Electronic Journal of Education, Social Economics and Technology
Vol. 6, No. 2, (2025), pp. 1~12, Article ID: 1316
ISSN 2723-6250 (online)
DOI: https://doi.org/10.33122/ejeset.v6i2.1316

SAINTIS publishing

Research Article

Teachers' Strategies in Implementing Differentiated Instruction on Plane Figures: A Qualitative Case Study Using NVivo

Lisa Sabitillah, Wildansyah Lubis*, Maisura

Master of Basic Education, Postgraduate, Universitas Almuslim, Matangglupang Dua, Bireueun, Indonesia
*Corresponding Author: wildansyahlubis@unimed.ac.id | Phone: +6281375444190

ABSTRACT

Differentiated instruction is considered a key approach to accommodate the diverse characteristics of students in mathematics learning, particularly in plane figures material at the elementary school level. However, its implementation in the field still faces challenges, and in-depth exploration of teacher strategies through a qualitative approach remains limited. This qualitative case study aims to explore teacher strategies in implementing differentiated instruction on plane figures material in fourth grade at UPTD SD Negeri 4 Bireuen. Data were collected through in-depth interviews with three teachers, classroom observation, and documentation studies, analyzed thematically with the assistance of NVivo 15 software to ensure systematic and in-depth analysis. The results reveal that teacher strategies are integrated into four main pillars: (1) content differentiation through adaptation of presentation modes (visual, auditory, kinesthetic) and learning contracts; (2) process differentiation based on heterogeneous grouping and contextual prompting questions; (3) product differentiation by providing choice in task forms and clear assessment rubrics; and (4) management of a collaborative learning environment. These strategies are supported by the application of the Problem Based Learning (PBL) model and interactive digital media (game-based learning). The study concludes that the success of differentiated instruction depends on the multidimensional synergy among learning elements and the teacher's commitment to being a reflective practitioner responsive to each individual student's needs. These findings provide a contextual strategic framework for teachers in implementing the student-centered Merdeka Curriculum.

Keywords: Differentiated Instruction; Teacher Strategy; Plane Figures; Qualitative Study; NVivo

1. INTRODUCTION

Elementary education plays a strategic role in establishing students' foundations of logical thinking and problem-solving skills (Weng, 2022; Asila, 2025). One of the subjects that significantly contributes to the development of these competencies is mathematics (Niss & Hojgaard, 2019; Kontrova et al., 2021). However, differences in students' abilities and learning styles often present challenges for teachers in creating effective learning processes (Ridwan et al., 2019; Killwn & O'Toole, 2023). This issue is particularly evident at the elementary school level, where the diversity of students' characteristics requires teachers to implement adaptive and flexible instructional strategies (Hardy et al., 2019). According to the Regulation of the Ministry of Education, Culture, Research, and Technology Number 8 of 2024 concerning Content Standards for Primary and Secondary Education, the scope of mathematics learning includes number concepts, patterns, spatial concepts (plane figures and solid shapes), as well as measurement and data interpretation. Among these topics, plane figures require strong visual and conceptual understanding. In practice, however, many students experience difficulties in understanding geometric concepts due to instructional approaches that remain uniform and insufficiently responsive to individual differences (Jones & Tzekaki, 2016; Klancar et al., 2021).

Teachers, as the frontline implementers of learning, are therefore required to design diverse and flexible instructional strategies (Boelens et al., 2018; Smets & Struyven, 2020). In line with Law Number 20 of 2023 on the National Education System, teachers are expected not only to transmit knowledge but also to act as facilitators and motivators who guide students in developing their potential optimally. One approach that aligns with this mandate is differentiated instruction, which involves adjusting learning content, processes, and products based on students' readiness, interests, and learning profiles (Tomlinson, 2017; Tomlinson & Jarvis, 2023; Danuri et al., 2023).

Differentiated instruction views learners as unique and diverse individuals; therefore, the learning process should provide opportunities for each student to develop according to their individual characteristics (Kanevsky, 2011; Tomlinson, 2017; Tomlinson & Jarvis, 2023). This approach is closely aligned with the educational philosophy of Ki Hajar Dewantara, which emphasizes guiding learners in accordance with their natural potential and the demands of their time (Dewantara,

2004; Darmawan & Sujoko, 2019). Student-centered education that respects individual diversity is essential for creating learning experiences that are meaningful and humanistic (Bhardwaj et al., 2025; Kumari, 2024; Tang, 2023). Despite its widespread introduction through the Merdeka Curriculum, the implementation of differentiated instruction in classroom practice continues to face significant challenges (Darius et al., 2025; Aziz et al., 2024). Preliminary observations conducted at UPTD SD Negeri 4 Bireuen in 2025 revealed that more than two-thirds of fourth-grade students had not met the Minimum Mastery Criteria in learning plane figures. Teachers also reported difficulties in adapting instructional strategies to accommodate students' visual, auditory, and kinesthetic learning styles due to limitations in time, learning resources, and professional training.

These findings are consistent with previous studies indicating that limited instructional time, teacher competence, and large class sizes are major obstacles to the effective implementation of differentiated instruction (Santoso, 2020; Almujab, 2023; Muthaharoh, 2024). However, with adequate professional development and effective classroom management strategies, these challenges can be addressed to support more inclusive and effective learning environments. Previous research has shown that differentiated instruction can improve students' learning outcomes and motivation (Wijayanti, 2020; Lestari and Puspitasari, 2021; Pratiwi, 2022). Nevertheless, studies that specifically examine teachers' strategies in implementing differentiated instruction for plane figures at the elementary school level remain limited, particularly in local contexts such as Bireuen Regency, where student characteristics are highly heterogeneous. However, most existing studies have primarily focused on measuring learning outcomes or evaluating the effectiveness of differentiated instruction using qualitative approaches. Research that specifically explores teachers' strategies in implementing differentiated instruction for plane figures at the elementary school level, particularly through qualitative approaches supported by data analysis software such as NVivo, remains limited. In fact, an in-depth understanding of teachers' instructional strategies, pedagogical decision-making processes, and classroom challenges is essential for portraying contextual and practical implementations of differentiated instruction, especially in regions with heterogeneous student characteristics such as Bireuen Regency.

