



Diverse students in mathematics classrooms: Capturing differentiated instruction by Indonesian elementary teachers

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Abstract

Differentiated mathematics learning is a complex strategy to apply, especially for elementary school teachers in Indonesia. However, information on the implementation of learning has not been studied much. The primary objective of this research is to elucidate and capture the implementation of Differentiated Instruction (DI) in the teaching of mathematics at the primary school level in Indonesia. Employing a phenomenological design, and a qualitative research approach, the study involves a collective of 22 elementary school teachers. The selection of purposive samples, chosen for their maximum variation, encompasses teachers from diverse geographical regions across Indonesia. The findings of the study in the first thematic group in this study indicate that support and resources from schools in guiding differentiated mathematics teaching may be inadequate. Concerning student grouping, learning methods, and measurement and assessment, it was found that teachers had applied distinctions. In the second thematic group on the implementation of differentiated mathematics teaching, teachers showed commitment to implementing a responsive and differentiated instruction approach, adapting the learning process according to student needs to achieve effective learning objectives. Overall, one thing that needs to be underlined is the need for more attention to providing resources and support for teachers in preparing teaching tools for differentiated mathematics teaching.

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Introduction

Studies on the application of differentiated instruction (DI) published internationally in developing countries have been conducted even decades ago, but DI is a new learning model that has recently been increasingly emphasized and promoted by the government and educational institutions in Indonesia. The Indonesian government is promoting differentiated instruction through teacher training and development programs, as well as by integrating differentiated instruction strategies in the curriculum and learning guidelines in Indonesia. Mathematics as one of the subjects that is compulsory in formal and non-formal schools does not escape the differentiation learning process. The proficient utilization of DI poses a challenging requirement in the teaching of mathematics across various educational levels (Russo et al., 2021). In mathematics learning, National Council Teacher of Mathematics (NCTM) promotes DI to facilitate differences in student learning styles as well as differences in aptitude, interests, and confidence (National Council Teacher of Mathematics [NCTM], 2000).

Many studies examine DI because the implementation of DI in learning in regular classes and inclusion classes has many benefits, including helping teachers serve student diversity (Ismajli & Imami-Morina, 2018; Pozas et al., 2019), to improve mathematical understanding (Chamberlin & Powers, 2010), increased student academic achievement (Grain et al., 2022; Kado et al., 2022; Kotob & Abadi, 2019), improve academic performance (Rudhumbu & Dziva, 2023; Sahril et al., 2021), on mathematical communication (Nurasiah et al., 2020), on student self-efficacy (Onyishi & Sefotho, 2021), and children's language skills and literacy (Buyse et al., 2016; Morris & Gill, 2023). It shows that the need for differentiated mathematics teaching is essential to ensure that learners are provided with sufficient learning opportunities to maximize students' mathematics learning process. This study is based on the context of DI which is implemented through learning in the Merdeka Curriculum in Indonesia.

Given the close relationship between the focus of the Merdeka Curriculum and the DI concept, it is very important to analyze the teacher's conceptualization and the conditions under which the concept is possible to be applied. Learning and analyzing the clarity of definitions associated with instructional strategies such as DI is important, as this will facilitate researchers and practitioners in new ways to implement such complex

strategies. This study aims to analyze the application of differentiated instruction in Indonesia, especially in the context of the Merdeka Curriculum. Focusing on mathematics as one of the compulsory subjects, this study also highlights challenges in the implementation of DI as well as government efforts in encouraging differentiated instruction practices. In addition, this study tries to fill the knowledge gap by detailing the portrait of differentiated mathematics instruction in elementary schools in Indonesia.

Literature Reviews

Differentiated instruction is a very complex teaching skill (Dixon et al., 2014; Eysink et al., 2017), and overall, it is difficult to give a comprehensive picture of differentiated instruction. Tomlinson, a prominent authority on personalized learning, characterizes differentiated instruction as an instructional philosophy grounded in the belief that students attain maximum learning outcomes when educators adjust to variations in their readiness levels, interests, and learning preferences (Tomlinson, 2005). Arthur and Cremin (2010, pp. 274–275) define differentiated instruction as a teacher's attempt to make one thing accessible to all, through recognition of different learning styles and experiences and knowledge of individual "foundational" knowledge and skills. It is also the teacher's point of view, that each student has a unique approach and level of readiness to learn, even if they are in the same level or class (Purba et al., 2021, p. 12). Nevertheless, differentiation is not just limited to instructional strategies per se, but is also not a formula for teaching; rather, it is an innovative approach to the teaching and learning process (Tomlinson, 1999, p. 108). To tailor instruction to student needs, teachers can distinguish content, processes, products, or learning environments (Association for Supervision and Curriculum Development [ASCD], 2011; Tomlinson, 2005).

