

# Analysis of Science Teachers' Difficulties in Implementing Differentiated Learning in the Independent Curriculum at Senior High Schools

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**Abstract:** Differentiated learning is an innovative approach aimed at improving instructional effectiveness by tailoring teaching methods and materials to meet students' individual needs. However, most science teachers in West Seram Regency have not yet implemented this approach optimally. Some teachers have even made mistakes in its application and face various significant challenges. This study aims to analyze the difficulties experienced by senior high school science teachers in implementing differentiated learning in accordance with the Merdeka Curriculum. The study involved 30 teachers from 6 senior high schools in the region and employed both quantitative and qualitative descriptive methods using a survey design. Instruments included questionnaires to measure levels of difficulty and interviews to strengthen the data. The results revealed that four out of six schools had not yet implemented differentiated learning effectively, with an average difficulty level reaching 63.3%. The main difficulties included a lack of conceptual understanding, limited resources, and minimal training related to the new curriculum. These findings underscore the need to enhance teachers' professional capacity through intensive training so that they can design more inclusive and adaptive learning strategies, ultimately improving the quality of education in West Seram Regency.

**Keywords:** Differentiated Learning; Difficulty Analysis; Science Teachers.

## Introduction

One of the fundamental components of the United Nations 2030 Sustainable Development Agenda is quality education, with the goal of ensuring inclusive and equitable quality education for all (Haleem et al., 2022). The curriculum is a key component of the education system, serving as a guideline for the teaching and learning process. It not only acts as a reference for instructional planning but also reflects the direction and goals of national education. Therefore, each educational institution is given the authority to develop its curriculum according to the needs and characteristics of its students. The curriculum serves as the primary guide for educators in determining meaningful teaching and learning objectives (Deriba & Sanusi, 2025). Throughout its history, Indonesia's education system has undergone

multiple curriculum reforms, from the 1947 Curriculum to the currently implemented Merdeka Curriculum (Riyan Rizaldi & Fatimah, 2022). Curriculum changes are not uncommon, as seen in countries such as New Zealand (Baker, 2002), the Philippines (Mendoza & Nakayama, 2003), Hong Kong (Chan, 2010), China (Lee, 2017), and Malaysia (Barghi et al., 2017). In Indonesia, the paradigm has shifted from teacher-centered learning to student-centered learning, requiring a transformation of traditional teaching approaches. Content-heavy curricula that reduced knowledge to mere memorization are now being phased out, especially in this era of rapid global development and fierce competition (Dewantara, 2020). Curriculum reform is necessary to allow reflection on content and methods and to keep pace with broader societal developments. Implementing a new curriculum

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is a positive step toward realigning education with national aspirations (Dube & Jita, 2018).

School support is crucial for successful curriculum implementation. To achieve this, schools must have strong support structures and undergo fundamental changes in teaching approaches. However, frequent curriculum changes can also cause confusion for both teachers and students. Optimizing the relationship between education and curriculum in Indonesia requires strong coordination among the government, educational institutions, teachers, and other relevant stakeholders (Wibowo et al., 2023). Currently, teachers across Indonesia are focusing on preparing to facilitate teaching and learning using the Merdeka Curriculum (or the Emancipated Curriculum) (Rohmah et al., 2024). This curriculum is designed to foster a joyful, pressure-free learning environment that allows students the freedom to think creatively. It aims to develop students who are independent, self-directed, and possess strong character, emphasizing the importance of student-centered learning. One key strategy to achieve these goals is the implementation of differentiated instruction, an approach tailored to the needs, interests, and learning styles of students (Astuti & Afendi, 2022; Yoto et al., 2024).

Differentiated instruction, grounded in the belief that all students can grow, empowers students with special needs by offering opportunities to engage and learn in inclusive school environments. It is widely recognized as a strategy that accommodates students' readiness levels, learning interests, and profiles (Tomlinson et al., 2003). The goal is to ensure that the inclusion of diverse needs is seen as enrichment and a challenge in learning, rather than a burden. Whether these needs are physical, behavioral, emotional, or based on socio-economic and linguistic factors, teachers are challenged to adapt and develop specific teaching skills—since no classroom is exempt from differentiated instruction (De Jager, 2013). Differentiated learning maximizes students' learning potential through suitable instructional strategies (Mills et al., 2014). One critical aspect of this approach is recognizing students' learning styles. In differentiated instruction, students' personal characteristics—such as prior knowledge, interests, and learning styles—are embraced. The approach offers a student-centered design aimed at academic success and seeks to improve students' self-regulation, problem-solving, communication, and metacognitive skills (Taş & Minaz, 2024). Teachers' understanding of learning styles can aid in designing effective and meaningful instruction. When students' learning styles are well supported, the learning process becomes more optimal and learning outcomes improve (Lauria, 2010). In education, there is no shortage of controversy regarding learning styles, with core questions remaining