Therefore, this study aims to explore in depth teachers' strategies in implementing differentiated instruction for plane figures in fourth-grade classrooms at UPTD SD Negeri 4 Bireuen through qualitative data analysis supported by NVivo. The findings of this study are expected to provide empirical contributions to the development of differentiated instruction practices in elementary education and to serve as a reference for teachers and educational stakeholders in optimizing the implementation of the Merdeka Curriculum that is responsive to students' individual learning needs.

2. RESEARCH METHOD

Research Design and Approach

This study employed a qualitative approach with a case study design. The qualitative approach was selected because the study aimed to obtain an in-depth understanding of teachers' strategies in implementing differentiated instruction for plane figures within the authentic context of classroom learning (Saldaña, 2009). The case study design enabled an intensive and contextual examination of differentiated instruction practices as implemented by teachers in a specific educational setting.

Research Site and Participants

The study was conducted at UPTD SD Negeri 4 Bireuen, Bireuen Regency, Aceh Province, from June to August 2025. The participants consisted of three fourth-grade teachers selected through purposive sampling. The selection criteria included teaching mathematics in fourth grade, having implemented differentiated instruction within the Merdeka Curriculum, and willingness to participate as research informants. The primary focus of this article is on interview data obtained from teachers, while observation and documentation data were used as supporting sources for triangulation.

Data Collection Techniques

Data were collected using multiple techniques to ensure depth and credibility of findings. First, in-depth semi-structured interviews were conducted with three fourth-grade teachers. The interviews focused on exploring teachers' strategies in implementing differentiated instruction, including differentiation of content, process, product, and learning environment, as well as perceived impacts on student learning outcomes and factors that support or hinder implementation. Second, classroom observations were carried out to directly examine the implementation of differentiated instruction during mathematics lessons, particularly in the teaching of plane figures. Observations focused on teachers' practices in managing learning content, instructional processes, student products, and the learning environment. Third, documentation studies were conducted by reviewing instructional documents such as teaching modules, learning contracts, instructional media, assessment rubrics, and samples of students' work related to differentiated instruction.

Data Analysis Techniques Using NVivo

Data analysis was conducted using a qualitative approach with the support of NVivo software. The use of NVivo aimed to enhance the systematic organization, transparency, and traceability of the qualitative data analysis process. The analysis

followed the interactive model proposed by Miles, Huberman, and Saldaña (2019), which consists of data reduction, data display, and conclusion drawing. The data analysis process was carried out through the following stages.

1. Preparation and Data Import
   All interview data were transcribed verbatim and then imported into NVivo. Each transcript was labeled according to the data source to facilitate data organization and retrieval during the analysis process.
2. Open Coding
   Initial coding was conducted by identifying relevant meaning units, such as strategies for content differentiation, process differentiation, product differentiation, and learning environment management, as well as their impacts on student learning outcomes.
3. Axial Coding
   Codes with related meanings were grouped into categories and subthemes, such as content differentiation strategies, process differentiation strategies, and factors hindering the implementation of differentiated instruction.
4. Selective Coding
   Core themes were developed to address the research objectives, including the implementation of differentiated instruction and its implications for student learning outcomes.
5. Data Presentation and Interpretation
   NVivo was used to generate data visualizations such as hierarchy charts and word clouds to facilitate the identification of thematic patterns and trends. The analysis results were then interpreted and linked to differentiated instruction theory and relevant previous studies. For publication purposes, selected visual outputs generated from NVivo were translated into English using conceptual equivalence to preserve the original analytical meaning.

To enhance the clarity of the research procedures, the overall methodological process of this study is summarized in **Figure 1**.

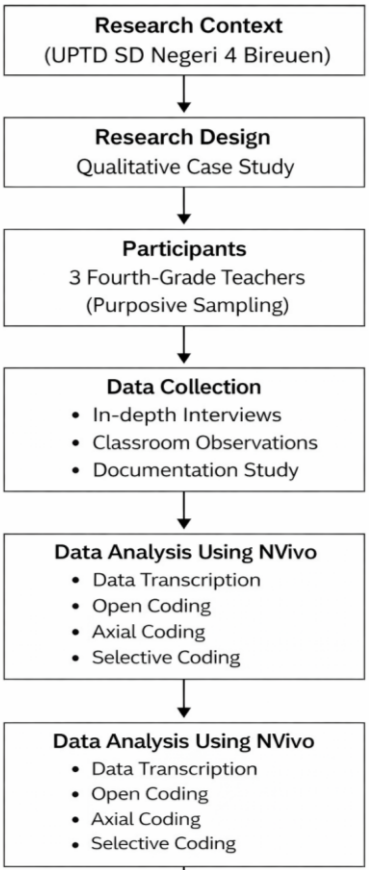

Figure 1. Flow of Qualitative Research Procedures

3. RESULTS AND DISCUSSION

3.1 Differentiated Learning Strategies

Based on the coding results of teacher interview transcripts analyzed using NVivo 15, four main subthemes were identified, namely content differentiation, process differentiation, product differentiation, and learning environment management, as illustrated in **Figure 2**.