Differentiated Instruction (DI) is a pedagogical approach that emphasizes the importance of assessing students' current levels of functioning and learning preferences to help them progress to more advanced levels of functioning and provide a better match of learning opportunities (Reis et al., 2011). The concept of DI is rooted in the idea of proactively adjusting teaching methods to match students' abilities and promote academic progress through systematic monitoring and data-based decision-making (Roy et al., 2015). It is a way to amplify each student's potential by responding to differences in students' knowledge and

abilities (Wiggs et al., 2022). DI is designed to create a cohesive classroom community while tailoring instruction to students' mathematical thinking (Hackenberg et al., 2020).

In the stages of differentiated instruction developed by Tomlinson (2017, p. 9), Tomlinson demonstrates a strong approach to accommodating students' learning needs. The process begins with an initial assessment by the teacher of future concepts/skills, which allows further adjustment to the material and teaching approach. At the end of the lesson, students will work in groups based on their interests to try out new content. Overall, this approach promotes diagnostic and formative assessment, emphasizes continuous adjustment based on student needs, and encourages active involvement in learning.

Methodology

Types of Research

This research is qualitative research with a phenomenological approach. Phenomenology is an approach to understanding the hidden meaning and essence of a collective experience (Kafle, 2013). The phenomenon understood in this study is the implementation of differentiated mathematics instruction in elementary schools. It was conducted for half a semester or three months, March-May 2023.

Participants

Study data were collected through two stages of sampling. First, through purposive sampling techniques: (1) teachers who have attended mobilizer teacher training; (2) teachers who are directly related to the mathematics learning process; (3) teachers who are willing to be

research subjects; (4) schools that have implemented a Merdeka Curriculum; and (5) schools that have obtained permission from local officials. The exclusion criteria are teachers who are not willing to be involved in research and teachers who are not directly involved in the learning process. Secondly, the selection of 22 teachers, was carried out with maximum variation sampling. The main goal of maximum diversity sampling is to capture varied teacher characteristics, including gender, application percentage, tenure, and geographical location. The demographic details of teachers within this research have been presented, as shown in [Table 1](#).

Data Collection

This study used "Interview Form 1" which consists of 13 open-ended questions with a semi-structured structure to explore class teachers' perceptions regarding the application of differentiated mathematics learning, the type of application, and its evaluation. These questions cover three main dimensions: (1) preparation before teaching, (2) implementation during the teaching process of differentiated mathematics, and (3) the teacher's conceptual knowledge of differentiated mathematics learning. In the data collection process, two planning stages are carried out. The first stage involves scheduling an online preliminary interview and the second stage involves the preparation of an "Interview Form 1" to explore the perception, implementation, and evaluation of the application of differentiated mathematics learning.

Data Analysis

The data acquired through interviews underwent analysis using descriptive analysis methods. The primary rationale for selecting this approach is the ability to

Table 1 Characteristics of research participants

	Characteristics	<i>F</i>	%
Gender	Woman	19	86.36
	Man	3	13.63
Work Experience	1–5 years	3	13.64
	6–10 years	8	36.36
	11–15 years	4	18.18
	16–20 years	5	22.73
	20 years and above	2	9.09
Percentage of differentiated mathematics teaching	0–50%	10	45.45
	51–100%	12	54.55
Geographical areas where teachers work	Western Indonesia (DI Yogyakarta, West Java, East Java, South Sumatra, West Kalimantan)	11	50.00
	Central Indonesia (Central Kalimantan, Central Sulawesi, NTT)	8	36.36
	Eastern Indonesia (Papua, Maluku)	3	13.64

pre-establish a conceptual framework. During the process of data coding, the researchers aimed to scrutinize the obtained data, delineate them into meaningful segments, and identify the conceptual significance inherent in each segment. These internally consistent segments were then assigned names by the researchers. Through this approach, the researchers sought to uncover concepts that most accurately capture the meaning of each segment during the coding process. In this study, the employed method was “coding based on concepts derived from the data” as there was no existing list of codes in the literature related to the subject under investigation.

Validity

Internal validity of research is carried out organized based on existing literature and is submitted to three field experts for their evaluation. Following necessary adjustments, a final question form is obtained. In addition, coding is shaped in such a way that it has a narrow scope so that irrelevant concepts are excluded and in such a wide scope the relevant concepts are included. Triangulation seeks to diversify researchers. For this purpose, individuals with a general understanding of the study’s subject and expertise in qualitative research methods were engaged to scrutinize the research from various perspectives. When reporting the data obtained, the identities of the teachers are kept secret. Each teacher is assigned a code so that the reader can know the basic characteristics of the teacher. For example, the code (P15P-S) means that the teacher’s gender is female, she has 15 years of teaching experience, has implemented more than 50 percent differentiated mathematics learning and her name is “S”.

Results

The results of the study provide information about the portrait of the implementation of differentiated mathematics learning under the umbrella of the national curriculum of education in Indonesia, called the Merdeka Curriculum. The portrait of the implementation of differentiated mathematics learning in elementary schools is classified into two thematic groups formed by several research sub-problems. The first thematic group and subgroup are differentiated mathematics teaching tools, and the second thematic group is the implementation of differentiated mathematics teaching.

