

Teachers' readiness and challenges in implementing differentiated instruction in mathematics education

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Abstract

Differentiated instruction, a key component of the contemporary learning paradigm, aims to tailor teaching strategies to students' varied needs. Despite its pedagogical relevance, this approach has yet to become a central focus among classroom practices. This study examines the readiness of junior high school mathematics teachers in Pekanbaru City to implement differentiated instruction. Employing a descriptive quantitative design, data were collected from 30 participants via an online questionnaire. The instrument included closed-ended items measured on a Likert scale across four dimensions: (1) conceptual understanding of differentiated instruction, (2) readiness in instructional planning, (3) readiness in classroom implementation, and (4) readiness in assessment practices. Open-ended items were also included to explore implementation challenges. The results reveal a low overall level of understanding and readiness, with an average score of 2.49 across all measured dimensions. Key barriers include limited access to information, insufficient time allocation, and unsupportive learning environments. This study provides empirical insights into instructional preparedness and practical constraints, offering a basis for future interventions aimed at strengthening the adoption of differentiated instruction in mathematics education.

Keywords: Mapping teacher readiness, Teacher barriers, Differentiated learning

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Introduction

Liberating education is an approach that empowers learners rather than turning them into captives surrounded by incomprehensible and unattainable content. The new learning paradigm emphasizes learner-centered education—teaching that is attuned to students' interests and talents, and responsive to their individual needs (Ambarita & Simanulang, 2023). Students enter the classroom with diverse characteristics, levels of preparedness, and abilities. These differences extend to their interest and aptitude in learning mathematics. Such variation leads to differing levels of understanding and processing speed when engaging with mathematical content (Ngali Mahuze, 2024). When students display a high level of interest during the learning process, teaching and learning interactions tend to improve; conversely, low interest can diminish instructional quality and negatively impact learning outcomes (Nasution et al., 2020). Learners with varying levels of mathematical conceptual



understanding require challenges aligned with their capabilities. Therefore, it is essential for teachers to foster an inclusive learning environment and to take into account students' cultural backgrounds and experiences when designing meaningful and relevant educational experiences (Ngali Mahuze, 2024; Wati et al., 2023).

The diversity of student characteristics serves as a foundational principle for tailoring instruction to meet learners' specific needs. One effective instructional approach that addresses these diverse learning needs is differentiated instruction (Johnsen, 2003; Mumpuniarti, 2023; Tomlinson, 2001). Differentiated instruction accommodates individual learning requirements and helps optimize each student's learning potential (Lindner & Schwab, 2020). Teachers assess students' learning needs, design and implement varied instructional strategies, and routinely evaluate the effectiveness of differentiated practices (Sugianto et al., 2023). (Roberts & Inman, 2023a) define differentiation simply as the alignment of curriculum and learning experiences with students' characteristics. As a concept, differentiated instruction offers educators a means to empower students by cultivating their full potential while attending to their learning readiness, interests, and profiles. Moreover, this approach enhances conceptual understanding by accommodating students' varying levels of preparedness for prerequisite material. Differentiated instruction also yields positive outcomes in terms of student achievement (O. A. Awofala & O. Lawani, 2020; Septyana et al., 2023).

Differentiated instruction is recognized as an effective approach to meeting students' learning needs. However, (Gusteti & Neviyarni, 2022) notes that teachers have yet to implement instructional practices that fully accommodate those needs. (Colquitt et al., 2017; Maeng & Bell, 2015) emphasize that teachers must differentiate the content they deliver and prepare the necessary processes and tools for successful implementation. A solid understanding of differentiated instruction is crucial prior to its application, as it ensures alignment with the underlying principles and objectives of learning. High professional demands and creativity expectations placed on teachers often hinder optimal use of this approach, as some lack the confidence and pedagogical skills required (Pozas et al., 2019; Roberts & Inman, 2023). These demands present not only academic challenges but also practical ones, including difficulties in evaluating the transferability of theoretical findings into classroom practice. (Jatmiko & Putra, 2022) highlight that teachers frequently encounter considerable obstacles, including activities that fall outside the scope of the Merdeka Curriculum. (Fauzia & Hadikusuma Ramadan, 2023) further argue that the implementation of differentiated instruction is inherently linked to various barriers, both internal and external, which can impede program effectiveness.

