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Math Teachers in Bone Regency Middle Schools: A Profile of Their Differentiated Learning Abilities

Rahma Hidayati Darwis[1], Suradi Tahmir[2], Ahmad Talib[3]

[1] Institut Agama Islam Negeri Bone, Sulawesi Selatan, Indonesia; rahma_darwis@yahoo.com
[2] Universitas Negeri Makassar, Sulawesi Selatan, Indonesia; suraditahmir@unm.ac.id
[3] Universitas Negeri Makassar, Sulawesi Selatan, Indonesia; ahmadtalibunm@gmail.com

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ABSTRACT

Differentiated learning is an instructional approach that prioritizes adapting to the unique needs and characteristics of each student. This study aims to elucidate educators' comprehension and implementation of differentiated learning within an autonomous curriculum framework, focusing on middle school math teachers in Bone Regency. Conducted as a mixed-methods descriptive study, data were collected through a structured academic survey targeting a representative sample of teachers from various middle schools in the region. Quantitative data were statistically analyzed to assess the prevalence of differentiated learning practices, while qualitative data were analyzed thematically to explore common themes and insights regarding teachers' perceptions and challenges. The findings indicate that teachers generally have a limited understanding of differentiated learning. Only 31% of the participants reported designing and implementing differentiated learning strategies, highlighting a significant gap in the application of this instructional approach within the curriculum. The study reveals a critical need for enhanced professional development and support for middle school math teachers in Bone Regency regarding differentiated learning. The limited understanding and implementation of differentiated learning strategies underscore the necessity for targeted training programs and resources to better equip teachers in addressing the diverse needs of their students. By fostering a deeper comprehension and more widespread application of differentiated learning, educational outcomes can be significantly improved within the autonomous curriculum framework.

Corresponding Author:
Rahma Hidayati Darwis
Institut Agama Islam Negeri Bone, Sulawesi Selatan, Indonesia; rahma_darwis@yahoo.com

1. INTRODUCTION

Differentiated learning is currently a prominent topic in the field of education. The curriculum highlights the importance of educators taking into account the diverse requirements of students during the learning process. This means that educators should embrace diversity and tailor the learning experience to meet the individual learning needs of students. The idea of diversified learning is founded on a profound reverence for students, acknowledgment of student disparities, and the determination to

facilitate the rapid development of all pupils. These theories suggest that teachers should actively modify their teaching techniques, resources, learning activities, or learning environments to better accommodate the learning demands of their students (Tomlinson et al., 2003).

The term "differentiated learning" in this study refers to a teaching approach where the teacher tailors the learning experience to match the interests, learning environment, and individual characteristics of the students. This is achieved by creating learning activities that take into account visual, auditory, and kinesthetic learning preferences. During implementation, teachers alone prioritize the content and procedural elements. The learning process commences with the teacher providing a concise introduction to the main subject matter, followed by actively engaging the students in the learning process. The students are required to participate by completing LKPD, which is distributed in groups. An example of this is the SPLDV material, which involves relating problems to students' everyday lives using visual, auditory, and kinesthetic means. Upon receiving this stimulus, pupils are subsequently granted the freedom to opt for visual, auditory, or kinesthetic work methods, using the guidance provided in the worksheet. Subsequently, the teacher categorizes students according to their individual learning styles. During the subsequent learning process, the teacher employs diverse methods to deliver the material, including utilizing animated videos, presenting information through visual aids, engaging in hands-on activities, and incorporating instructional videos for auditory learning.

Several advancements in the education sector have heightened the demand for customized learning. To accommodate the diverse backgrounds and characteristics of students, schools have admitted a wide range of students. To address the varying learning needs of these students, differentiated learning is considered an effective approach for teachers to ensure an equitable education system (Oakes, 2008; Schütz et al., 2008; Schofield, 2010; OECD, 2012, 2018). The concept that students possess distinct learning requirements and therefore necessitate a more diverse approach has now gained traction with policies that prioritise the provision of support to all students to cultivate their knowledge and skills according to their unique interests, habits, and profiles (Rock et al., 2008; Schleicher, 2016). Another primary objective of differentiated learning is to minimise the disparity between pupils with the lower aptitude and those with higher aptitudes. Students with poor aptitude will receive differentiated instruction to accommodate their individual needs, as it is essential for teachers to incorporate variances in the learning process to attain the desired learning outcomes.