Differentiated Mathematics Teaching Tools

This section presents an analysis of various teaching tools used by teachers, including lesson plans, the selection of learning materials, student grouping strategies, instructional methods, and forms of assessment. The purpose is to examine the extent to which teachers adapt their teaching tools to align with students’ diverse needs. In addition, this section explores the challenges teachers face in accessing and adapting these tools, as well as how they navigate administrative and resource limitations to continue delivering relevant and responsive instruction for all students.

RPP used by teachers for differentiated teaching

The results of data analysis and reduction of differentiated mathematics teaching tools show that teachers obtain lesson plans (RPP) that they use in differentiated mathematics teaching, as shown in Table 2.

Table 2 How teachers obtain teaching plans

Data	RPP Used by Teachers for Differentiated Teaching	Theme subgroups
Online/ list of questions	1. Search from the internet	Search freely on the internet
	2. Usually many examples from the internet, which I take from there	
	3. Download from platform merdeka mengajar	Taking from the platform
	4. Between RPP from independent teaching and teacher sharing	
	5. I take examples from the internet, then I adjust them to my needs	Modify from multiple sources
Interview	1. I usually modify from internet downloads, tailored to my needs	Modify from multiple sources
	2. Usually, I edit from an existing RPP	
	3. I usually directly download the RPP for one semester from the platform	Taking from the platform
	4. Depending on the time available, sometimes I search the internet, and sometimes make my own	Make own
	5. Sometimes I compile my RPP	
	6. At my location, I usually hold KKG to make RPP, so I use the RPP	From Kelompok Kerja Guru (KKG)

Statements of teachers (P11P-P) and teachers (L07S-B) regarding the lesson plans they use in teaching differentiated mathematics:

“Neither the administration nor the school library facilitate RPP. From the compulsory textbooks given, I still have difficulty if I will develop my own RPP, so I often look for RPP on the internet.”

(P11P-P).

“I did not have any RPP support from the school administration where I worked, for the differentiated mathematics teaching that I applied. As teachers, we need to make lesson plans no matter what.”

(L07S-B).

From the above statements and tables, it can be interpreted that the school administration does not provide adequate teaching resources or teachers do not consider the teaching resources provided qualitatively adequate.

Criteria for selecting teaching materials and learning resources

In the second sub-theme are the criteria used by teachers to select learning materials and resources. The results of data reduction and analysis in this area support previous data on the RPP sources teachers use most often in differentiated mathematics teaching (Table 3).

The results of the researchers’ interviews, underline the answers given by teachers (P12S-M) and teachers (P05P-A) according to this interpretation:

“I think it is easier to use RPP which is already available on the internet. If we must prepare our lesson plans to be used, we will experience a lot of learning lag because of the limited time we have, plus a lot of other administrative burdens.”

(P12S-M).

“I use more RPP than I get from the internet. The lesson plan there makes my work easier and the content or learning approach used is something that I usually have applied.”

(P05P-A).

From these interviews, researchers can assert that teachers do not consider the level of readiness of students and data on the nature of the material (topic) in determining learning materials and resources even though the main essence of differentiated instruction is meeting the individual needs of students in the learning process. From this, it can be interpreted that teachers do not plan the application of differentiated instruction, especially in the process of identifying the needs of their students.

Grouping students by teachers learning environment

A summary of the research findings on grouping students by teachers’ learning environment can be seen in Table 4.

When Table 4 is examined, it is seen that teachers use more predetermined, heterogeneous, and homogeneous groups. The reduction also shows that there are teachers who adopt a group formation method based on student choice and allow all students to decide who they want to work with or students who succeed (get the highest score) to form their groups even if only a few do, according to the teacher’s statement (P16S-H) according to this interpretation.

Table 3 Criteria used by teachers to select learning materials and resources

Data	Criteria for determining learning materials and resources	Theme subgroups
Online/ list of questions	1. I use the ones I easily get on the internet	Availability-accessibility
	2. I teach according to what is in the textbook	Textbooks
	3. I adjust it to the material, sometimes I used video	Topical Features
	4. I adjust it to the facilities in the school	Suitability to the school environment
Interview	1. Usually, I choose materials and sources that I can easily get (no need to create more)	Availability-accessibility
	2. I followed the material in the textbook	Textbooks
	3. Usually, I follow what is in the curriculum	Curriculum
	4. On certain topics/materials, I use appropriate sources	Topical Features
	5. Sometimes I look at my students first when choosing learning resources	Level of readiness of learners

Table 4 Grouping students by teachers in learning environments

Data	Grouping Style	Tema
Online/ list of questions	1. I group students based on their abilities	Grouping based on teacher preferences
	2. I group students based on previous learning groups	
	3. I group students who have different levels of competence	Grouping based on student preferences
	4. Sometimes I let students choose their group	
	5. I apply competitively, students with the highest scores can choose their group	
Interview	1. I mix students who are smart with students who are not	Grouping based on teacher preferences
	2. At the beginning of learning, I have created a group, which I use until the end of the semester	
	3. I see a match between students	Grouping based on student preferences
	4. I am flexible in grouping students, my students have the freedom to choose their group members	
	5. I appreciate the student's effort in letting the group leader choose his or her group members	

"In differentiated mathematics teaching, I apply grouping students based on what I have determined/ have made before, with the view that all students can perform well. However, there were some inconsistencies, so in the middle of the semester, I used heterogeneous groupings. In this way, students can work cooperatively in the teaching process."