Previous studies indicate persistent issues regarding teachers' knowledge and understanding of differentiated instruction. Accordingly, this research is essential to explore and identify junior high school mathematics teachers' comprehension and readiness, as well as the barriers and challenges they face in implementing differentiated instruction in Pekanbaru City. These factors directly influence the successful realization of differentiated learning as envisioned in the Merdeka Curriculum. The purpose of this study is to investigate the understanding and readiness of junior high school teachers in Pekanbaru to apply differentiated instruction—specifically examining their grasp of key concepts, preparedness

in planning, execution, and assessment processes, and the obstacles encountered in implementing this approach in school settings.

Methods

This study employs a quantitative research design using a descriptive method. The descriptive approach involves drawing conclusions based on statistical representations of collected data. Sampling was conducted using a non-random convenience sampling technique, as no specific criteria were applied beyond membership in the Pekanbaru City Mathematics MGMP group. Respondents were selected based on accessibility—specifically, teachers who were part of the WhatsApp group and willing to complete the questionnaire. The research subjects consisted of 30 mathematics teachers affiliated with the professional teaching forum or community in Pekanbaru City. Data collection was carried out using a questionnaire distributed via Google Forms, with links shared in the WhatsApp group of the MGMP Mathematics Pekanbaru. Data were collected in March 2024.

The questionnaire consisted of closed-ended items using a five-point Likert scale to measure four dimensions: (1) teachers' understanding of differentiated instruction, (2) teachers' ability to plan differentiated instruction, (3) teachers' ability to implement differentiated instruction, and (4) teachers' ability to assess differentiated instruction. In addition, open-ended questions were included to explore the challenges and obstacles experienced during the implementation of differentiated instruction (Hartoyo, 2015).

Data on teachers' understanding and readiness to implement differentiated instruction were collected based on its core principles and characteristics (Bayumi et al., 2021). Understanding-related data encompassed teachers' conceptual grasp, implementation stages, and key components of differentiated instruction. Readiness in planning was assessed through diagnostic evaluation, development of teaching modules, determination of instructional strategies, and provision of relevant resources. Readiness in implementation was reflected in teachers' ability to conduct instruction according to pre-established plans. Readiness in assessment involved teachers' ability to provide feedback, facilitate reflection, and differentiate student output. To identify barriers faced by teachers in implementing differentiated instruction, data were collected on the specific challenges encountered.

The data analysis technique used in this study is descriptive analysis. Descriptive analysis involves the use of statistical methods to describe or illustrate the research subject based on the collected data (Sugiyono, 2017). Data obtained across dimensions (1) to (4) were measured by calculating the average level of achievement for each dimension. Results were then categorized according to the teachers' readiness levels, with the following thresholds (Umar, 2011):

1.00–1.80: "Very Low"

1.81–2.60: "Low"

2.61–3.40: "Moderate"

3.41–4.20: "High"

4.21–5.00: "Very High"

In addition to quantitative analysis, this study also employed qualitative analysis based on teachers' responses concerning the difficulties they encountered. The qualitative approach

allowed researchers to better understand the most common challenges faced in implementing differentiated instruction, thereby providing implications and recommendations for relevant stakeholders.

Results

Teachers' understanding and readiness to implement differentiated instruction in this study were assessed across four dimensions: (1) teachers' understanding of differentiated instruction, (2) readiness in instructional planning, (3) readiness in implementation, and (4) readiness in assessment. Table 1 presents a summary of the analysis results for each dimension as well as the cumulative evaluation of teachers' readiness and understanding.

Table 1. Categories of Teachers' Understanding and Readiness in Differentiated Instruction

Dimension	Mean Score	Achievement Category
Understanding of differentiated instruction	2,39	Low
Readiness in planning differentiated instruction	2,40	Low
Readiness in implementing differentiated instruction	2,63	Moderate
Readiness in assessing differentiated instruction	2,57	Low
Overall readiness in applying differentiated instruction	2,49	Low

Based on Table 1, the cumulative average score of teachers' readiness to implement differentiated instruction falls into the "Low" category, with an overall mean of 2.49. This classification is consistent across most dimensions, including understanding, planning, and assessment readiness, which all registered in the "Low" achievement range. The lowest-scoring dimensions were teachers' conceptual understanding, planning capacity, and evaluation practices—indicating that educators have yet to develop sufficient foundational knowledge and instructional readiness for effective application of differentiated instruction. A closer analysis of each dimension and its corresponding indicators provides more detailed insights into these areas.