Even if the notion of differentiated learning is not new in the world of education, instructors still tend to find it difficult to grasp how to differentiate it from the learning that has been implemented so far (Van Casteren et al., 2017). A study indicated that teachers in diverse nations rarely adapt their learning to the distinct features of students (Schleicher, 2016). Most teachers merely deliver one instruction to all students. Single teaching alone is not enough for heterogeneous learners. Students with poor abilities are compelled to understand or complete excessively difficult tasks or, conversely, students with high abilities can easily practice the skills they have acquired (Tomlinson et al., 2003). A recent study and meta-analysis of varied learning techniques in basic education demonstrates that differentiated learning has the potential to increase student learning outcomes, if applied correctly (Deunk et al., 2018). However, these results may not be extended directly to the secondary school level, because the learning process at the secondary education level is somewhat different compared to elementary education (Van Casteren et al., 2017).

Effective implementation of differentiated learning in the classroom necessitates meticulous preparation and strategic instructional planning. Teachers must consider at least two things when preparing to execute the design. The first part pertains to differentiated learning pedagogy and didactics, which refers to the specific teaching procedures and strategies employed by educators, as well as the elements that are distinguished or varied within the learning process (McQuarrie et al., 2008; Valiande and Koutselini, 2009). Teachers can provide modifications to students in terms of the curriculum, present a range of options during the learning process, employ diverse assessment methods, and adjust the learning environment to accommodate students' individual learning requirements (Tomlinson, 2014). Teachers may also provide additional study time to select individuals or conversely, motivate high-

achieving students to accelerate their learning process (Coubergs et al., 2013). Teachers might employ pre-teaching or supplementary education to cater to the individual needs of pupils (Smets and Struyven, 2018).

Furthermore, the implementation of differentiated learning necessitates a structured strategy, whereby teachers must employ several methodologies. Teachers can employ a macro-adaptive strategy by utilising several methods, such as homogenous grouping, while simultaneously delivering differentiated teaching (Corno, 2008). Additionally, they can establish flexible student groupings based on shared attributes, such as readiness or interest. Another option is for teachers to employ heterogeneous grouping in order to facilitate the development of diverse instructional approaches during the learning process. This step enables differentiation in the learning process when students categorise activities into groups according to their proficiency level, preferences, or learning styles. Individualised education refers to the tailoring of the learning process to meet the specific needs of each student, while maintaining the same learning objectives. This level of adaptation ensures that each student receives personalised treatment. Previous research has been undertaken by multiple authors on individual approaches to differentiated learning construction theory (Smit et al., 2011; Coubergs et al., 2013; Tomlinson, 2014, Bray and McClaskey, 2013; Roy et al., 2013).

Prior research indicates that teachers exhibit considerable enthusiasm toward varied learning. However, they heavily rely on team support, adequate time, and implementation guidelines to effectively cultivate differentiated learning (Stollman, 2018). Research indicates that teachers are highly receptive to bottom-up professionalization methods, such as peer coaching, cooperation with colleagues and experts, and support in adopting differentiated learning principles. This study has demonstrated that teachers possess an incomplete comprehension of differentiated learning, as they still want further time, coaching, and guidelines in order to proficiently execute this instructional approach.

The primary aim of the research is to thoroughly investigate the proficiency of mathematics teachers in Bone Regency in implementing differentiated learning. The objective is to gather comprehensive information about the teachers' abilities in implementing differentiated learning. In addition, it is anticipated that there will be comprehensive information regarding the challenges encountered by instructors in adopting it, enabling prompt exploration of potential remedies to address these challenges.