(P16S-H).

The preceding statement suggests that teachers have considered the principle of creating distinct groups corresponding to various levels of instruction, considering students' differences. This principle is a key aspect of differentiated teaching, in addition to the utilization of diverse content and materials when forming study groups. Table 6 outlines the teaching methods and techniques already employed by teachers in instructing differentiated mathematics.

Methods, techniques, and approaches teachers choose in differentiated teaching

A summary of the results on methods, techniques, and approaches teachers choose in differentiated teaching can be seen in Table 5.

In general, teachers in Indonesia in carrying out their teaching have used varied methods, techniques, and approaches. The results of the analysis show that the most widely used learning methods by teachers are cooperative, project-based instruction methods, problem-based learning, and scientific learning. The teacher's statement (P07P-F) can be a good example of the importance of cooperative learning methods, and their use in differentiated math teaching classrooms.

"I think discussion is the best way for students to acquire, and justify their knowledge. I can tell how far students can understand the material given from the discussions they have with their coworkers. Therefore, I make students work together in study groups."

(P07P-F).

The findings can be understood as indicating that teachers place significant emphasis on teaching that takes into consideration individual differences, such as students' areas of intelligence or learning styles. This implies that teachers do not entirely overlook factors like student learning styles, learning profiles, interests, and abilities as sources of differentiation in reading instruction.

Table 5 Methods, techniques, and approaches teachers choose

Data	Methods, Techniques, and Approaches that Teachers Choose	Theme subgroups
Online/ list of questions	1. Implement cooperatives, assignments, and projects	Using varied methods, techniques, and approaches
	2. Group discussions, peer tutors	
	3. Scientific / discussion/demonstration/assignment / PBL / project	
	4. Vary	
	5. Scientific, project assignment	
Wawancara	1. Cooperative, scientific	Using varied methods, techniques, and approaches
	2. I tend to apply scientific and assignment	
	3. Adapted to the material taught, sometimes using Problem-based learning models, Projects, assignments, cooperative	
	4. Approaches used among others scientific, cooperative, assignment, and even project	

Implementation of evaluation

A summary of the research findings on the application of evaluation by teachers can be seen in Table 6.

From Table 6, differentiation is not used by most teachers and individual differences have been noticed in activities before starting differentiated mathematics teaching. Table 6 shows that teachers during teaching activities make these measurements through questions and answers and although there are teachers who take measurements through observation to reveal deficiencies in teaching, the observations made are still rough. In addition, the measuring tools most widely used by teachers after the implementation of differentiated mathematics teaching are essay/description tests, multiple-choice tests, and answer questions, and there are no teachers who provide true-false tests in the process of measuring differentiated mathematics teaching results. The fact that teachers in study groups have used different assessment processes to differentiate instruction during teaching activities is evidence of differentiated mathematics teaching practices that have been applied by teachers although not all teachers apply them. The teacher's statement (P05P-R) summarizes the teacher's general opinion regarding the timing of assessment and evaluation, the methods used, and the assessment tools:

"In differentiated mathematics teaching, I sometimes give tests at the beginning before teaching, during teaching, and after teaching. Before teaching sometimes I give tests, sometimes lighter questions. In the middle of the lesson, I usually only observe the students' work process and at the end, after the teaching process is over, I give tests to students, both multiple-choice tests and description tests. I view student test results as a result of students' ability to receive teaching."

(P05P-R)

Implementation of Differentiated Mathematics Teaching

The section on the implementation of differentiated mathematics teaching will cover two main parts: preliminary implementation and implementation of content differentiation, processes, and products.

Preliminary implementation

The thematic group developed based on the literature on the second sub-problem is determined as the implementation of differentiated mathematics teaching. The sub-themes of this group of themes are "introduction" (Figure 1), and "differentiation of content, processes and products" (Figure 2).

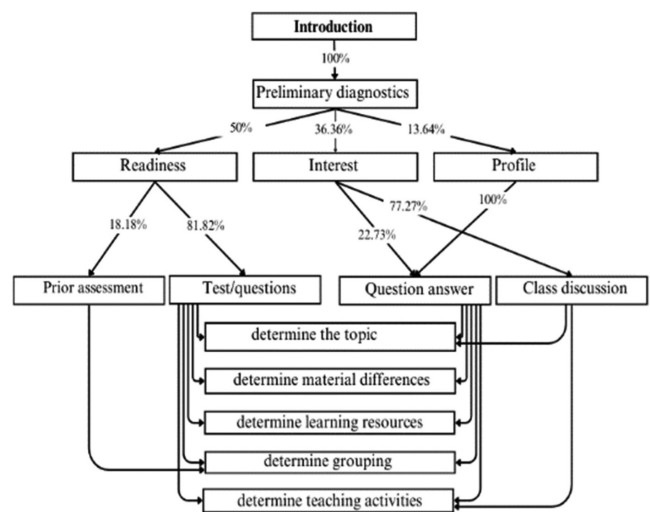


Figure 1 Preliminary implementation scheme on differentiated mathematics teaching

