments, portfolios, and observations, to obtain a comprehensive understanding of each student's academic progress. Fourthly, the teacher provided constructive and specific feedback to the students. This feedback not only focuses on the final result but also on the learning process that students experience. By adopting this approach, students feel valued and driven to persistently improve their abilities.

The implementation of differentiated instruction enables each student to achieve their full potential and experience a sense of motivation in the learning process. This instruction not only improves academic outcomes but also fosters the emotional and social development of students. This is in line with research conducted by Pebriyanti (2023) and Pane et al. (2022), which discovered that differentiated instruction has an influence on improving students' thinking skills. According to Astria and Kusuma (2023), despite the fact that differentiated instruction has a positive impact on students' thinking skills, it must be implemented multiple times in order to observe the expected increase in results. This demonstrates that differentiated instruction goes beyond using a single approach and instead requires a continual process of adaptation and evaluation to effectively address student needs and achieve the optimal possible outcomes.

Differentiated instruction necessitates that teachers possess a profound comprehension of pedagogy, excellent classroom management skills, and the ability to develop and implement innovative learning strategies. Teachers who successfully implement differentiated instruction demonstrate a high commitment to the academic achievement of each student. According to Gusteti and Neviyarni (2022), differentiated instruction could be used in mathematics learning because it was able to accommodate students' learning needs. Therefore, it is crucial to implement differentiated instruction in mathematics to ensure that each student receives learning opportunities tailored to their abilities and needs.

2. Differentiated Instruction Participated in by Students

The implementation of differentiated learning in class 8A considered students' cognitive styles: reflective, impulsive, and slow-inaccurate. The explanation of the students' responses to the learning activities is outlined in Table 3, as follows:

Table 3. Student Responses to Differentiated Instruction

Differentiated Instruction Steps	Response Differences		
	Reflective Students	Impulsive Students	Slow-inaccurate Students

DOI: https://doi.org/10.62872/k3d5gd27

Form groups according to the teacher's direction.	Organized, paid attention to the characteristics of group members.	Spontaneous, ignored individual needs.	Took a longer time to join.
Receive a detailed explanation of the learning objectives.	Appreciated the detailed explanation.	Faced difficulties in following explanations, prefer to get started right away.	Required re-explanation or more detail.
Demonstrate self-confidence in individual abilities.	Accurate, confident with strong understanding.	Self-confidence beyond capability, situational.	Hesitant, needed additional encouragement.
Prepare the necessary materials and facilities.	Organized before studying.	Act without careful planning.	Took a longer time to prepare.
Ask the teacher in case of having any difficulties.	Actively sought clarification or assistance.	Not actively sought for assistance.	Waited until confused before asking.
Listen to the teacher's explanation.	Good focus and attention.	Had difficulty maintaining focus.	Often required re-explanation.
Actively discuss in groups.	Active, structured thinking.	Spontaneous response, lack of in-depth analysis.	Passive, required encouragement to participate.
Demonstrate responsibility in the group.	High, aware of the importance of responsibility.	Shows less responsibility.	Needed to be reminded of the responsibility sometimes.
Present the results of group work.	Good, the information was presented systematically.	Had difficulty conveying information, spontaneous.	Lacked self-confidence, needed help compiling information.
Listen to feedback from the teacher.	Serious, used it as self-improvement.	Not interested, needed to be reminded.	Took time to understand and implement.
Participated in learning activities well.	Active, positive participation.	Had difficulty in learning well.	Had difficulty maintaining focus.
Provide response or feedback on learning.	Deep, structured.	The response lacked detail.	Simple response, needed assistance.
Listen to feedback from teachers to improve understanding and skills.	Effective, used for self-improvement.	Required encouragement to utilize feedback.	Required additional time and assistance to implement.