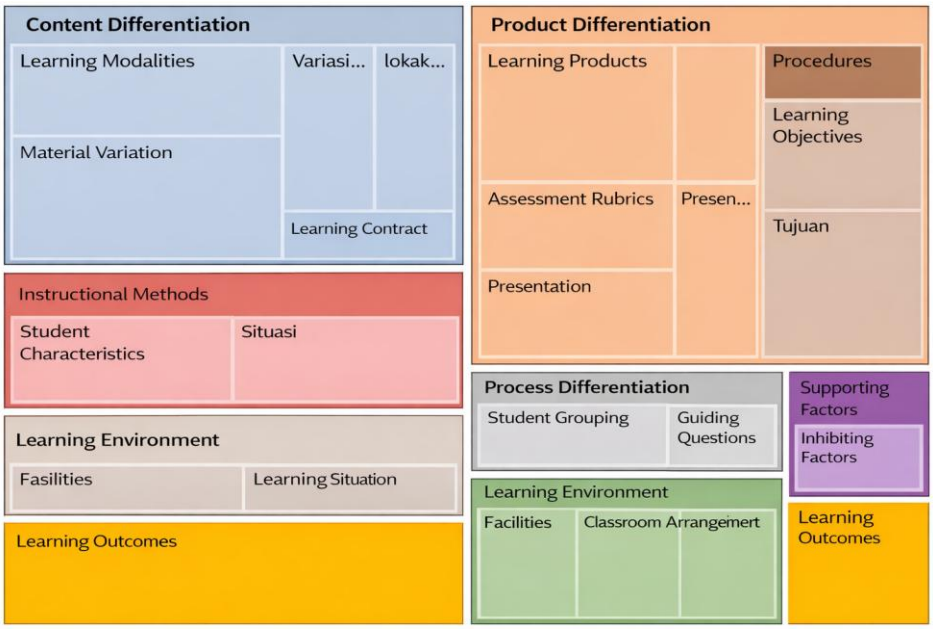

Figure 2. NVivo Hierarchy Chart of Differentiated Instruction Strategies

Figure 1 illustrates a hierarchy chart generated from NVivo analysis of teacher interview data, depicting the themes and subthemes of teachers' strategies in implementing differentiated instruction for plane figures. The size of each box in the diagram represents the frequency with which each theme appeared in the interview data. The results indicate that content differentiation emerged as the most dominant theme, encompassing variations in material presentation, learning modalities, and adjustments to students' characteristics and readiness levels. Product differentiation also appeared as a prominent theme, reflected in the provision of task choices, variations in learning outputs, and the use of flexible assessment rubrics. Process differentiation was evident through student grouping strategies, variations in learning activities, and the use of guiding questions during instruction. Meanwhile, the learning environment dimension was reflected in classroom facility management, classroom arrangement, and teachers' efforts to align learning activities with students' interests. The diagram also presents additional supporting themes, including instructional methods and procedures, learning outcomes, and factors that support or hinder the implementation of differentiated instruction. These patterns are further reinforced by Figure 2, which identifies the most frequently occurring keywords and highlights teachers' primary focus in implementing differentiated learning strategies through a word cloud visualization.

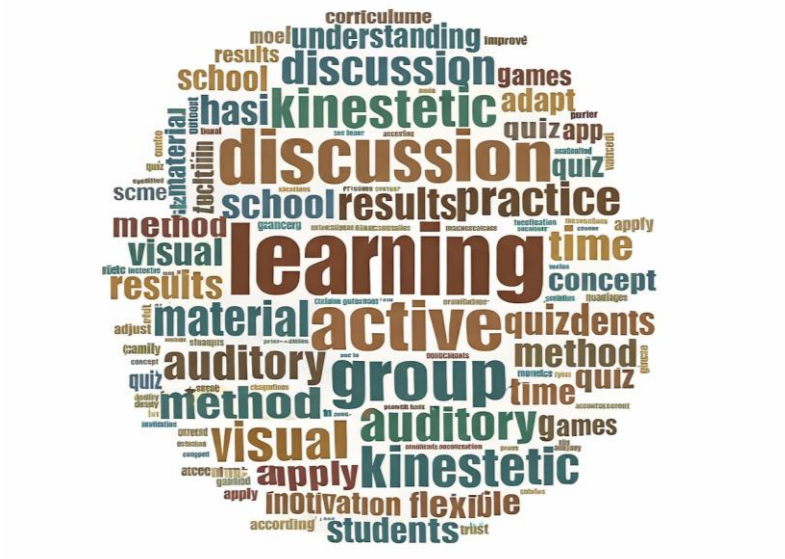

Figure 3. Word Cloud of Teachers' Differentiated Learning Strategies

Figure 3 presents a word cloud visualization displaying the most frequently occurring words in the interview transcripts related to teachers' strategies in differentiated instruction. The most prominent terms include learning, discussion, time, active, practice, group, visual, auditory, and kinesthetic. The frequency of these words indicates that teachers primarily focused on implementing active, varied, and learning style oriented instructional practices. The dominance of the word learning reflects that all strategies were centered on improving the quality of the learning process. The frequent appearance of the words discussion, group, and practice suggests that teachers predominantly employed collaborative and participatory approaches, encouraging students to engage in discussions, cooperative work, and hands-on learning activities. Furthermore, the presence of the terms visual, auditory, and kinesthetic indicates that teachers applied the principles of differentiated instruction based on students' learning styles. Learning activities were designed to accommodate diverse learning preferences through visual media, listening activities, and motor or practical tasks. Meanwhile, the words time, material, and method highlight teachers' attention to instructional planning and classroom management aligned with students' conditions and characteristics. The appearance of the terms improvement, outcomes, and understanding emphasizes teachers' efforts to ensure that differentiated strategies contributed to enhanced student learning outcomes. Overall, the word cloud illustrates that teachers played an active role in creating adaptive, collaborative, and diverse learning environments, consistent with the core principles of differentiated instruction proposed by Tomlinson (2017), which emphasize aligning learning content, processes, and products with students' readiness, interests, and learning profiles.

3.2 Content Differentiation

Content differentiation emerged as one of the primary strategies most frequently implemented by teachers. Based on the NVivo coding results, the dominant subthemes included instructional material adjustment, learning contracts, and the use of varied learning resources, as illustrated in **Figure 4**.