Table 6 Application of evaluation by teachers

Data	Measurement Time	Measurement Techniques	Theme subgroups
Online/ list of questions	1. Conduct an Initial Assessment by giving questions	Essay/ description	Before the lesson
	2. Conduct initial assessments through prior learning	Essay/ description	
	3. I give a lighter question before learning	Q&A	
	4. I check students' comprehension with a short Q&A	Q&A	During the lesson
	5. I gave some questions for the students to do	Essay/ description/ multiple choice	After teaching
Interview	1. Usually, I ask students first if, desire to learn outside the classroom	FAQs	Before the lesson
	2. I gave test questions, but only 2 questions	Essay/ description/ multiple choice	During the lesson
	3. I made my observations and concluded in outline about the students	Observation	
	4. I ask questions and ask students for answers directly	Q&A	After teaching
	5. I give test questions to students	Essay/ description/ multiple choice	

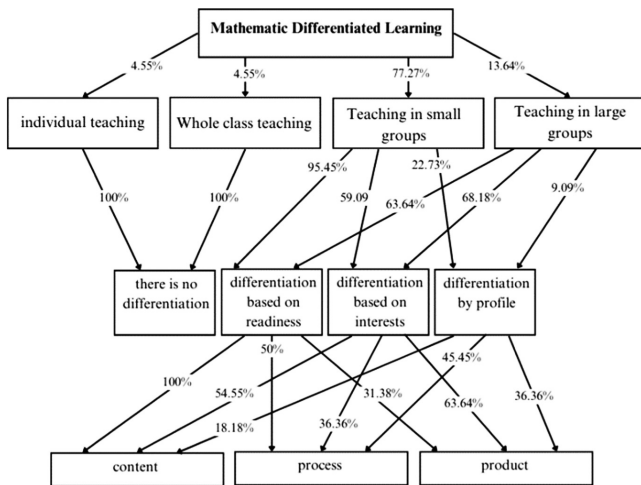


Figure 2 Scheme of implementation of differentiated mathematics

From Figure 1, all teachers conduct preliminary activities before differentiated mathematics teaching. Most teachers conduct preliminary evaluations before teaching to determine the level of student readiness by giving tests/questions, some use assessments in previous learning even if only a few. Data show that teachers evaluate student interest through class discussions, and a few use question-and-answer techniques. All teachers conduct preliminary evaluations to determine student learning profiles using question-and-answer techniques, and teachers use the results of previous assessments to determine student groupings. On the other hand, teachers use tests/questions and question-answer techniques to determine topics, distinguish material, learning resources, and grouping, and determine teaching activities through these methods. Finally, teachers use class discussions to determine topics and teaching activities.

Implementation of content differentiation, processes and products

The teaching structure most often implemented by teachers is teaching in small groups while teaching in large groups is second. It also found that only one teacher implemented differentiated mathematics teaching either through individual or comprehensive teaching, as shown in Figure 2.

On the other hand, it is seen that almost all teachers who conduct teaching in small groups differentiate based on readiness, interests, and profiles and that they use differentiation of content, process, and product in applied teaching. The teaching of differentiated mathematics

through large groups is only slightly implemented by teachers. Teachers who implement teaching in large groups differentiate based on student readiness, interests, and profiles, and they categorically differentiate most often in processes, and rarely in content and products. These patterns indicate that all teachers who implement teaching activities in small groups and large groups agree that they choose to differentiate content, processes, and products to realize differentiation in their teaching.

Discussion

The study identified two main themes related to differentiated mathematics teaching: the tools used and their implementation. A key finding was that teachers frequently turn to the internet for resources, valuing ease of access and availability above all. This suggests that schools are not providing sufficient materials and support for differentiated teaching in mathematics, highlighting a gap in administrative assistance for educators seeking to tailor their instruction to diverse learner needs.

The majority of teachers use small groups as a method of grouping students, and most of them involve small groups in more than half of the cumulative class hours in a single meeting. These findings suggest that small-group group teaching has a significant prevalence in the context of differentiated mathematics teaching. The preference of teachers in forming study groups is to use groups that are predetermined by them as a method of group formation, while a few teachers allow students to choose their groups. It seems that the deliberate application of student group composition is generally regarded by teachers as a simpler practice to prepare and implement (Chiner & Cardona, 2012). Overall, the principles of flexible study groups have been adopted by most teachers in the teaching of differentiated mathematics.

Related to the use of learning methods, teachers in Indonesia involved in the research recognized the importance of applying learning methods based on individual student differences. These individual differences can be seen in learning styles, areas of intelligence, interests, and abilities, to support differentiation of instruction in mathematics learning (Leppan et al., 2018; Lim & Park, 2022; Tomlinson, 2017). In measurement and assessment practice, the distinction between measurement and assessment is used by some elementary school mathematics teachers in Indonesia, indicating an effort to identify and

evaluate learning outcomes more comprehensively. The teacher's statement (P05P-R) describes a more inclusive approach to measurement and assessment, including the use of a variety of assessment methods that are appropriate to students' characteristics and focus on the outcomes of their ability to receive instruction.