The research findings addressing differentiated instruction for reflective, impulsive, and slow-inaccurate students indicate that reflective students prefer to engage in thorough thinking and consider multiple factors before making decisions. This was evident in their method of approaching the assignment given, as they demonstrated a tendency to be more thorough and careful. The implementation of differentiated instruction for them must prioritize the provision of resources that facilitate in-depth exploration and the allocation of adequate time for reflection and thought.

Impulsive students had a tendency to make quick decisions without giving much thought to the consequences. They demonstrated rapid responses, but they were less accurate in assignment completion. For these types of students, differentiated instruction should focus on developing self-control and critical thinking skills, as well as providing challenging activities that can hold their interest and direct their energy toward productive activities.

DOI: https://doi.org/10.62872/k3d5gd27

Slow-inaccurate students demonstrated slowness in assignment completion and often made mistakes. They needed additional time and guidance during the learning process. For them, an effective method of differentiated instruction consists of providing explicit and structured instructions, as well as breaking down assignments into smaller and more manageable steps. Furthermore, providing additional support and constructive feedback is critical to increasing their confidence and accuracy in completing assignments.

Optimal utilization of differentiated instruction may improve learning outcomes and accommodate individual differences in learning styles by taking into account the different characteristics and needs of each student group.

D.CONCLUSION

The teacher's implementation of differentiated instruction demonstrated positive results. The implementation percentage experienced a 7.15% increase, from 85.71% in the first meeting to 92.86% in the second meeting. The steps carried out include mapping student needs, planning differentiated instruction, implementing learning according to the plan, and evaluating and reflecting on the learning process. Moreover, students' responses to differentiated instruction varied according to their individual cognitive styles. Reflective style students demonstrated a strong sense of organization and self-confidence in comprehending the material, despite requiring more time to answer. In addition, impulsive-style students tended to be quick to give answers but were less accurate, whereas slow-inaccurate-style students took longer to process information and often made mistakes.

Differentiated instruction enables teaching approaches to be adapted to better suit the individual needs of students, thereby improving their learning effectiveness. The findings of this study indicate that implementing differentiated instruction improved the quality of mathematics learning at the junior high school level. Additionally, for further research, it was suggested that differentiated instruction be subjected to a more thorough assessment of its long-term impact on student learning motivation and academic achievement over an extended period. Furthermore, it is imperative that teachers receive additional training in the implementation of differentiated instruction strategies to ensure that they possess the requisite skills and knowledge to effectively accommodate their students' diverse cognitive styles.

REFERENCES

Afifah, D. S. N., & Fatmawati, N. I. (2024). Student Reasoning Based on Mathematical Ability in Solving HOTS Problems through Differentiated Learning. *ATHENA: Journal of Social, Culture and Society*, *2*(1), 314–324. https://doi.org/https://doi.org/10.58905/athena.v2i1.232

Aisy, F. A. R., Trapsilasiwi, D., & Setiawani, S. (2021). Profile of Students ' Ability in Solving Mathematics Problems Based on Polya ' s Stages Assessed from Reflective and Impulsive Cognitive Styles Profil Kemampuan Pemecahan Masalah Matematika Siswa Berdasarkan Tahapan Polya Ditinjau dari Gaya Kognitif Refle. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika*, *5*(1), 33–43.

Astria, R. T., & Kusuma, A. B. (2023). Analisis Pembelajaran Berdiferensiasi untuk Meningkatkan Kemampuan Berpikir Kreatif Matematis. *Proximal: Jurnal Penelitian Matematika Dan Pendidikan Matematika*, *6*(2), 112–119. https://doi.org/10.30605/proximal.v5i2.2647

Faigawati, Safitri, M. L. O., Indriani, F. D., Sabrina, F., Kinanti, Mursid, H., & Fathurohman, A. (2023). Implementation of Differentiated Learning in Elementary Schools. *Jurnal Inspirasi Pendidikan*, *13*(1), 47–58. https://doi.org/https://doi.org/10.21067/jip.v13i1.8362

