

The Ability of Junior High School Mathematics Teachers to Implement Differentiated Instruction

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Abstract—This study aims to describe the level of ability of junior high school mathematics teachers in Kendari City in implementing differentiated instruction and to identify the factors influencing it. The research approach is a mixed-methods explanatory sequential design. The research sample consisted of 108 teachers. Qualitative informants included 12 teachers, 3 school principals, and 3 supervisors. Research instruments comprised questionnaires, observations, document analysis, and interviews. The research results indicate that teachers' ability to implement differentiated instruction falls into the Moderate category with a score of 68.42. The strongest domains are Product Differentiation (72.8) and Content (71.5). The weakest domain is Diagnostic Assessment (64.1). Teachers with 6–15 years of experience and those who are certified scored higher. The main obstacles teachers face in implementing differentiated instruction include administrative workload, large class sizes, misconceptions, and a lack of concrete examples from trainers during professional development. Factors supporting teachers in implementing differentiated instruction include learning communities, principal support, and the use of technology. The main recommendations are professional development based on lesson study and the establishment of Master Teachers in differentiation within the MGMP.

Keywords— Differentiated instruction, teacher competence, diagnostic assessment.

I. INTRODUCTION

The implementation of the Merdeka Curriculum demands a paradigm shift for teachers from being instructors to becoming facilitators responsive to student diversity. The core principle of the Merdeka Curriculum is learner-centered learning, acknowledging that every child has different levels of readiness, interests, and learning profiles (Ministry of Education, Culture, Research, and Technology, 2022). To accommodate this diversity, differentiated learning strategies are essential. Tomlinson (2017) emphasizes that differentiated learning is a teacher's proactive response to modify content, processes, products, and the learning environment based on diagnostic assessment data. Without differentiation, classrooms tend to adopt a "one-size-fits-all" approach, which risks causing *learning loss* for students with lower readiness and *learning boredom* for those with higher readiness.

The urgency of differentiation is particularly high in middle school mathematics. Mathematics is hierarchical and abstract, making it easy for gaps in understanding to occur among students (Boaler, 2016). When teachers present material at a single pace and using a single strategy, slower students fall behind conceptually, while faster students lose

the challenge. This situation aligns with Sugiono's (2024) assertion that active learning requires high-ability students to remain challenged, while other students need appropriate scaffolding to avoid frustration. In other words, undifferentiated mathematics instruction fails to meet the principles of the *zone of proximal development* (Vygotsky, 1978).

Empirically, many international studies have reported the positive effects of differentiation. Smale-Jacobse et al. (2019), in a meta-analysis of 21 studies, found that differentiated instruction had an effect size of 0.41 on students' cognitive learning outcomes. Similar results were reported by Deunk et al. (2018), who reviewed 14 differentiation programs in elementary and secondary schools in the Netherlands. They concluded that well-planned differentiation can narrow the learning achievement gap by up to 30%. In the United States, Prast et al. (2018) demonstrated that *tiered instruction* in 6th-grade mathematics significantly increased students' growth mindset and post-test scores compared to a control class. In Asia, Maulana et al. (2021) conducted observations in 156 junior high school classes in Indonesia and the Netherlands; the results showed that the quality of teacher differentiation had a positive correlation of 0.38 with student behavioral engagement during mathematics lessons.

However, implementing differentiation is not without challenges. Van Geel et al. (2019) identified four main barriers for teachers in Europe: workload, planning, time constraints, and low self-efficacy in managing heterogeneous classes. Dixon et al. (2014) added that many teachers have a positive attitude toward differentiation but do not apply it in practice due to a lack of concrete training. This is reinforced by Suprayogi et al. (2017), who studied 272 junior high school teachers in Indonesia. They found a strong correlation between teachers' self-efficacy and the frequency of using differentiation strategies. Teachers who are confident in their abilities tend to differentiate more frequently. These findings indicate that technical competence and self-confidence are two sides of the same coin.

Specifically in the Indonesian context, policy support is already robust. Ministry of Education, Culture, Research, and Technology Regulation No. 16 of 2022 on the Standard Process mandates instructional planning that accounts for student diversity. The Merdeka Curriculum Learning and Assessment Guide (Ministry of Education, Culture, Research, and Technology, 2022) positions diagnostic assessment and differentiated instruction as an inseparable cycle. The

Directorate for Junior High Schools' (2021) book, *Model of Differentiated Instruction*, offers real instances of content, process, and product differentiation in mathematics. Unfortunately, field data reveals a gap. A 2023 report from the Southeast Sulawesi Teacher Development Center notes that only 42% of junior high school teachers in Kendari City have ever attempted differentiation. Of that number, only 18% consistently apply it across all three aspects. Most remain at the stage of pseudo-differentiation—distinguishing the difficulty level of questions without adjusting the learning process or providing support.