The second thematic group is *the implementation of differentiated mathematics teaching*. According to the implementation structure of differentiated teaching carried out by elementary school mathematics teachers in Indonesia, all teachers in differentiated mathematics teaching consistently carry out preliminary activities before the learning process. The majority of teachers use preliminary evaluation to measure student readiness, primarily through the use of tests/questions, although a small percentage also apply assessment to previous learning. These teachers also actively seek to understand student interests through initial evaluation, with a preference for class discussion as the primary tool, although the use of Q&A is less.

Overall, the researchers still find signs that there are still challenges in differentiated mathematics teaching to primary school teachers in Indonesia, especially in terms of providing appropriate resources. A lack of support can affect the quality of differentiated instruction and may limit the potential for more effective teaching. The barriers to differentiated teaching can be categorized into two main categories; i.e. internal and external. Internal challenges refer to obstacles that teachers face that come from within themselves, and external barriers refer to the opposite. These challenges can further be classified into manageable and unmanageable, by teachers. The regulatable factor refers to the factor that can be controlled or modified by the teacher while the non-regulatable factor refers to the opposite factor (Manivannan & Nor, 2020).

In Indonesia itself, although differentiated instruction is not a new idea, for many teachers, especially those who are accustomed to traditional pedagogy, the implementation of differentiated instruction may not be easy at first because a paradigm shift is needed in seeing the learning process. Lack of familiarity with DI precedes feelings of insecurity and misunderstanding of teachers (Shareefa et al., 2019) about the use of differentiation strategies in the classroom. Even teachers who already have an open way of thinking and are confident in the benefits of differentiated instruction, still need to be supported in practice (Mahfudz, 2023). Therefore, government support for the implementation of differentiated instruction is critical to ensuring the success

and sustainability of this approach at various levels of education. Mobilizer teacher training and the concept of driving schools have an important role in supporting the optimal application of differentiated instruction. Both of these initiatives help prepare teachers for challenges and provide the support needed for differentiated instruction to succeed. Dixon et al. (2014) ensure that teacher training on DI plays a critical role in preparing teachers for the challenges they pose and how to deal with them effectively.

As seen in the results of the study, the summary of the data shows that many teachers have not been able to make differentiated mathematics teaching tools. As a result, they search for devices on the internet because of the accessibility and availability of such teaching devices. Pilten (2016) capturing through his phenomenological study of 17 teachers who applied reading teaching through a differentiation approach, found that most teachers (64.71%) considered the accessibility and availability of material and content to affect their teaching preferences. Another study of 137 primary school teachers in the Maldives by Shareefa et al. (2019) found that insufficient administrative support, characterized by heavy teacher workloads, limited resources, and infrequent professional learning opportunities, negatively influences their ability to implement Differentiated Instruction effectively.

Confronting the constraints that arise in differentiated teaching, (Aldossari, 2018) suggests the provision of all supporting facilities to encourage teachers working in education to use modern teaching strategies, especially differentiated instruction strategies. The research conducted by (Gibbs, 2023) unveiled that, in general, the challenges articulated by teachers align with those encountered by many educators globally (Graham et al., 2021; Manivannan & Nor, 2020). The study underscored the imperative for equipping teachers with the essential resources to enable effective implementation of Differentiated Instruction (DI). This encompasses allocating time for curriculum planning and teaching, enhancing teacher resources to facilitate the creation of necessary teaching materials, and fostering flexible classroom environments that promote student motivation and learning.

Conclusion and Recommendation

Research findings reveal that although differentiated learning is a complex teaching strategy, in practice, teachers in Indonesia have been able to realize the planning and application of learning based on individual differences even though it is not optimal. This study highlights the significant reliance of teachers on Internet resources for differentiated mathematics teaching due to inadequate institutional support, underscoring the need for more accessible and diverse teaching materials. Predominantly using small groups for instruction reflects an effort towards personalized teaching, yet challenges remain in effectively implementing differentiated instruction (DI). To address these issues, recommendations include bolstering school and governmental support for DI, enhancing professional development for teachers, developing accessible teaching resources, encouraging collaborative learning, and promoting further research and innovation in teaching strategies. This comprehensive approach aims to improve DI's quality and effectiveness, meeting diverse student needs in mathematics learning.

Conflict of Interest

The authors declare that there is no conflict of interest.