2. METHODS

This study employs a mixed-methods descriptive approach, integrating both qualitative and quantitative data to comprehensively understand middle school math teachers' proficiency in implementing differentiated learning strategies in Bone Regency. The research was conducted during the odd semester of the 2022/2023 academic year and involved a representative sample of 24 junior high school mathematics teachers.

Out of the 24 participating teachers, 3 were selected for in-depth interviews based on their prior use of differentiated learning and their proficient communication abilities. This selection criterion ensured that the interviewees could effectively articulate their thoughts and experiences, allowing for a deeper exploration of their understanding and challenges related to differentiated learning.

Data were collected through a structured academic survey and comprehensive interviews. The survey was designed to assess teachers' academic capabilities in differentiated learning, with specific indicators evaluating assessment abilities, questioning techniques, student engagement, preparation for differentiated learning, and the implementation of differentiated learning. In-depth interviews were conducted with the three selected teachers to gather detailed qualitative data on their experiences, challenges, and perceptions of differentiated learning.

To ensure the validity and reliability of the research data, triangulation techniques were employed. This involved comparing survey responses with interview data to confirm the consistency and accuracy of the information collected. The agreement between the survey and interview responses was used to validate the findings.

The data analysis process involved three key steps: data reduction, data display, and conclusion generation. Data reduction focused on condensing and focusing the data related to teachers' profiles and their understanding of differentiated learning. Data display involved assembling the data into coherent groups to illustrate teachers' profiles and their comprehension and implementation of differentiated learning strategies. Conclusion generation drew insights from the data to highlight the significance of the findings regarding teachers' proficiency and preparedness in implementing differentiated learning.

Quantitative data from the survey responses were statistically analyzed to determine the prevalence and extent of differentiated learning practices among the teachers. Qualitative data from the interviews were analyzed thematically to identify common themes and insights regarding the teachers' perceptions and challenges related to differentiated learning.

3. FINDINGS AND DISCUSSION

3.1 Findings

Teachers play a pivotal role in enhancing student achievement. Consequently, implementing more effective learning methods is crucial to facilitate the absorption of valuable knowledge by students. According to Kyriakides, Creemers, and Antoniou (2009), the most effective teaching model accommodates diverse student needs. Differentiated learning, in practice, requires teachers to possess adaptive teaching abilities, customizing instruction to meet individual student requirements. Additionally, teachers must have deep content knowledge and exhibit exemplary diagnostic, didactic, pedagogical, and classroom management skills (Smeets, Ledoux, Regtvoort, Felix, & Mol Lous, 2015; Vogt & Rogala, 2019). Therefore, adopting differentiated learning is complex. Teachers must thoroughly understand students' needs and characteristics, providing various learning resources and activities that students can engage with in multiple ways. It is essential to consider the learning environment and teaching style when implementing this approach.

In this research, data on teacher academic surveys has been acquired which has been strengthened by interview data. One of the teachers who was an informant had provided information pertaining to the differentiated mathematics learning that had been applied, one of which was differentiated learning on two-variable linear equation systems. SPLDV material is one of the resources that has ideal features for implementing differentiated learning based on learning styles. For example, from the standpoint of topic differentiation, teachers can develop activity sheets by creating material in the form of crossword puzzles, using SPLDV boards for students who have a visual learning style, carrying out direct practice for students who have a kinesthetic learning style.

Moreover, the data pertaining to teacher competency, which encompasses the capacity to devise and execute differentiated learning strategies as evidenced by comprehensive survey findings, is presented in Table 1 below.