Teachers' Understanding of Differentiated Instruction

The dimension of teachers' understanding of differentiated instruction encompasses their knowledge of its definition, implementation stages, and core components. As shown in Table 1, this dimension received the lowest mean score of 2.39, placing it within the "Low" achievement category. Table 2 presents the detailed indicators reflecting this dimension.

Table 2. Teachers' Understanding of Differentiated Instruction

Dimension	Mean Score	Achievement Category
Knowledge of differentiated instruction	2,33	Low
Understanding the stages of implementation	1,83	Low
Understanding key components (content, process, product)	2,23	Low
Formulating learning objectives aligned with student needs	3,20	Moderate

Based on the data in Table 2, the indicator related to teachers' understanding of the implementation stages falls into the "Low" category. This suggests that many teachers lack a

solid grasp of the sequential steps involved in differentiated instruction—namely, initial assessment to identify student learning needs, instructional planning, strategy development, and evaluation. Additionally, teachers showed limited understanding of four essential components of differentiated instruction: content, process, product, and learning environment, and how to integrate these into teaching modules and instructional practices. Their conceptual knowledge of differentiated instruction also scored low, attributed in part to the limited availability of literature on its application. On a more encouraging note, some teachers have successfully formulated learning objectives that align with the diverse needs of their students.

Teachers' Readiness in Planning Differentiated Instruction

Teachers' readiness in planning differentiated instruction encompasses five indicators: planning diagnostic assessments to map students' learning needs or characteristics, developing teaching modules, determining instructional strategies, preparing support systems, and adjusting instructional content according to students' learning needs. As indicated in Table 1, the planning dimension falls into the "Low" category, reflecting that teachers have not yet fully engaged in planning differentiated instruction. Table 3 presents the achievement levels for each indicator within this dimension.

Table 3. Achievement of Teachers' Readiness in Planning Differentiated Instruction

Dimension	Mean Score	Achievement Category
Readiness to design diagnostic assessments	2,25	Low
Readiness to develop differentiated teaching modules	1,97	Low
Readiness to create differentiated instructional strategies	2,40	Low
Readiness to prepare support systems (facilities and learning media)	2,63	Moderate
Readiness to design content differentiation	2,77	Moderate

The data in Table 3 show that indicators related to diagnostic assessment, module development, and instructional strategy design are categorized as "Low." Most teachers have yet to conduct initial assessments to identify student learning needs and characteristics as part of their instructional planning, largely because they find the process challenging and time-consuming. Moreover, teachers have not fully integrated the key components of differentiated instruction—namely content, process, and product—into teaching modules and instructional strategies. Designing modules aligned with differentiated instruction requires early-stage identification, appropriate strategy selection, and the inclusion of relevant instructional elements. This limitation stems from teachers' inability to effectively differentiate content, process, and products. Ultimately, the lack of comprehensive understanding of differentiated instruction underlies teachers' difficulties in developing effective instructional plans.

In terms of support systems—such as the availability of technology in schools, student-centered instruction, and the use of cooperative learning models—teachers have begun incorporating these elements, although they remain within the "Moderate" category. Limited access to differentiated learning media presents a challenge, as teachers are required to prepare varied resources tailored to the diverse learning needs of students. The indicator for

content differentiation also falls within the “Moderate” category, indicating that teachers have not yet fully adapted instructional materials to align with individual student needs.

Based on the overall data related to the planning dimension, it can be concluded that teachers are not yet fully capable of designing differentiated instruction—whether in terms of teaching modules, instructional strategies, learning materials, or supporting systems.

Teacher Readiness in Implementing Differentiated Instruction

The dimension of teacher readiness in implementing differentiated instruction includes several indicators, such as the execution of process differentiation, use of varied teaching methods, and student-centered learning. Based on Table 1, this readiness dimension is categorized as “Moderate.” The achievement data for each indicator within this dimension is presented in Table 4.