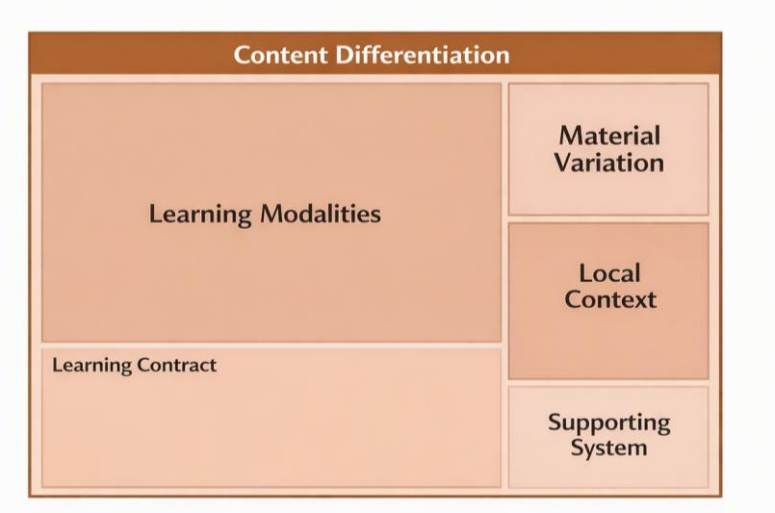

Figure 4. Hierarchy Chart of Content Differentiation

Figure 4 indicates that content differentiation was strongly influenced by learning modalities, as reflected by the larger size of the learning modalities node compared to other subthemes. This was followed by learning contracts and material variation, while the supporting system appeared as a less dominant element. These findings suggest that teachers primarily modified how students accessed and engaged with learning content rather than altering the content itself uniformly. The NVivo coding results from interviews with three teachers demonstrate that learning modalities played a central role in content differentiation strategies. As expressed by one teacher:

> *"Saya menggunakan ketiga moda tersebut. Visual dengan gambar dan media, auditori dengan penjelasan dan diskusi, kinestetik dengan praktik atau permainan. Saya menyesuaikannya berdasarkan hasil pengamatan cara belajar siswa."*
> *(Guru Kelas A)*

In addition to learning modalities, content differentiation was supported by the implementation of learning contracts. Teachers reported establishing agreements with students before beginning the plane figures topic. These learning contracts were collaboratively discussed and formulated between teachers and students, serving as a shared guideline to foster a conducive and participatory learning environment. One teacher explained:

> *"Kontrak belajar dibuat di awal semester, berisi kesepakatan tentang aturan kelas, seperti masuk kelas tepat waktu, mengerjakan tugas, dan saling menghargai. Prosesnya dimusyawarahkan bersama kemudian disusun dan ditempelkan di dinding kelas."*
> *(Guru Kelas B)*

The collaborative development of learning contracts reflects the principles of student-centered learning, as students are actively involved in establishing classroom rules and responsibilities. This process helps cultivate a sense of ownership and responsibility toward the agreed-upon norms. The visual display of learning contracts on classroom walls also functions as a continuous reminder that reinforces shared commitments between teachers and students.

Another aspect of content differentiation involved material variation. Teachers prepared instructional materials with varying levels of difficulty, ranging from basic shape recognition to more complex tasks involving the calculation of area and perimeter of composite plane figures. As noted by one teacher:

"Saya menyesuaikan materi dengan kebutuhan siswa, dan contoh yang ada di lingkungan sekitar. Misalnya, saat membahas persegi atau persegi panjang, saya akan mengaitkan dengan bentuk pintu rumah, lapangan, atau jendela kelas."
(Guru Kelas C)

Furthermore, teachers emphasized the importance of school-level support systems in facilitating content differentiation, particularly in the provision of learning media and diverse instructional resources. As stated by one teacher:

"Sekolah menyediakan media pembelajaran yang memadai, ruang kelas yang aman dan nyaman, serta kebijakan untuk mengembangkan kreativitas guru dalam memilih metode pembelajaran."
(Guru A)

The presence of supporting systems indicates that the implementation of content differentiation does not rely solely on individual teacher initiatives but also requires structural support from the school to ensure effective and sustainable differentiated learning practices.

3.3 Process Differentiation

Based on the NVivo 15 analysis, three main subthemes were identified in the implementation of process differentiation, namely the use of guiding questions, student grouping, and the use of appropriate graphic organizers. These subthemes are visualized in the hierarchy chart presented in **Figure 5**.

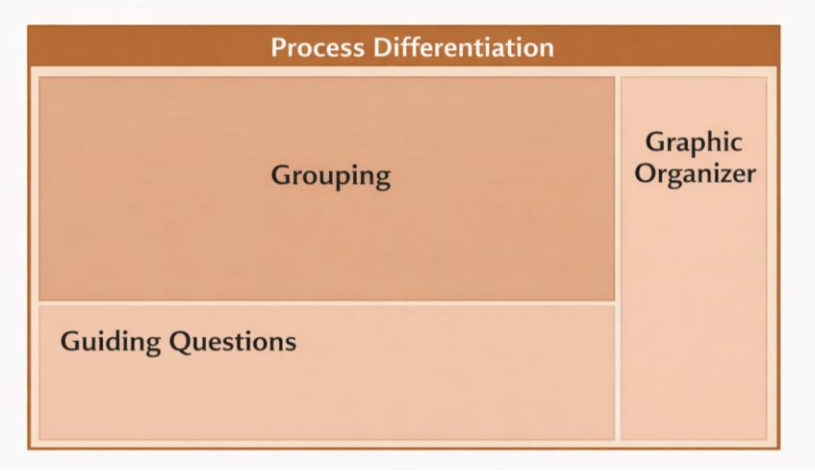

Figure 5. Hierarchy Chart of Process Differentiation

Figure 5 shows that student grouping emerged as the subtheme with the highest frequency of occurrence, followed by the use of guiding questions, while the use of graphic organizers appeared as the least frequently applied strategy. These findings indicate that student grouping was the most dominant process differentiation strategy implemented by teachers in teaching plane figures. Student grouping strategies were implemented by considering students' diverse learning styles and levels of ability. One teacher stated:

"Saya biasanya membuat kelompok dengan campuran berbagai gaya belajar (visual, auditori, kinestetik) agar siswa bisa saling melengkapi. Perbedaannya ada pada cara saya menyampaikan materi, untuk siswa visual saya sediakan gambar, untuk auditori saya jelaskan lewat diskusi, dan untuk kinestetik saya beri kegiatan praktik."
(Guru A)