Table 1. Results of analysis of teacher academic abilities

No	Observed aspects	Percentage
1	Implementation of initial learning assessments	87,5
2	Providing trigger questions that suit the learning objectives	83,33
3	Providing opportunities for students to participate actively	75
4	Use of Learning Media	58,33
5	Planning differentiated learning	41,675
6	Implementing differentiated learning	30,77
7	Implementation of reflection on learning activities	79,17
8	Carry out learning assessments or formative learning assessments	87,5

Based on the results of the analysis in Table 1, it is evident that, in general, teacher competency has met the minimum criteria. For instance, the initial assessment has been carried out by teachers, with 87.5% of the surveyed teachers implementing it based on the predetermined criteria. Additionally, 83.33% of teachers have fully implemented the component of providing trigger questions, 75% have provided opportunities for active participation, and 58.33% have effectively used learning media. However, the lowest assessment was observed in the component of Mathematics teachers' ability to implement differentiated learning, with only 30.77% of the surveyed teachers successfully applying this approach.

Despite the overall positive survey results indicating that teacher competency meets the minimum criteria, the analysis also reveals that many teachers lack a comprehensive understanding of differentiated learning. This finding aligns with interview data highlighting several challenges teachers face in the learning process, particularly in activities crucial for differentiated learning. For example, teachers reported difficulties in forming initial assessments to diagnose students' differences and in integrating learning readiness, styles, and profiles into their teaching strategies.

This observation is corroborated by various studies in the literature, including those by Hapsari et al. (2018), Annemieke E. et al. (2019), and Baurzhan et al. (2022), which generally state that most teachers struggle with differentiated learning. These difficulties include identifying student differences due to a lack of understanding of the diagnostic assessments used in the identification process. Teachers with less developed knowledge and skills are more likely to encounter challenges in implementing differentiated learning effectively. Therefore, addressing these gaps through targeted professional development and training programs is crucial to enhance teachers' ability to implement differentiated learning successfully.

The analysis of interview data revealed that most teachers believed the current training and coaching provided insufficient knowledge of differentiated learning. Consequently, teachers still encountered numerous challenges in preparing for differentiated learning. To establish a robust correlation between theory and application, this study involved extensive collaboration between researchers, educational consultants, and teacher trainers with specialized knowledge in mathematics. At this step, the researcher endeavored to investigate and establish agreement among experts and practitioners regarding the specific actions teachers need to take in their everyday practice to effectively apply differentiated learning. The results obtained in this phase gave rise to a process known as the differentiation cycle. This cycle is essential for bridging the gap between theoretical knowledge and practical application, ensuring that differentiated learning can be effectively implemented in classrooms.

The differentiation cycle begins with the identification of learning needs. In this initial stage, teachers must analyze students' skills and divide them into homogeneous achievement groups, typically categorized as low achievers, average achievers, and high achievers. Once these groups are formed, the allocation of learning time is divided into two sessions. In the first session, the teacher conducts classical learning, while in the second session, the teacher provides differentiated instructions and feedback to accommodate the needs of each group.

During the learning process, students can transition between groups based on the changes they experience, allowing for adaptation to their evolving needs. Identifying these changes in students is not limited to achievement tests; it also involves other diagnostic measures such as observation analysis and performance-related interviews. The diagnostic assessments used should signal changes in each student's needs and qualitatively determine learning requirements. For example, these assessments can help identify why a student is struggling with a particular concept and what specific support they need to overcome this challenge.

Such diagnostic tests are crucial because when students receive the attention and support they need, they often gain confidence in their ability to learn and develop. Over time, this increased confidence can make students feel more prepared and willing to tackle higher academic challenges.

Furthermore, this process fosters a supportive learning environment where students are encouraged to take risks and engage deeply with the material.

By implementing the differentiation cycle effectively, teachers can ensure that each student receives personalized support tailored to their unique learning needs. This approach not only enhances academic achievement but also promotes a more inclusive and equitable educational experience for all students.

Subsequently, during the second phase, the instructor establishes distinct objectives that are both demanding and attainable for students in various cohorts. Effective differentiated instruction should include tasks and activities that align with students' capabilities and personal interests. Teachers must possess the ability to modify instructional methods and learning tasks to engage advanced learners and offer assistance to pupils requiring further support. By adopting this approach, pupils are motivated to strive for their utmost capabilities. Just like how students are actively involved, differentiated learning also promotes active student engagement in the learning process. Teachers should establish a cooperative atmosphere, fostering student collaboration, communication, and idea-sharing. In addition, educational institutions must offer avenues for students to inquire, articulate viewpoints, and engage in the process of making decisions about their own learning.