Table 4. Achievement of Teacher Readiness in Implementing Differentiated Instruction

Dimension	Mean Score	Achievement Category
Teacher readiness in executing process differentiation	2,03	Low
Student-centered methods and instruction	3,07	Moderate
Use of engaging and varied instructional methods	2,80	Low

Based on the data presented in Table 4, the process differentiation indicator falls under the “Low” category. This suggests that efforts to adapt or modify instructional processes to meet individual student needs remain limited or ineffective. In practice, teachers tend to adopt uniform approaches that insufficiently account for students’ individual differences.

The indicator for student-centered methods and instruction is categorized as “Moderate,” indicating that while some teachers have selected varied methods in each session and oriented their instruction toward students, they have yet to incorporate differentiation within the process itself. Fundamentally, student-centered learning emphasizes attention to student needs and characteristics as the central focus, which includes the use of engaging and varied instructional strategies and fostering student involvement.

Teacher Readiness in Assessing Differentiated Instruction

According to Table 1, teacher readiness in conducting differentiated assessment is categorized as “Low,” indicating that such readiness has not yet reached an optimal level. This dimension includes several components: product differentiation, the implementation of feedback and reflection, flexible timing in responding to students, and the execution of continuous assessment to monitor student progress. The achievement data for each indicator within this dimension is presented in Table 5.

Table 5. Achievement of Teacher Readiness in Assessing Differentiated Instruction

Dimension	Mean Score	Achievement Category
Readiness to implement product differentiation	2,34	Moderate
Readiness to conduct continuous assessment	2,40	Moderate
Readiness to implement feedback and reflection	3,07	Moderate
Ability to conduct assessment with flexible timing	2,47	Moderate

As shown in Table 5, all indicators within the dimension of teacher readiness in conducting differentiated assessment fall into the “Moderate” category. This reflects that overall, teachers possess an adequate capacity to carry out differentiated assessment practices. However, feedback and reflection at the end of the learning process involving students have not been maximally implemented.

In practice, continuous assessment is still considered lacking due to teachers' limited understanding of how to effectively design and execute this form of assessment. Effective continuous assessment demands time for planning, implementation, and analysis—resources which may not be readily available to many teachers.

Challenges Faced by Teachers

Based on the collected data, the common challenges experienced by teachers in implementing differentiated instruction are illustrated in Figure 1. These include a lack of access to information on differentiated instruction, limited time for planning differentiated lessons, and unsupportive learning environments. Teachers have not yet fully carried out the stages of differentiated instruction due to limited understanding of how to apply it effectively in the classroom. Some teachers also feel uncertain about managing the complexity of differentiated instruction and struggle to initiate the process. Many are accustomed to conventional teaching approaches. Furthermore, professional training and development opportunities focused specifically on differentiated instruction remain largely unavailable to teachers.

Limited time for planning differentiated instruction often poses a significant challenge for teachers in implementing this strategy. For those teaching in classrooms with large student populations, it becomes particularly difficult to design differentiated lessons tailored to each student, as this requires substantially more time to customize instruction, prepare materials, and develop supportive media that accommodate diverse learning needs—compared to planning homogeneous teaching approaches. One of the contributing factors to these time constraints is the considerable responsibilities teachers hold outside the classroom, including preparing instructional content, assessing student work, communicating with parents, and participating in meetings and other activities. These responsibilities demand extensive time and leave little room for teachers to comprehensively plan differentiated instruction.

Environmental factors—such as class size, availability of resources, and the degree of support from schools and administrators—have not yet sufficiently facilitated the implementation of differentiated instruction in schools. Large class sizes, typically ranging from 35 to 40 students, make it difficult for teachers to provide individualized attention to each learner. This condition poses challenges for teachers in adapting instruction to meet diverse learning needs. A lack of resources, including teaching materials and instructional media, further limits the ability of teachers to carry out differentiated instruction. Teachers may find themselves constrained by the equipment and tools available to support students' varied learning requirements. Moreover, schools often fail to provide adequate support for differentiated learning initiatives—such as professional development, access to resources, and collaborative planning time—thereby hindering effective implementation.

School policies that do not prioritize individual learning needs or grant teachers the flexibility to design differentiated instruction can create significant barriers to adopting this instructional strategy.