This statement indicates that teachers applied flexible grouping as an effort to adapt the learning process to students' learning needs. Through this strategy, students were given opportunities to learn collaboratively and support one another, making the learning process more inclusive and participatory. In addition to grouping, teachers implemented process differentiation through the use of guiding questions. Open-ended questions were used at the beginning of lessons to stimulate student engagement, connect learning materials to everyday experiences, and focus students' attention on plane figures. One teacher explained:

"Misalnya, 'siapa yang bisa menyebutkan benda di sekitar kita yang berbentuk segitiga?'. Pertanyaan pemantik seperti ini dapat memacu keaktifan siswa untuk mengikuti proses pembelajaran. Karena siswa merasa dekat dengan pengalaman sehari-hari, mereka lebih mudah menjawab dan akhirnya lebih fokus mengikuti pelajaran."
(Guru C)

The use of guiding questions served as a cognitive bridge that helped students relate mathematical concepts to real-life contexts, thereby facilitating their understanding of plane figures. Meanwhile, the use of graphic organizers represented the least frequently applied form of process differentiation. Only one teacher reported using visual tools such as concept maps and Venn diagrams in mathematics instruction.

As expressed by one teacher:

"Saya pernah menggunakan graphic organizer seperti peta konsep dan tabel Venn saat mengajar matematika, khususnya pada materi bangun datar. Misalnya, saya membuat peta konsep untuk menunjukkan hubungan antara berbagai jenis bangun datar, seperti persegi, persegi panjang, segitiga, dan lingkaran. Selain itu, saya juga menggunakan tabel Venn untuk membandingkan sifat-sifat dua bangun datar."
(Guru B)

These findings indicate that the use of graphic organizers has not yet become a common practice in classroom instruction, possibly due to limited instructional time or teachers' limited understanding of the potential of graphic organizers in helping students organize and integrate geometric concepts.

3.4 Product Differentiation

Based on the NVivo 15 coding of interview transcripts from three fourth-grade teachers, five main subthemes were identified in the implementation of product differentiation, namely project-based learning activities, student choice of final products based on individual interests, the development of clear assessment rubrics, explanations of product presentation procedures, and the creation of genuinely differentiated products. These subthemes are illustrated in **Figure 6**.

Figure 6. Hierarchy Chart of Product Differentiation

The hierarchy chart visualization shows that learning products emerged as the most frequently occurring subtheme, followed by assessment rubrics, instructional strategies, presentation, and task choice. These findings indicate that teachers tended to place greater emphasis on how students' final products were assessed and presented, while aspects related to expanding task variation and deepening product differentiation strategies received relatively less attention. Overall, teachers provided opportunities for students to express their understanding through various forms of products aligned with students' interests and abilities. One teacher stated:

"Saya beri kebebasan untuk memilih bentuk produk akhir sesuai dengan minat dan kemampuan mereka. Ada yang memilih membuat poster tentang bangun datar, ada yang membuat maket sederhana dari kertas karton, dan ada juga yang menyusun presentasi sederhana menggunakan gambar. Dengan memberikan pilihan, siswa menjadi lebih termotivasi, kreatif, dan bertanggung jawab terhadap hasil karyanya."
(Guru B)

This statement demonstrates that teachers applied the principle of student choice as a core component of product differentiation. By allowing students to select the form of their final products, teachers enabled learners to demonstrate their understanding in ways that suited their preferences, whether visually, in written form, or orally. In addition, interview findings revealed that teachers developed assessment rubrics to evaluate student products. One teacher explained:

"Saya selalu buat rubrik sederhana, misalnya dari aspek isi, kerapian, dan kreativitas. Anak-anak juga saya tunjukkan supaya mereka tahu apa yang dinilai."
(Guru C)

These findings indicate that teachers paid attention not only to the final product but also to transparent processes and clearly defined success criteria. This practice aligns with Heacox (2018), who emphasizes that rubrics are essential tools in differentiated instruction to ensure fair and objective assessment based on students' diverse learning styles.

Another subtheme identified was product presentation, in which teachers provided opportunities for students to present their work in front of the class. One teacher noted:

"Saya menyampaikan langkah-langkah presentasi dan kemudian saya juga memberikan contoh singkat bagaimana cara presentasi di depan kelas. Saya memberikan kebebasan kepada siswa dalam memilih cara mereka menampilkan hasil belajar, tapi umum yang sering digunakan siswa adalah presentasi lisan di depan kelas."
(Guru B)

Meanwhile, the subthemes related to task choice and broader product differentiation strategies showed lower frequencies in the coding results. This suggests that some teachers may still need to expand the range of tasks and further develop product differentiation strategies to provide students with more varied options for demonstrating their learning outcomes.

3.5 Learning Models and Methods as Supporting Strategies in Differentiated Instruction

Based on the NVivo 15 coding of interview transcripts from three fourth-grade teachers, a word cloud visualization was generated to illustrate the distribution of frequently occurring keywords related to learning models and instructional methods. The visualization is presented in **Figure 7**.