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References

- Aldossari, A. T. (2018). The challenges of using the differentiated instruction strategy: A case study in the general education stages in Saudi Arabia. *International Education Studies*, 11(4), 74. <https://doi.org/10.5539/ies.v11n4p74>
- Arthur, J., & Cremin, T. (2010). *Learning to teach in the primary school* (2nd ed.). Routledge. <https://privateedelt.com/wp-content/uploads/2022/11/learning-to-teach-in-the-primary-2nd-edition.pdf>
- Association for Supervision and Curriculum Development [ASCD]. (2011). *Key elements of differentiated instruction*. ASCD. https://pdo.ascd.org/LMSCourses/PD11OC115M/media/DI-Intro_M4_Reading_Key_Elements.pdf
- Buyse, V., Peisner-Feinberg, E., Soukakou, E., Fetting, A., Schaaf, J., & Burchinal, M. (2016). Using Recognition & Response (R & R) to improve children's language and literacy skills: Findings from two studies. *Early Childhood Research Quarterly*, 36, 11–20. <https://doi.org/10.1016/j.ecresq.2015.11.005>
- Chamberlin, M., & Powers, R. (2010). The promise of differentiated instruction for enhancing the mathematical understandings of college students. *Teaching Mathematics and Its Applications*, 29(3), 113–139. <https://doi.org/10.1093/teamat/hrq006>
- Chiner, E., & Cardona, M. C. (2012). Inclusive education in Spain: How do skills, resources, and supports affect regular education teachers' perceptions of inclusion?. *International Journal of Inclusive Education*, 17(5), 526–541. <https://doi.org/10.1080/13603116.2012.689864>
- Dixon, F. A., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. *Journal for the Education of the Gifted*, 37(2), 111–127. <https://doi.org/10.1177/0162353214529042>
- Eysink, T. H. S., Hulsbeek, M., & Gijlers, H. (2017). Supporting primary school teachers in differentiating in the regular classroom. *Teaching and Teacher Education*, 66, 107–116. <https://doi.org/10.1016/j.tate.2017.04.002>
- Gibbs, K. (2023). Voices in practice: Challenges to implementing differentiated instruction by teachers and school leaders in an Australian mainstream secondary school. *The Australian Educational Researcher*, 50(4), 1217–1232. <https://doi.org/10.1007/s13384-022-00551-2>
- Graham, L. J., de Bruin, K., Lassig, C., & Spandagou, I. (2020). A scoping review of 20 years of research on differentiation: Investigating conceptualisation, characteristics, and methods used. *Review of Education*, 9(1), 161–198. <https://doi.org/10.1002/rev3.3238>
- Grain, H. M. J. S., Neamah, N. R., Al-gburi, G., Abdzahra, A. T., Hassan, A. Y., Kadhim, A. J., Obaid, A. A., & Yahea, S. A. (2022). Differentiated instructions effect on academic achievements of level 2 english students. A case on Iraq Public Sectors Universities. *Eurasian Journal of Applied Linguistics*, 8(2), 87–95. <https://files.eric.ed.gov/fulltext/EJ1374606.pdf>
- Hackenberg, A. J., Creager, M., & Eker, A. (2020). Teaching practices for differentiating mathematics instruction for middle school students. *Mathematical Thinking and Learning*, 23(2), 95–124. <https://doi.org/10.1080/10986065.2020.1731656>
- Ismajli, H., & Imami-Morina, I. (2018). Differentiated instruction: Understanding and applying interactive strategies to meet the needs of all the students. *International Journal of Instruction*, 11(3), 207–218. <https://doi.org/10.12973/iji.2018.11315a>
- Kado, K., Dorji, N., Dem, N., & Om, D. (2022). The effect of differentiated instruction on academic achievement of grade eleven students in the field of derivative in Bhutan. *International Journal of Educational Studies in Social Sciences (IJESSS)*, 2(1), 27–34. <https://doi.org/10.53402/ijesss.v2i1.37>