Gusteti, M. U., & Neviyarni. (2022). Pembelajaran Berdiferensiasi pada Pembelajaran Matematika di Kurikulum Merdeka. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, *3*(3), 636–646. https://doi.org/10.46306/lb.v3i3.180

Iryani, E., Hufad, A., & Rusdiyani, I. (2023). Efektivitas Model Pembelajaran Inklusif Terintegrasi Model Pembelajaran Differensiasi pada Sekolah Dasar Inklusi. *Research and Development Journal Of Education*, *9*(2), 968–976. http://dx.doi.org/10.30998/rdje.v9i2.19505

Lestari, A. S. B., Wahyono, A., Akkuşci, Y. E., Purwanto, Anas, K., Nurmalasari, Y., Bibi, R., & Yunus,

DOI: https://doi.org/10.62872/k3d5gd27

M. (2023). Plan – Do – See : Lesson Study-Based Differentiated Learning in Middle Schools. *Delta-Phi: Jurnal Pendidikan Matematika*, *1*, 41–45. https://doi.org/https://doi.org/10.61650/dpjpm.v1i1.76 Plan

Maiti, M., & Pardi, M. H. H. (2023). Analisis Kemampuan Berpikir Kreatif Matematis Siswa SMP Ditinjau dari Gaya Kognitif Reflektif, Impulsif, dan Gender. *Journal of Math Tadris*, *3*(2), 48–72. https://doi.org/10.55099/jmt.v3i2.85

Mastuti, A. G., Abdillah, & Rumodar, M. (2022). Peningkatan Kualitas Pembelajaran Guru Melalui Workshop dan Pendampingan Pembelajaran Berdiferensiasi. *JMM (Jurnal Masyarakat Mandiri)*, *6*(5), 3415–3425. https://doi.org/10.31764/jmm.v6i5.9682

Mubarok, M. A., & Kurniasari, I. (2019). Berpikir Kreatif Siswa dalam Pemecahan Masalah Matematika Ditinjau dari Gaya Kognitif Field Independent dan Jenis Kelamin. *MATHEdunesa: Jurnal Ilmiah Pendidikan Matematika*, *8*(2), 142–147.

Pane, R. N., Lumbantoruan, S., & Simanjutak, S. D. (2022). Implementasi Pembelajaran Berdiferensiasi untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik. *BULLET: Jurnal Multidisiplin Ilmu*, *1*(3), 173–180.

Pebriyanti, D. (2023). Pengaruh Implementasi Pembelajaran Berdiferensiasi pada Pemenuhan Kebutuhan Belajar Peserta Didik Tingkat Sekolah Dasar. *Jurnal Kridatama Sains Dan Teknologi*, *5*(01), 89–96. https://doi.org/10.53863/kst.v5i01.692

Rismen, S., Juwita, R., & Devinda, U. (2020). Profil Kemampuan Pemecahan Masalah Matematika Ditinjau dari Gaya Kognitif Siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *4*(1), 163–171. https://doi.org/10.36085/mathumbedu.v9i3.3462

Rompis, F. F. (2023). Peningkatan Hasil Belajar Siswa pada Materi Aritmetika Sosial Melalui Pembelajaran Berdiferensiasi. *Jurnal Didaktika Pendidikan Dasar*, *7*(1), 219–236. https://doi.org/10.26811/didaktika.v7i1.1054

Santoso, P. H., Istiyono, E., & Haryanto. (2022). Physics Teachers' Perceptions about Their Judgments within Differentiated Learning Environments: A Case for the Implementation of Technology. *Education Sciences*, *12*(582), 1–19. https://doi.org/https://doi.org/10.3390/educsci12090582

Simamora, E. W., & Akhiruddin. (2022). Analisis Kemampuan Literasi Numerasi Mahasiswa Ditinjau dari Gaya Kognitif Reflektif dan Impulsif. *Jurnal Magister Pendidikan Matematika (JUMADIKA)*, *4*(2), 89–95. https://doi.org/10.30598/jumadikavol4iss2year2022page89-95