unresolved: Do learning styles truly exist? Can they be reliably assessed and categorized? If so, does assessing them lead to more effective instruction? A significant body of literature from the late 1970s to the 1990s debated these issues, focusing on whether science supports the concept and its usefulness for educators (Landrum & McDuffie, 2010).

Identifying students' learning styles in schools is an important responsibility for teachers (Shenoy et al., 2013). By creating learning style profiles, teachers can gain a deeper understanding of how students absorb and process information. The impact of different learning styles on science education is particularly noteworthy. Students with active learning styles tend to perform better in science exams and have more positive attitudes toward science subjects (Shaidullina et al., 2023). Furthermore, knowledge of learning styles in educational settings is highly beneficial for addressing various learning difficulties experienced by students and encourages them to become more effective learners (Sarabi-Asiabar et al., 2015). Although identifying learning styles is a complex issue, several models have been proposed by various scholars to categorize each style (García, Amandi, Schiaffino, & Campo, 2007). One of the most well-known models is the VARK model developed by Neil Fleming, a teacher and educator from New Zealand, who introduced the concept to evaluate learning preferences among populations (Shenoy et al., 2013). Learning styles are considered to be independent, not limited by, nor driven by, demographic profiles, and are not influenced by academic performance (Malacapay, 2019). A study of elementary school students in Ambon City found that 88.7% of students had a unimodal learning style, while 11.3% were multimodal learners. Among the unimodal styles, kinesthetic was the most dominant (58.6%), and visual the least (6%). Multimodal learning styles included all combinations of bimodal, trimodal, and quadmodal. The greater the number of learning style variations a student possesses, the lower the frequency. The large number of students with a single learning style also contributes to the overall number of students with multimodal tendencies (Leasa et al., 2018).

Field evidence shows that many teachers still struggle to implement differentiated instruction effectively (Witraguna et al., 2024; Maphumulo & Biccard, 2024). This is consistent with observations and interviews conducted in six senior high schools across West Seram Regency, where it was found that four schools still lacked a full understanding of differentiated instruction. Teachers in these schools still tend to apply conventional teaching methods and are not yet capable of developing diagnostic tests or grouping students based on their learning profiles. Previous research supports these findings. According to Reis & Renzulli

(2018), teachers perceive differentiated instruction as complex and difficult to apply. Additionally, teachers who struggle to teach according to the Merdeka Curriculum also report difficulties in assessing the learning process (Mesta Limbong & Asnah MN Limbong, 2023). This is unfortunate, considering that the Merdeka Curriculum offers a strong foundation, emphasizing student-centered learning—a method that places students' needs and interests at the core of the educational process. This approach promotes student engagement, collaboration, and autonomy, aiming to create a supportive, challenging, and aligned learning environment that meets students' needs and goals (Kerimbayev et al., 2023).

The lack of stimulus from teachers to encourage students to express their individual learning styles is one of the reasons for the suboptimal implementation of differentiated learning (Hu et al., 2021). Supporting factors such as teacher competence, infrastructure availability, the gap between theory and practice, and inadequate facilities contribute to the low success rate of implementation. However, teachers often do not apply differentiated instruction in the classroom for various reasons. For example, they may find it difficult to provide all students with learning activities that suit them best, or they may lack instructional autonomy (Krishan & Al-Rsa'I, 2023). This study is expected to provide a realistic depiction of the current conditions in the field and serve as a foundation for developing more effective learning strategies aligned with the spirit of Merdeka Belajar (Freedom to Learn). Therefore, the aim of this study is to analyze the difficulties faced by senior high school science teachers in implementing differentiated instruction under the Merdeka Curriculum.