Figure 7. Word Cloud of Learning Models and Instructional Methods

Figure 7 shows that dominant keywords include discussion, games, problems, material, simple, active, enjoyable, and group. The prominence of these terms indicates that teachers tended to implement learning models and instructional methods that are collaborative, contextual, and student-centered. Such approaches enable students to actively engage in learning through peer interaction, problem-solving activities, and the use of engaging and enjoyable learning media. One teacher stated that the learning model most frequently applied was Problem Based Learning (PBL):

"Saya paling sering menggunakaan model PBL, karena dengan model ini siswa diajak untuk memecahkan suatu permasalahan, sehingga siswa dapat berfikir kritis. Tujuannya agar siswa dapat memcahkan masalah sesuai dengan tingkat pemahaman masing-masing siswa."
(Guru B)

The emergence of keywords such as problem, real, and PBL indicates that teachers predominantly oriented their instructional practices toward the Problem Based Learning model. Teachers linked learning activities to contextual problems relevant to students' daily lives, enabling students to develop critical and creative thinking skills in identifying solutions. This strategy effectively supports process differentiation, as it allows students to work according to their levels of readiness and interests. Similarly, other teachers explained:

"Saya paling sering menggunakan model Problem Based Learning (PBL), karena siswa diajak memecahkan masalah nyata sehingga lebih kritis dan kreatif. Untuk membuat suasana lebih menarik saya selingi dengan game edukatif berupa kuis interaktif seperti Wordwall, educaplay, dan quizizz, agar siswa lebih bersemangat sekaligus mengukur pemahaman

mereka secara lebih menyenangkan."
(Guru A dan C)

Furthermore, the frequent appearance of words such as games, Wordwall, Quizizz, and Educaplay suggests that teachers sought to create enjoyable learning environments through the use of digital game-based learning media. These interactive platforms not only increased student motivation but also enhanced learning experiences through visual representation and immediate feedback, which align well with the characteristics of today's digital-native learners.

Keywords such as simple, flexible, and enjoyable reflect teachers' efforts to adjust instructional delivery so that learning materials were easily understood by students with diverse learning styles, including visual, auditory, and kinesthetic learners. This flexibility represents a key characteristic of differentiated instruction, as it allows teachers to provide equitable learning experiences without reducing the depth of the subject matter. One teacher explained:

"Saya menjelaskan tahapan model PBL dengan cara sederhana, dan dengan bahasa yang mudah difahami siswa. Tahapan tersebut sangat fleksibel, dimana siswa yang audi dan visual akan dibantu dengan gambar dan video pembelajaran dan lebih aktif dalam diskusi, dan siswa kinestetik akan dilibatkan dalam kegiatan praktik."
(Guru B)

These findings align with Djamarah et al. (2013), who state that instructional strategies consist of systematically designed activities aimed at achieving learning objectives. Within the context of differentiated instruction, learning models and instructional methods function as complementary components, where the model provides direction and structure, while methods serve as flexible means to accommodate individual differences among students. Overall, the word cloud analysis reinforces the finding that teachers' differentiated instruction strategies extend beyond content, process, product, and learning environment dimensions and are strongly influenced by teachers' ability to select and implement adaptive and contextual learning models and instructional methods.

These findings are further supported by classroom observations and document analysis of supporting instructional materials, including student worksheets (LKPD) and teaching modules. The worksheets were designed progressively to match students' varying ability levels, ranging from exploration and elaboration activities to reflection. Meanwhile, teaching modules served as systematic guides that supported the consistent implementation of content, process, and product differentiation across lessons. The relationships among these instructional components are visualized through the NVivo 15 Project Map, as shown in Figure 6. The Project Map results indicate that the central node, "Teachers' Strategies in Differentiated Instruction," functions as a core element connecting various supporting components, including content, process, product, learning environment, instructional methods, and learning models. Each node is directly interconnected, suggesting that teachers did not modify a single aspect of instruction in isolation, but rather adjusted all instructional elements to create adaptive and inclusive learning experiences. For instance, the application of group discussion methods is closely linked to process differentiation, while the use of project-based or problem-based learning models is associated with product differentiation that allows students to express creativity in presenting their work.

These findings strengthen classroom observation results showing that teachers actively fostered learning environments that support collaboration and student participation. Classroom arrangements were flexibly organized based on students' interests and readiness levels, while instructional materials and worksheets were developed in tiered formats to accommodate differences in students' cognitive abilities. Thus, the NVivo 15 Project Map analysis confirms that teachers' strategies in differentiated instruction involve not only the modification of content, process, product, and learning environment, but are also reinforced by the application of appropriate learning models and instructional methods, supported by teaching resources such as worksheets and instructional modules. Together, these components form an adaptive, collaborative, and effective instructional system that enhances the quality of mathematics learning on plane figures in fourth-grade classrooms.

3.6 Discussion

The findings of this study reveal that teachers' strategies in implementing differentiated instruction for plane figures are primarily focused on four core dimensions: content, process, product, and learning environment, supported by the selection of adaptive learning models and instructional methods. The NVivo analysis indicates that content differentiation emerged as the most dominant strategy, followed by product and process differentiation. These findings are consistent with the core principles of differentiated instruction, which emphasize the need to align learning experiences with students' readiness, interests, and learning profiles (Tomlinson, 2017; Tomlinson & Jarvis, 2023; Danuri et al., 2023). The following discussion elaborates on each major finding, supported by relevant and recent empirical studies (Kumar et al., 2017; Ibrahim & Haerudin, 2024). Content differentiation emerged as the most prominent strategy, indicating that teachers perceived instructional material adaptation as the initial and most critical step in differentiated instruction (Gaitas & Alves, 2017). This adaptation was implemented through variations in learning modalities (visual, auditory, and kinesthetic) (Rahman & Budivanto, 2019;), the development of learning contracts, and adjustments in the level of material difficulty. This finding is supported by Magableh and Abdullah (2020), who concluded that content differentiation, particularly through multimodal

presentation of information, significantly enhances students' understanding and retention in subjects such as mathematics (Ramdhani et al., 2025; Rijal & Waluyo, 2025) .

Participatory learning contracts also played a crucial role in fostering students' sense of ownership. According to Bondie et al. (2021), involving students in establishing classroom agreements is an effective strategy for increasing engagement, responsibility, and self-regulation within differentiated learning environments. Furthermore, linking plane figure concepts to real-life objects in students' surroundings, such as doors and windows, reflects contextual learning practices aligned with the principles of realistic mathematics education. Pratiwi et al. (2022) emphasized that contextualizing geometric concepts strengthens students' connections to abstract ideas and facilitates deeper, more meaningful understanding. Process differentiation in this study was primarily realized through heterogeneous student grouping based on learning styles and the use of guiding questions. Mixed grouping strategies that combine visual, auditory, and kinesthetic learners enable students to complement one another and engage in collaborative learning. This finding aligns with Suprayogi et al. (2022), who demonstrated that flexible grouping based on learning profiles in differentiated instruction not only improves academic achievement but also promotes students' social skills.