Apa kendala atau hambatan yang bapak/ibu alami ketika akan menerapkan pembelajaran berdiferensial ?
tidak memiliki waktu yang cukup untuk membuat perangkat pembelajaran berdiferensiasi
Tugas tambahan selain menjadi guru yang membuat guru sibuk
Waktu
Dalam hal sarana prasana di sekolah
Siswa masih ada yang belum fokus
Didalam satu kelas ada beragam kemampuan peserta didik sehingga untuk mengajarkan sesuai dengan kemampuan kelompok anak dalam satu waktu dengan kemampuan yang berbeda
Waktu jam mengajar dan karakteristik peserta didik yang cukup sulit di kendalikan
Kekurangan waktu dan masih bingung dengan penerapan pembelajaran diferensial..
Kurangnya pemahaman saya mengenai pembelajaran berdiferensiasi. Tidaknya dilakukan asesmen diagnostik. Serta banyaknya tuntutan tugas kepada guru selain mengajar
Manajemen waktu, manajemen kelas, penyesuaian dengan kebutuhan belajar siswa
Persiapan yang membutuhkan waktu yang lama.
Kesenjangan antar siswa
Alat alat untuk praktek
Informasi mengenai pembelajaran berdiferensial masih sedikit, masih mempelajari di forum mgmp
Kurang memahami pembelajaran berdiferensiasi
Siswa/i yang masih belum cukup bisa untuk mengikuti pembelajaran berdiferensial.
Kurangnya pemahaman dan keterampilan terkait penerapan pembelajaran berdiferensial serta kurangnya data kebutuhan belajar siswa.

Figure 1. Respondents' Responses

Translation of Figure 1:

What obstacles do you face when implementing differentiated instruction?

Not having enough time to prepare differentiated learning materials.

Additional non-teaching tasks assigned to teachers, which increase workload.

Time constraints.

Inadequate school facilities.

Students who are unfocused.

The classroom contains students with varying levels of ability, making it difficult to teach according to their groups within the same timeframe.

Limited teaching hours and the diverse characteristics of students, which are difficult to manage.

Lack of understanding and confusion about the application of differentiated instruction.

Limited understanding of differentiated instruction. No diagnostic assessments are conducted. In addition, teachers face many demands beyond teaching.

Time management, classroom management, aligning with students' needs.

Preparation that requires a long time.

Learning disparities among students.

Limited teaching tools or practice equipment.

Very limited access to information about differentiated instruction, except for what is discussed in teacher working groups (*Musyawarah Guru Mata Pelajaran-MGMP*).

Insufficient understanding of differentiated instruction.

Students who are still at a basic level, making it difficult to apply differentiated instruction.

Lack of understanding and skills related to implementing differentiated instruction, as well as limited data on students' learning needs.

Teacher readiness in implementing differentiated instruction is not solely determined by the level of understanding teachers possess regarding the concept, but also by their ability to apply it across various stages of instruction: planning, execution, and evaluation. Based on the findings, teachers reported insufficient understanding of how to implement differentiated instruction, largely due to limited access to relevant information or training. (Smale-Jacobse et al., 2019) similarly point out the scarcity of literature that provides clear guidance on the instructional processes required, resulting in teachers lacking clarity on how to effectively apply differentiation in practice. Research conducted by (Adili et al., 2023) also assessed

multiple aspects of teacher readiness for differentiated instruction and found suboptimal results. During the planning stage, which includes conducting initial assessments and developing differentiated instructional modules, teachers also scored in the “Low” category. Initial assessment has proven to be a particular challenge in initiating the differentiated instruction cycle. This aligns with findings from Syamsuddin et al., (2023) who note that many teachers lack familiarity with diagnostic testing techniques, especially in assessing mathematical proficiency.

Difficulties in developing instructional modules were further elaborated by (Jatmiko & Putra, 2022) who observed that teachers remain uncertain about how to integrate students' learning readiness, styles, and interests into the instructional design. The difficulties experienced by teachers in the planning stage are closely linked to the underdeveloped implementation of differentiated instructional processes. Findings indicate that teachers have not yet fully applied process differentiation, tending to use uniform instructional approaches that overlook student diversity. (Mulyono & Wekke, 2018) emphasized the importance of recognizing individual learner differences; however, this principle has not received sufficient attention among educators.