## Method

This research employs a mixed-method approach, specifically a descriptive research type that combines both quantitative and qualitative methods. This approach was chosen to provide a comprehensive understanding of the phenomenon being studied, incorporating both numerical data and in-depth insights into the context and experiences of the research subjects. The research design used in this study is a survey design, a widely used method in the field of education to systematically collect data on various aspects such as attitudes, interests, habits, and behaviors of students or educators (Prasad & Kumar, 2024). The aim of survey research is to obtain a broad overview of a particular condition or phenomenon by collecting information directly from respondents through instruments such as questionnaires or interviews (Sheikh, 2024). Therefore,

the use of a survey design in this study is expected to yield both empirical data and qualitative insights to support a more valid and comprehensive analysis and interpretation of the results.

### *Participants*

The sample in this study consists of six senior high schools (SMA) located in the West Seram Regency, with a total of 30 science teachers selected representatively from these schools. The selection of science teacher participants aimed to obtain accurate and relevant data regarding the implementation of differentiated instruction at the senior high school level. The sampling technique used was random sampling, where each school had an equal opportunity to be selected as part of the study. This method was chosen to minimize bias in respondent selection and to ensure that the research findings could be more broadly generalized to the population of science teachers in West Seram Regency. Thus, this approach supports the validity and reliability of the data, making the research findings more objective and representative.

### *Instruments*

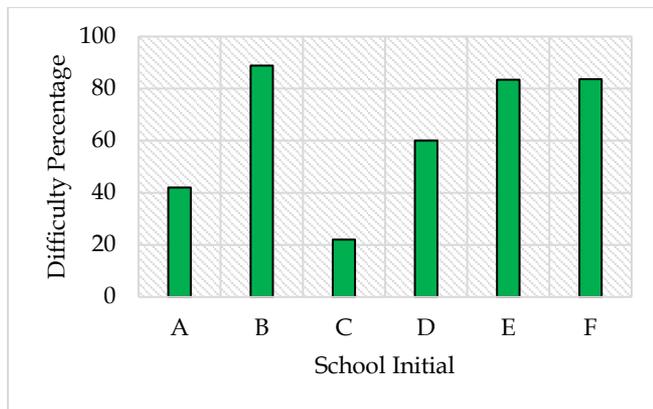
The instruments used in this study include a questionnaire to measure teachers' difficulties in implementing differentiated instruction and an interview guide to reinforce the results obtained from the questionnaire. The questionnaire instrument was tested for validity and reliability on 17 science teachers in Ambon City. The validity test results showed that all statement items in each indicator had a significance value (2-tailed) less than 0.05, indicating that the questionnaire was valid. The reliability test yielded a Cronbach's Alpha value of 0.8, indicating that the instrument was reliable.

### *Data Analysis Techniques*

The data analysis in this study was conducted using descriptive quantitative analysis to present the data as it is in the form of percentages, along with qualitative explanations to describe the data or events in narrative form. The analysis focuses on examining the difficulties faced by science teachers in implementing differentiated instruction.

## Results and Discussion

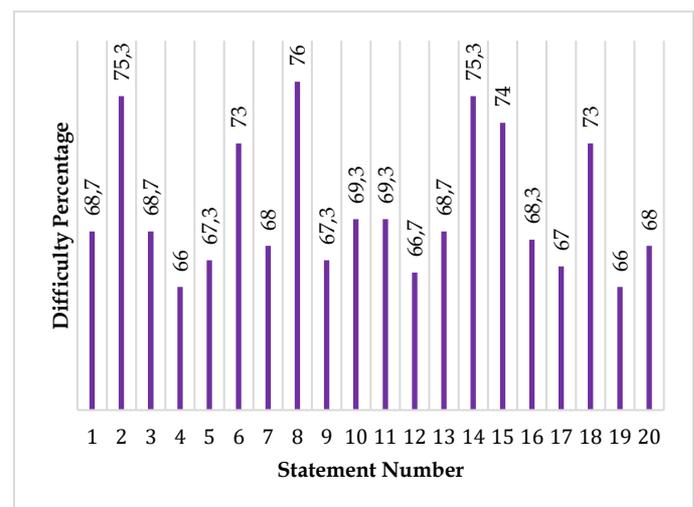
Based on the results of the study involving 30 science teachers at the senior high school level in six schools across West Seram Regency, using a questionnaire instrument, it was found that four schools still experience significant difficulties in implementing differentiated instruction, as illustrated in Figure 2