Several domestic studies confirm this picture. Pratiwi (2023) found that the primary challenge for junior high school mathematics teachers in Malang City lies in process differentiation, particularly when managing groups with different learning styles within an 80-minute timeframe. Handayani (2022) in Bandung Regency reported that teachers' diagnostic assessments remain dominated by cognitive tests. Students' interests and learning profiles are rarely explored. Consequently, student grouping is inaccurate. Suryani and Ishak (2023) in Makassar identified another barrier: class sizes reaching 36 students per group, leaving teachers feeling unable to provide differentiated support. Meanwhile, Nurhayati et al. (2021) in Semarang demonstrated that a 32-hour workshop-based training program combined with lesson study mentoring was able to increase teachers' differentiation skills scores from 58 to 81 on a 100-point scale. This indicates that appropriate interventions can improve the situation.

The city of Kendari has a specific context that makes this research relevant. First, as the capital of Southeast Sulawesi Province, Kendari has 56 junior high schools with a total of more than 18,000 students. Student characteristics are highly heterogeneous in terms of ethnicity—Tolaki, Bugis, Muna, Javanese—as well as socioeconomic status. Second, the 2023 Kendari City Education Report indicates that junior high school numeracy achievement stands at only 48.3%, below the national average of 54.7%, and falls into the "Requires Special Intervention" category. Third, the Kendari City Education Office has conducted three rounds of Merdeka Curriculum training workshops since 2022. However, an evaluation by the Southeast Sulawesi Provincial Education and Culture Office (BBPMP Sultra, 2023) states that the workshop materials remain at the conceptual introduction level. They have not yet addressed the practical dissection of teaching modules, *tiered assignment* simulations, and the development of differentiation rubrics for Mathematics.

Teachers' ability to implement differentiated instruction is multidimensional. Tomlinson and Imbeau (2010) divide it into four domains. The first domain is diagnostic assessment. Teachers must be able to select cognitive and non-cognitive instruments, process the results, and map students into groups based on readiness, interests, and learning profiles (Pozas et al., 2020). The second domain is content differentiation. Teachers present material at various levels of complexity, using visual, auditory, and kinesthetic representations, and connecting it to local contexts such as trade at Kendari Central Market or coastal land measurement (Santangelo & Tomlinson, 2012). The third domain is process differentiation.

Teachers design tiered activities, learning centers, RAFT, and varied scaffolding aligned with the Zone of Proximal Development (ZPD) (Roy et al., 2013). The fourth domain is product and assessment differentiation. Teachers offer choices in assignment formats, develop analytical rubrics, and conduct ongoing formative assessments (Wan, 2017).

These four domains require strong *Pedagogical Content Knowledge* (PCK) (Shulman, 1986). Without PCK, mathematics teachers struggle to identify appropriate analogies for auditory learners when teaching linear equations or effective manipulatives for kinesthetic learners when teaching geometric transformations. Gaitas and Martins (2017) demonstrated that teachers with high PCK are more flexible in implementing differentiation compared to teachers who are merely content-strong. Therefore, assessing teachers' capabilities is insufficient through perception surveys alone. Data triangulation is required: analysis of lesson plan/teaching module documents, classroom observations using the *Differentiated Instruction Observation Scale*, and reflective interviews (Coubergs et al., 2017).

The literature review indicates a research gap. International studies have largely been conducted in developed countries with low student-teacher ratios and high levels of technological support (Smale-Jacobse et al., 2019; Deunk et al., 2018). Studies in Indonesia remain focused on the elementary school level (Suryani & Ishak, 2023) or on teachers' general perceptions (Suprayogi et al., 2017). No research has been found that specifically examines the competency levels of junior high school mathematics teachers across the four domains of differentiation in Kendari City. Yet this data is crucial for the Education Office to design targeted strengthening programs rather than generic ones. Mills et al. (2014) caution that training not grounded in data-driven needs merely wastes budget with minimal impact.

Based on these arguments, this study aims to: 1) Describe the level of competency of junior high school mathematics teachers in Kendari City in implementing differentiated instruction across the aspects of diagnostic assessment, content, process, and product. 2) Identify the supporting factors and barriers experienced by teachers. 3) Formulate recommendations for a capacity-building model based on learning communities and lesson study. The research findings are expected to contribute theoretically to the development of differentiation scholarship in the context of the coastal urban areas of Eastern Indonesia. Practically, these results serve as a roadmap for the Kendari City Education Office and the Southeast Sulawesi Provincial Education and Culture Office (BBPMP Sultra) in designing tailored follow-up professional development workshops. From a policy perspective, this study supports the achievement of the Education Report Card targets, particularly the indicators of learning quality and a climate of diversity. Thus, the urgency of this research is not only academic but also operational. Without an accurate assessment of students' abilities, it is difficult to ensure that every junior high school student in Kendari City receives an education tailored to their needs. Differentiated instruction must move beyond mere discourse to become a technical competency inherent in every mathematics teacher.

II. METHOD

This study employs a *mixed-methods* approach with an *explanatory sequential design*. The first phase uses descriptive quantitative methods to assess teachers’ proficiency levels. The second stage uses qualitative methods to explain the supporting and inhibiting factors behind these quantitative figures (Creswell & Plano Clark, 2018). The selection of this design is based on the research objective, which seeks not only to determine “what the level of teachers’ competence is,” but also “why that level exists” (Pozas et al., 2020).