In addition, the use of open and contextual guiding questions served as a cognitive hook to activate students' prior knowledge and enhance engagement at the beginning of mathematics lessons. Santoso and Lestari (2023) found that effective guiding questions increase students' participation and focus while facilitating the transition toward deeper conceptual understanding. By connecting mathematical concepts to everyday experiences, guiding questions function as a bridge between abstract knowledge and real-world application. Product differentiation was reflected in teachers' practices of allowing students to choose the form of their final products, such as posters, models, or presentations. Providing student choice represents a key motivational element in differentiated instruction, as it accommodates individual interests and learning preferences (Heacox, 2018). Moreover, the use of transparent assessment rubrics highlights the importance of formative assessment in differentiated learning. Prast et al. (2020) emphasized that clear and well-communicated rubrics enable fair and objective assessment while guiding students' efforts toward clearly defined learning goals. However, the relatively limited variation in tasks and product differentiation strategies suggests opportunities for further development. Integrating technology-based projects or digital portfolios may expand students' options for demonstrating understanding and enhance creativity in product outcomes.

The application of the Problem Based Learning (PBL) model and digital educational games such as Quizizz and Wordwall illustrates teachers' efforts to create active, contextual, and enjoyable learning environments. The integration of PBL within differentiated instruction is particularly appropriate, as the model inherently supports differentiation in both process and product by allowing students to approach problems with varying strategies and depths of understanding. Valiandes and Neophytou (2021) demonstrated that problem-based approaches within differentiated frameworks effectively enhance critical thinking and learning outcomes among diverse student populations.

Similarly, the use of game-based learning tools aligns with the characteristics of today's digital-native learners and functions as an engaging form of process differentiation. Aldabbus (2022) reported that platforms such as Quizizz facilitate personalized learning, provide immediate feedback, and sustain student motivation across different learning styles.

Beyond technical strategies related to content, process, product, and learning environment, the essence of differentiated instruction lies in a paradigm shift from teaching the class as a homogeneous unit to serving each student as a unique individual (Tomlinson, 2017; Suprayogi et al., 2022). The key element is not merely the variation of activities, but teachers' continuous ability to read and respond to students' specific learning needs through responsive teaching (Bondie et al., 2021).

To ensure that differentiated instruction remains contextual and effective, teachers must conduct authentic and ongoing diagnostic assessments, not only at the beginning of instruction but throughout the learning process. Understanding students' readiness, interests, and learning profiles dynamically enables teachers to design proactive and structured differentiation plans while maintaining flexibility during classroom implementation (Tomlinson, 2017; Prast et al., 2020). Such practices require teachers to act as reflective practitioners who regularly evaluate the impact of their instructional strategies and collaborate with colleagues to develop diverse instructional resources and strategies (Almujab, 2023; Valiandes & Neophytou, 2021). Without this foundational awareness, differentiated instruction risks becoming a series of superficially varied activities that fail to address the deeper learning needs of individual students (Bondie et al., 2021).

4. CONCLUSION

Based on this NVivo-assisted qualitative study, it can be concluded that teachers' strategies in implementing differentiated instruction for plane figures in fourth-grade classrooms at SD Negeri 4 Bireuen were carried out through the integrated adjustment of four main pillars. Content differentiation emerged as the most dominant strategy, reflected in variations in presentation modalities and the use of learning contracts. Process differentiation was implemented through heterogeneous student grouping and the use of guiding questions, while product differentiation emphasized task choice and the use of clear assessment rubrics. All of these strategies were supported by the selection of learning models such as Problem Based Learning and the use of digital media, which contributed to the creation of active and collaborative learning environments.

These findings confirm that the effectiveness of differentiated instruction lies in the synergy among instructional elements rather than reliance on a single strategy. This study provides practical contributions in the form of a contextual strategy framework that can support teachers in implementing the Merdeka Curriculum, particularly in teaching abstract mathematical content. However, further optimization requires systemic support to address challenges related to time management and the development of more diverse product assessment strategies. Future studies are strongly recommended to explore the long-term impact of differentiated instruction on students' spatial abilities and to develop more practical and applicable teacher training models.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the teachers and school administrators of SD Negeri 4 Bireuen for their cooperation and willingness to participate in this study. The authors also appreciate the support provided during the data collection process.

REFERENCES

Aldabbus, S. (2022). The impact of using Quizizz on learning vocabulary in an EFL classroom. International Journal of Technology in Education and Science (IJTES), 6(1), 1-12. https://doi.org/10.46328/ijtes.362

Almujab, S. A. (2023). Tantangan guru dalam implementasi pembelajaran berdiferensiasi di sekolah dasar. Jurnal Basicedu, 7(1), 450-461. https://doi.org/10.31004/basicedu.v7i1.4500

Asila, K. (2025). Tasks for developing logical thinking skills in early childhood for primary school students. Pedagogik islohotlar va ularning yechimlari, 12(01), 121-123.

Aziz, M., Napitupulu, D. S., & Tanjung, S. A. (2024). Implementation of Differentiated Learning in the Merdeka Belajar Curriculum for Elementary Schools. Journal of Elementary Educational Research, 4(2), 127-142.

Bhardwaj, V., Zhang, S., Tan, Y. Q., & Pandey, V. (2025, February). Redefining learning: student-centered strategies for academic and personal growth. In Frontiers in Education (Vol. 10, p. 1518602). Frontiers Media SA.

Boelens, R., Voet, M., & De Wever, B. (2018). The design of blended learning in response to student diversity in higher education: Instructors' views and use of differentiated instruction in blended learning. Computers & Education, 120, 197-212.