**Figure 1.** Science Teachers' Difficulties in Implementing Differentiated Instruction at Senior High Schools in West Seram Regency

Based on Figure 1, it is evident that senior high schools in West Seram Regency still face challenges in implementing differentiated instruction. This is reflected in the percentage of difficulty in applying differentiated instruction at schools A, B, C, D, E, and F, which were 42%, 88.8%, 22%, 60%, 83.4%, and 83.6%, respectively. Science teachers at Schools A and C have already implemented differentiated instruction, and all teaching materials reflect differentiated practices. This can be attributed to the fact that these two schools are among the most reputable (favorite schools) in the area, have relatively adequate facilities, and include several “guru penggerak” (teacher leaders). On the other hand, science teachers at Schools B, D, E, and F have not yet implemented differentiated instruction. This is due to the absence of teacher leaders, insufficient school facilities, and geographic constraints, with some schools being quite remote. Although some science teachers claim to be implementing differentiated instruction, in practice, they do not conduct diagnostic assessments. These teachers simply divide students into groups in a conventional manner, without considering students' learning styles. Their instructional materials also do not reflect differentiated learning principles. This study aligns with the findings of Melesse (2015), who conducted surveys, semi-structured interviews, and focus groups with 232 primary school teachers in Ethiopia. Melesse concluded that many factors contribute to the challenges of implementing differentiated instruction, such as lack of knowledge and experience, class size, limited time, and inadequate resources. Similarly, in a qualitative study involving 322 student-teachers in Norway, Brevik et al. (2018) found that although the teachers recognized the importance of differentiation, they lacked the confidence to implement it. In fact, differentiated instruction is a learner-centered approach that should be based on students' readiness,

interests, and learning styles. When teachers understand these three components, the learning process becomes easier, more student-centered, and more enjoyable and productive. This view is supported by Stavrou & Koutselini (2016), who argue that differentiation is not merely a teaching strategy but an innovative way of thinking about teaching and learning. However, successful implementation primarily depends on teachers' perceptions of what learning is and how it can be achieved. The implication is that there needs to be a greater focus on how best to train and retrain teachers, so that they experience conceptual change, which in turn will motivate them to consciously engage in diversifying their teaching techniques and acquiring the necessary knowledge and skills for effective implementation. Once teachers understand their students' learning styles, they can apply three differentiation strategies: content, process, and product differentiation. The diversity in students' learning style data can serve as a basis for planning instruction that addresses four key aspects: content, process, product, and learning environment (Aminuriyah et al., 2023). Students have unique ways of processing information during learning. The VARK learning styles, which relate to memory, are also considered to influence emotional intelligence (Leasa et al., 2017). The data in Figure 1 was obtained through a questionnaire on the difficulties of implementing differentiated instruction, accessible via the link: <https://shorturl.at/C3E6a>. The detailed results of the questionnaire are presented in Figure 2.



**Figure 2.** Percentage of Difficulty per Questionnaire Item

Based on Figure 2, there were 20 statements related to the challenges of implementing differentiated instruction. As shown in the figure, science teachers encountered significant difficulties in applying differentiated instruction, as evidenced by all 20 items showing difficulty percentages above 60%. This finding

is also supported by interview data from several randomly selected science teachers who had attempted to implement differentiated instruction in West Seram Regency. The following transcript illustrates how these teachers identify students' learning styles.

How do you identify students' learning styles?

- Mr. A By conducting non-cognitive diagnostic tests
- Mrs. A By conducting both diagnostic tests and initial assessments
- Mrs. B I group students as usual without considering their learning styles
- Mrs. C I know about diagnostic testing, but I do not conduct it
- Mrs. D I ask students to raise their hands if they prefer visual, auditory, or kinesthetic learning
- Mr. B I do not conduct diagnostic tests

From the interviews regarding how teachers recognize students' learning styles, it was found that most teachers are aware that diagnostic testing should precede the implementation of differentiated instruction, but some do not apply it in practice. Differentiated instruction is a teaching approach tailored to students' individual needs. It recognizes that every learner has unique characteristics, making initial diagnostic assessments essential to understand students' learning styles. A study conducted at Al-Hussein Bin Talal University Applied School in Ma'an Governorate during the first semester of the 2020/2021 academic year found that technology-oriented differentiated instruction significantly enhanced student motivation to learn science compared to traditional teaching methods (Krishan & Al-Rsa'i, 2023). With the information obtained from diagnostic tests, teachers can design lessons that align with students' needs, making the learning experience more meaningful, enjoyable, and potentially retained in long-term memory. Transcript of Teachers' Difficulties in Implementing Differentiated Instruction:

What challenges do you face in implementing differentiated instruction?