- Kaffe, N. P. (2013). Hermeneutic phenomenological research method simplified. *Bodhi: An Interdisciplinary Journal*, 5(1), 181–200. <https://doi.org/10.3126/bodhi.v5i1.8053>
- Kotob, M. M., & Abadi, M. A. (2019). The influence of differentiated instruction on academic achievement of students in mixed ability classrooms. *International Linguistics Research*, 2(2), 8. <https://doi.org/10.30560/ilr.v2n2p8>
- Leppan, R. G., van Niekerk, J. F., & Botha, R. A. (2018). Process model for differentiated instruction using learning analytics. *South African Computer Journal*, 30(2), 17–43. <https://doi.org/10.18489/sacj.v30i2.481>
- Lim, Y., & Park, H. (2022). Who have fallen behind? the educational reform toward differentiated learning opportunities and growing educational inequality in South Korea. *International Journal of Educational Development*, 92, 102599. <https://doi.org/10.1016/j.ijedudev.2022.102599>
- Mahfudz, M. S. (2023). Pembelajaran berdiferensiasi dan penerapannya [Differentiated instruction and its implementation]. *Sentri: Jurnal Riset Ilmiah*, 2(2), 533–543. <https://doi.org/10.55681/sentri.v2i2.534> [in Indonesian]
- Manivannan, M. L., & Nor, F. (2020). Barriers in differentiated instruction: A systematic review of the literature. *Journal of Critical Reviews*, 7(6), 293–297. <https://doi.org/10.31838/jcr.07.06.51>
- Morris, D., & Gill, T. (2023). A commonsense approach to end-of-grade reading assessment: Implications for differentiated instruction. *Reading and Writing Quarterly*, 39(6), 538–558. <https://doi.org/10.1080/10573569.2022.2147465>
- National Council of Teacher of Mathematics [NCTM]. (2000). *Principles & standards for school mathematics*. The National Council of Mathematics. <https://archive.org/details/principlesstanda00nati/page/n4/mode/1up>
- Nurasiah, L., Priatna, B. A., & Priatna, N. (2020). The effect of differentiated instruction on student mathematical communication ability. *Journal of Physics: Conference Series*, 1469, 012160. <https://doi.org/10.1088/1742-6596/1469/1/012160>
- Onyishi, C. N., & Sefotho, M. M. (2021). Differentiating instruction for learners' mathematics self-efficacy in inclusive classrooms: Can learners with dyscalculia also benefit? *South African Journal of Education*, 41(4), 1–15. <https://doi.org/10.15700/saje.v41n4a1938>
- Pilten, G. (2016). A phenomenological study of teacher perceptions of the applicability of differentiated reading instruction designs in Turkey. *Educational Sciences: Theory & Practice*, 16(4), 1419–1451. <https://jsttp.com/manuscript/index.php/estp/article/view/556>
- Pozas, M., Letzel, V., & Schneider, C. (2019). Teachers and differentiated instruction: exploring differentiation practices to address student diversity. *Journal of Research in Special Educational Needs*, 20(3), 217–230. <https://doi.org/10.1111/1471-3802.12481>
- Purba, M., Purnamasari, N., Soetantyo, S., Suwama, I. R., & Susanti, E. I. (2021). *Naskah akademik: Prinsip pengembangan pembelajaran berdiferensiasi (differentiated instruction) pada kurikulum fleksibel sebagai wujud merdeka belajar* [Academic manuscript: Principles of developing differentiated instruction in a flexible curriculum as a manifestation of independent learning]. Pusat Kurikulum dan Pembelajaran, Badan Standar, Kurikulum, dan Asesmen Pendidikan, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, Republik. <https://kurikulum.kemdikbud.go.id/wp-content/uploads/2022/arsip/Buku-Nasmik-ISBN.pdf> [in Indonesian]
- Reis, S. M., McCoach, D. B., Little, C. A., Muller, L. M., & Kaniskan, R. B. (2011). The effects of differentiated instruction and enrichment pedagogy on reading achievement in five elementary schools. *American Educational Research Journal*, 48(2), 462–501. <https://doi.org/10.3102/0002831210382891>
- Roy, A., Guay, F., & Valois, P. (2015). The big-fish–little-pond effect on academic self-concept: The moderating role of differentiated instruction and individual achievement. *Learning and Individual Differences*, 42(2), 110–116. <https://doi.org/10.1016/j.lindif.2015.07.009>
- Rudhumbu, N., & Dziva, D. (2023). The influence of differentiated instruction on the academic performance of mathematics students in universities. *International Journal of Innovation and Learning*, 33(1), 1. <https://doi.org/10.1504/IJIL.2023.10045323>
- Russo, J. A., Bobis, J., & Sullivan, P. (2021). Differentiating instruction in mathematics. *Mathematics Teacher Education and Development*, 23(3), 1–5. <https://mtd.merga.net.au/index.php/mtd/article/view/715/436>
- Sahril, S., Aulia, S. N., & Nur, M. S. (2021). The impact of differentiated instruction on students' performance in critical reading. *Eralingua: Jurnal Pendidikan Bahasa Asing dan Sastra*, 5(1), 275. <https://doi.org/10.26858/eralingua.v5i1.18937>
- Shareefa, M., Moosa, V., Zin, R. M., Abdullah, N. Z. M., & Jawawi, R. (2019). Teachers' perceptions on differentiated instruction: Do experience, qualification and challenges matter? *International Journal of Learning, Teaching and Educational Research*, 18(8), 214–226. <https://doi.org/10.26803/ijlter.18.8.13>
- Tomlinson, C. A. (1999). *The differentiated classroom: Responding to the needs of all learners*. Association for Supervision and Curriculum Development. <https://files.ascd.org/staticfiles/ascd/pdf/siteASCD/publications/books/differentiated-classroom2nd-sample-chapters.pdf>
- Tomlinson, C. A. (2005). Grading and differentiation: Paradox or good practice? *Theory Into Practice*, 44(3), 262–269. https://doi.org/10.1207/s15430421tip4403_11
- Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (3rd ed.). Association for Supervision and Curriculum Development. <https://files.ascd.org/staticfiles/ascd/pdf/siteASCD/publications/books/HowtoDifferentiateInstructioninAcademicallyDiverseClassrooms-3rdEd.pdf>
- Wiggs, N. B., Reddy, L. A., Kettler, R., Hua, A., Dudek, C., Lekwa, A., & Bronstein, B. (2022). Convergence between teacher self-report and school administrator observation ratings using the classroom strategies assessment system. *Assessment for Effective Intervention*, 48(2), 113–123. <https://doi.org/10.1177/15345084221112858>