3.2 Discussion

The findings of this study highlight the pivotal role teachers play in enhancing student achievement through effective teaching methods. The research underscores that differentiated learning, which tailors instruction to meet diverse student needs, is an essential approach for fostering academic success (Kyriakides, Creemers, & Antoniou, 2009). Differentiated learning requires teachers to have adaptive teaching abilities, deep content knowledge, and exemplary skills in diagnostics, didactics, pedagogy, and classroom management (Smeets et al., 2015; Vogt & Rogala, 2019). However, the implementation of differentiated learning is complex and necessitates a thorough understanding of students' needs and characteristics, as well as the provision of varied learning resources and activities. This approach must consider both the learning environment and teaching style to be effective.

The data acquired from teacher academic surveys, strengthened by interview data, reveals that while most teachers meet the minimum competency criteria, there are significant gaps in their ability to implement differentiated learning. Table 1 demonstrates that while high percentages of teachers perform well in areas like initial learning assessments (87.5%) and providing trigger questions (83.33%), only 30.77% effectively implement differentiated learning. This discrepancy suggests that although teachers may be competent in certain aspects of their roles, many lack a comprehensive understanding of differentiated learning, as evidenced by their challenges in forming initial assessments and integrating learning readiness, styles, and profiles into their strategies. These findings are consistent with previous studies that indicate widespread difficulties among teachers in applying differentiated learning techniques (Hapsari et al., 2018; Annemieke E. et al., 2019; Baurzhan et al., 2022).

Interview data further corroborates the survey results, highlighting that the current training and coaching provided to teachers are insufficient for equipping them with the necessary knowledge of differentiated learning. Teachers reported numerous challenges in preparing for differentiated learning, indicating a disconnect between theoretical knowledge and practical application. To bridge this gap, the study involved collaboration between researchers, educational consultants, and teacher trainers, leading to the development of a differentiation cycle. This cycle aims to facilitate the practical application of differentiated learning by guiding teachers through a structured process, starting with the identification of learning needs and the formation of homogeneous achievement groups. This process allows for the adaptation of teaching strategies to meet the evolving needs of students, fostering a supportive and dynamic learning environment.

Effective implementation of the differentiation cycle involves setting distinct, challenging yet attainable objectives for different student groups. Differentiated instruction should include tasks and activities that align with students' capabilities and interests, encouraging advanced learners while

supporting those who need additional help. By fostering a cooperative atmosphere that promotes student engagement, collaboration, and communication, teachers can create an inclusive educational experience that motivates students to achieve their highest potential. Moreover, educational institutions must provide opportunities for students to take an active role in their learning, encouraging them to inquire, express opinions, and participate in decision-making processes. This holistic approach not only enhances academic achievement but also promotes a more equitable and personalized educational experience for all students.

4. CONCLUSION

According to the research findings, overall teacher competence met the minimum standards, with an average score of 66.77%. However, a notable discovery revealed that the component of planning and implementing diversified learning scored only 30.77%, indicating a significant deficiency in teachers' understanding of differentiated learning. This was further demonstrated by ongoing challenges in developing educational resources and an incomplete understanding of the learning environment and required learning behaviors. Teachers also struggle to effectively regulate the classroom in the context of differentiated learning, leading to disrupted activities and disturbances. While other components, such as assessment implementation and the use of trigger questions, showed high implementation rates of 87.5% and 83.33% respectively, and 75% of teachers successfully engaged pupils, several challenges remain. These include ensuring resource availability, providing adequate teacher training, and establishing appropriate evaluation methods to measure the effectiveness of differentiated learning. A limitation of this research is its focus on a specific educational context, which may not be generalizable to other settings. Future research should develop a distinct model of differentiated learning, offering clear instructions for teachers to implement activities that meet the requirements of this approach and address the identified challenges.

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