- Mr. A It requires a lot of time to implement
- Mrs. A Choosing methods/models and media that stimulate student activity
- Mrs. B Preparing instructional materials
- Mrs. C Time management and organization
- Mrs. D Students tend to be noisy during group activities

Mr. B Related to the preparation of learning materials

Several factors contribute to the difficulties faced by teachers in implementing differentiated instruction based on students' learning styles: (1) Limited school resources. School may face limitations in terms of time, funding, or personnel to effectively support differentiated learning approaches. (2) Standardized Curriculum A rigid and standardized curriculum can restrict teachers' flexibility in adapting lessons to the individual learning styles of students. (3) Lack of Teacher Knowledge and Skills. Some teachers may lack understanding of various student learning styles and how to adapt their teaching methods accordingly. (4) Large Class Sizes. In classrooms with a large number of students, it becomes challenging for teachers to provide individualized attention and adapt instruction based on learning styles. (5) Limited Instructional Time. Time constraints often hinder teachers from planning and delivering differentiated instruction tailored to each student's needs. (6) Resistance from Students or Parents. Some students or parents may be unfamiliar with or skeptical of the benefits of differentiated learning and may not support its implementation. (7) Varying Student Ability Levels. In heterogeneous classrooms with a wide range of student abilities, it can be difficult for teachers to meet each learner's individual needs. (8) Inadequate Space and Facilities. Inadequate classroom facilities or limited space can obstruct the creation of an optimal learning environment suited to diverse learning styles. These factors can significantly hinder the effective implementation of differentiated instruction based on students' learning styles. Transcript: Teachers' Strategies in Facilitating Differentiated Instruction

How do you facilitate students when implementing differentiated instruction?

- Mr. A By selecting interactive and varied learning media depending on students' learning styles
- Mrs. A First, I identify students' learning styles, then prepare instructional materials including models, methods, and media to support them
- Mrs. B By preparing instructional tools and utilizing both lab resources and the surrounding environment
- Mrs. C By choosing appropriate media
- Mrs. D By creating engaging and active learning strategies
- Mr. B By preparing high-quality teaching materials

Teachers who understand their students' characteristics are better able to make informed

decisions in choosing methods, models, and media. For visual learners, teachers can facilitate learning using videos, images, and other materials that stimulate visual perception. For auditory learners, music or recorded narrations are useful tools to stimulate auditory senses.

For kinesthetic learners, role-playing, physical movement, or hands-on activities can enhance engagement. This is supported by Zagoto et al. (2019), who suggest improving visual learning through video playback, maximizing image use, and posting learning materials on the board. To enhance auditory learning, teachers should encourage active group discussions and ask students to read aloud. For kinesthetic learners, demonstrations and hands-on field activities are recommended. These differentiated strategies help teachers meet individual student needs and provide tailored support accordingly. Another study also found a significant relationship between emotional intelligence and critical thinking skills in students with auditory, reading, and kinesthetic learning styles (Leasa, 2018).

## Conclusion

Based on the research findings, it can be concluded that: 1) Four out of six senior high schools (SMA) in West Seram Regency have not yet implemented differentiated instruction; 2) Teachers still struggle and lack understanding of differentiated instruction; 3) The average percentage of difficulty in implementing differentiated instruction is 63.3%, indicating that most science teachers at the senior high school level in this region continue to experience significant challenges and lack knowledge of differentiated learning. This study was not conducted across all senior high schools in West Seram Regency and therefore has limitations. Further research is needed to explore the condition in other schools within the region. The researcher suggests that comprehensive training on differentiated instruction be conducted across all senior high schools in West Seram Regency to improve teachers' understanding and implementation skills.

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All authors have real contribution in completing this manuscript

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### Conflicts of Interest

The authors declare no conflict of interest

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