A key indicator—and foundational principle—of differentiated instruction is continuous assessment. Results show that teachers have not fully implemented continuous assessment, largely due to time constraints in planning and analyzing outcomes. (Nadhifah et al., 2023) further highlighted that teachers often fail to conduct regular formative assessments because of challenges such as large class sizes, limited time availability, insufficient practical knowledge, and the lack of intensive training. Common barriers to implementing differentiated instruction also include time management and support systems. This aligns with findings from (Febrianti et al., 2023) who noted that teachers struggle with limited time for mapping cognitive diagnostic assessments, difficulties in formulating probing questions, and challenges linked to students' non-cognitive attitudes.

There is no doubt that differentiated instructional planning demands significantly more time—particularly when accommodating students' interests, readiness levels, and learning profiles—than devising a single instructional approach for the entire class. Teachers need adequate time to identify students' learning needs, prepare instructional plans, and address limitations in resources or learning media (Bo'riboyev A.A. & Xakberdiyev Sh.M., 2023; Bondie et al., 2019). Additionally, extra responsibilities outside of teaching make it difficult for teachers to allocate sufficient time for designing or preparing instructional tools and media that meet students' varied needs.

The successful implementation of differentiated instruction in schools requires supporting factors. (Bondie et al., 2019) identified several key factors that influence teachers' ability to apply differentiated instruction in their teaching practices—namely, teachers' understanding and belief in the effectiveness of this approach. Teachers' personal development experiences related to differentiated instruction are critically important, as longer teaching experience and ongoing self-development enhance their ability to adapt and apply instructional strategies and curriculum changes (Balkist et al., 2023). Teachers need access to resources that go beyond theoretical frameworks and offer practical applications—such as training sessions with expert facilitators and collaborative opportunities among teachers within their schools and professional communities. Differentiated instruction can

only be effectively implemented when teachers are motivated to modify their practices and receive the appropriate support. Thus, it is essential to equip teachers with intensive guidance and foundational understanding.

Enhancing teachers' comprehension, skills, and instructional practices is expected to foster a more inclusive and empowering learning environment for all students. The influence of differentiated instruction has been shown to improve student learning outcomes (Rachmadhani & Kamalla, 2023; Siburian et al., 2019). The findings of this study provide a clear picture of the challenges teachers face in applying differentiated instruction. These insights can serve as a foundation for schools and educational authorities to design more targeted teacher professional development programs, particularly those aimed at strengthening teachers' capacity to plan and implement differentiated instruction. Increasing teacher readiness requires a coordinated and comprehensive effort from stakeholders, including teachers, principals, supervisors, and relevant government officials at both local and national levels. (Handa, 2019) also highlighted the importance of pedagogical alignment between school leadership and teachers, as well as the need for effective leadership practices to ensure the successful implementation of differentiated instruction. Without adequate training, teachers may lack the necessary skills and knowledge to design and carry out differentiated instructional strategies effectively.

Conclusion

The overall readiness of junior high school teachers in Pekanbaru to implement differentiated instruction is categorized as low, particularly in the areas of understanding, planning, and assessment. The common barriers faced by teachers in applying differentiated instruction include: (1) limited access to relevant information, (2) time constraints, and (3) inadequate resources. The lack of teacher comprehension regarding this approach should be a shared concern, not only for teachers as implementers but also for policymakers tasked with supporting instructional innovation.

Differentiated instruction strategies should no longer be merely informative or recommendatory but rather instructional in nature. The incomplete implementation of this approach reveals opportunities for improving teacher competencies through: (1) the provision of training and support, (2) adequate resource allocation, (3) the formation of collaborative teams, and (4) the development of school policies that promote differentiated instruction. Such measures are essential for enhancing the learning environment to support more inclusive and responsive instructional practices.

Given that the study sample was limited to members of the Mathematics MGMP in Pekanbaru, the generalizability of the research findings remains constrained. Future studies are encouraged to expand the sample size by involving teachers across various educational levels and regions to gain a more comprehensive understanding of teacher readiness for implementing differentiated instruction.

Declarations

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