Bondie, R. S., Dahnke, C., & Zusho, A. (2021). How does changing "one-size-fits-all" to differentiated instruction affect teaching? Review of Research in Education, 45(1), 170–189. https://doi.org/10.3102/0091732X20985068

Darius, A. P., Tumonglo, Y. T., Mar'ah, F. H., & Hari, R. (2025). Differentiated Learning in the Merdeka Curriculum: A Literature Review on School Practices. Journal of English Language and Education, 10(4), 1535-1544.

Darmawan, I. P. A., & Sujoko, E. (2019). Understanding ki hadjar dewantara's educational philosophy. International Journal of Humanities and Innovation (IJHI), 2(3), 65-68.

Gaitas, S., & Alves Martins, M. (2017). Teacher perceived difficulty in implementing differentiated instructional strategies in primary school. International Journal of Inclusive Education, 21(5), 544-556.

Hardy, I., Decristan, J., & Klieme, E. (2019). Adaptive teaching in research on learning and instruction. Journal for educational research online, 11(2), 169-191.

Ibrahim, S., & Haerudin, H. (2024). Pembelajaran Berbasis Pendekatan Diferensiasi. Lingua Rima: Jurnal Pendidikan Bahasa dan Sastra Indonesia, 13(2).

Jones, K., & Tzekaki, M. (2016). Research on the teaching and learning of geometry. The second handbook of research on the psychology of mathematics education: The journey continues, 109-149.

Killen, R., & O'Toole, M. (2023). Effective teaching strategies 8e. Cengage AU.

Klančar, A., Starčič, A. I., Cotič, M., & Žakelj, A. (2021). Problem-based geometry in seventh grade: Examining the effect of path-based vs. conventional instruction on learning outcomes. International Journal of Emerging Technologies in Learning (Online), 16(12), 16.

Kontrová, L., Biba, V., & Šusteková, D. (2021). Relationship between Mathematical Education and the Development of Creative Competencies of Students. European journal of contemporary education, 10(1), 89-102.

Kumar, B., Manrai, A. K., & Manrai, L. A. (2017). Purchasing behaviour for environmentally sustainable products: A conceptual framework and empirical study. Journal of retailing and consumer services, 34, 1-9.

Kumari, S. (2024). Humanism in education: Fostering student-centered learning through maslow's and rogers' theories. Journal homepage: www. ijrpr. com ISSN, 2582, 7421.

Magableh, I. S., & Abdullah, A. (2020). The effect of differentiated instruction on EFL learners: Teachers' perspective. International Journal of Academic Research in Progressive Education and Development, 9(2), 255-267. https://doi.org/10.6007/IJARPED/v9-i2/7518

Muthaharoh, N. (2024). Analisis faktor penghambat implementasi pembelajaran berdiferensiasi pada Kurikulum

Merdeka. Jurnal Pendidikan dan Konseling, 6(1), 123-134. https://doi.org/10.31004/jpdk.v6i1.21045

Niss, M., & Højgaard, T. (2019). Mathematical competencies revisited. Educational studies in mathematics, 102(1), 9-28.

Prast, E. J., Weijer-Bergsma, E. V., Kroesbergen, E. H., & Van Luit, J. E. (2020). Differentiated instruction in primary mathematics: Effects of teacher professional development on student achievement. Learning and Instruction, 54, 101304. https://doi.org/10.1016/j.learninstruc.2020.101304

Pratiwi, I. D., Waluyo, S. B., & Rochmad, R. (2022). Realistic Mathematics Education (RME) approach for geometry learning in elementary school: A systematic literature review. Jurnal Elemen, 8(2), 609-626. https://doi.org/10.29408/jel.v8i2.5673

Rahman, A., & Budivanto, U. (2019, September). Case based reasoning adaptive e-learning system based on visual-auditory-kinesthetic learning styles. In 2019 6th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI) (pp. 177-182). IEEE.

Ramdhani, S., Nurcahyono, N. A., & Nirmala, S. D. (2025). Designing Interactive E-Modules Based on Differentiated Instruction and the Theory of Didactical Situations for Primary Mathematics Education. Educational Process: International Journal, 17, e2025368.

Ridwan, H., Sutresna, I., & Haryeti, P. (2019, October). Teaching styles of the teachers and learning styles of the students. In Journal of Physics: Conference Series (Vol. 1318, No. 1, p. 012028). IOP Publishing.

Rijal, A., & Waluyo, B. (2025). Effectiveness of Differentiated Learning in Mathematics: Insights from Elementary School Students. Journal of Education and Learning (EduLearn), 19(1), 241-248.

Santoso, F. Y., & Lestari, S. (2023). The use of opening questions to stimulate student activity in elementary mathematics learning. Journal of Education and Learning (EduLearn), 17(1), 124-130. https://doi.org/10.11591/edulearn.v17i1.20567

Smets, W., & Struyven, K. (2020). A teachers' professional development programme to implement differentiated instruction in secondary education: How far do teachers reach?. Cogent Education, 7(1), 1742273.

Suprayogi, M. N., Valcke, M., & Godwin, R. (2022). Teachers' perception of differentiated instruction in elementary school: A study in a context of inclusive education. International Journal of Inclusive Education, 1-18. https://doi.org/10.1080/13603116.2022.2048103

Tang, K. H. D. (2023). Student-centered approach in teaching and learning: What does it really mean?. Acta Pedagogia Asiana, 2(2), 72-83.

Tomlinson, C. A. (2017). Differentiated instruction. In Fundamentals of gifted education (pp. 279-292). Routledge.

Tomlinson, C. A., & Jarvis, J. M. (2023). Differentiation: Making curriculum work for all students through responsive planning & instruction. In Systems and models for developing programs for the gifted and talented (pp. 599-628). Routledge.

Valiandes, S., & Neophytou, L. (2021). Implementing differentiated instruction in mixed-ability classrooms: The impact of providing professional development and support to teachers. Teachers and Teaching, 27(6), 518-533. https://doi.org/10.1080/13540602.2021.1933417

weng, T. S. (2022). Enhancing Problem-Solving Ability through a Puzzle-Type Logical Thinking Game. Scientific Programming, 2022(1), 7481798.