The study population consists of all public and private junior high school mathematics teachers in Kendari City for the 2025/2026 academic year, totaling 148 individuals spread across 56 schools. The sampling technique used was *proportional stratified random sampling* based on public and private school status as well as the regions of West Kendari, Kendari, Baruga, and Puuwatu. The sample size was determined using the Slovin formula at a 5% error rate, resulting in 108 teachers. For the qualitative phase, 12 teachers were selected purposively based on the following criteria: 3 teachers at the high proficiency level, 6 at the moderate level, and 3 at the low level, as determined by the quantitative scores from Phase 1. Three school principals and three supervisors were also interviewed to serve as triangulation sources (Sugiyono, 2022).

This study used 4 main instruments. The first instrument was the Differentiated Learning Ability Questionnaire. This questionnaire was adapted from the *Differentiated Instruction Questionnaire* by Coubergs et al. (2017) and tailored to the context of the Merdeka Curriculum. The questionnaire consists of 40 items on a 1–5 Likert scale measuring 4 domains: 1) Diagnostic Assessment (10 items), 2) Content Differentiation (10 items), 3) Process Differentiation (10 items), and 4) Product Differentiation (10 items). The instrument’s content validity was tested by three experts: one educational evaluation lecturer from UHO, one senior trainer from BBPMP Sultra, and one teacher leader. Pilot testing results on 30 teachers outside the sample showed a Cronbach’s Alpha reliability of 0.91.

The second instrument is the Learning Practice Observation Sheet. This observation sheet uses the *Differentiated Instruction Observation Scale* by Roy et al. (2013), which has been modified. This observation sheet contains 20 aspects to be observed, scored on a scale of 1–4. The focus of the observation is the implementation of differentiation when teachers teach mathematics to grades VII–IX. Each teacher was observed during two class sessions.

The third instrument is the Document Analysis Guide. This guide is used to evaluate teachers’ Instructional Modules or Lesson Plans. The aspects analyzed are: 1) Availability of diagnostic assessment results, 2) Alignment of objectives with readiness levels, 3) Variation in process strategies, 4) Selection of products and rubrics. Evaluation uses a 1–4 scale rubric adapted from the Directorate of Junior High Schools (2021).

The fourth instrument is the Semi-Structured Interview Guide. This Interview Guide is used to explore supporting and hindering factors. The questions were developed based on the findings of Van Geel et al. (2019) regarding workload, time,

self-efficacy, and school support. Interviews were recorded and transcribed for analysis.

Data collection took place over 3 months, from February to April 2026, following this flow: Phase 1. Quantitative: Dissemination and completion of questionnaires online via Google Forms and offline for teachers with limited internet access. A collection of teaching modules from the last semester from 108 teachers. Classroom observations of 12 teachers selected at random from the 108-teacher sample. Each teacher taught 2 class periods. Observations were conducted by 2 trained observers, and inter-observer reliability was tested with a Cohen’s Kappa value of 0.84.

Phase 2. Qualitative: In-depth interviews lasting 45–60 minutes with 12 teachers, 3 school principals, and 3 supervisors. To corroborate preliminary findings, a focus group discussion (FGD) with the Kendari City Mathematics Teachers’ Working Group (MGMP).

Survey and observation data were analyzed using descriptive statistics with SPSS version 26. Total scores were converted to a 100-point scale and categorized as follows: 85–100 Very High, 70–84 High, 55–69 Moderate, 40–54 Low, <40 Very Low. Document analysis utilized the percentage of indicator achievement. To examine differences in competency based on years of service and certification status, a One-Way ANOVA and Independent Samples t-test were used at $\alpha = 0.05$ (Prast et al., 2018).

Interview and FGD data were analyzed using the Miles, Huberman, & Saldaña (2014) model, which consists of data condensation, data presentation, and conclusion. Data validity was ensured through source triangulation, method triangulation, and member checking. To avoid bias, the researcher employed bracketing throughout the process. Reporting Stage: Quantitative-qualitative integrative analysis, article drafting, and dissemination to schools and the Education Office.

III. RESULTS AND DISCUSSION

The study sample consisted of 108 junior high school mathematics teachers in Kendari City. Characteristics: 62% female, 38% male. Years of service: 0–5 years (21%), 6–15 years (48%), >15 years (31%). Certification status: 73% certified. School distribution: 64% public junior high schools, 36% private junior high schools. A total of 89% of teachers stated they had participated in the Merdeka Curriculum training, but only 34% had participated in specialized training on differentiated instruction.

Based on a combination of questionnaire scores, observations, and documents, the average teacher competency was 68.42 on a scale of 100, falling into the “Moderate” category. The distribution of levels is presented in Table 1

TABLE 1. Teacher Competency Levels

Domain	Average Score	Category	% of High-Level Teachers
Diagnostic Assessment	64.1	Medium	22.2%
Content Differentiation	71.5	High	41.7
Process Differentiation	65.3	Moderate	25.9
Product Differentiation	72.8	High	45.4%
Total	68.42	Medium	28.7%

These findings reveal disparities across domains. The “Product Differentiation” domain scored the highest because teachers are accustomed to assigning different tasks, such as posters versus research papers. However, these product choices have not been accompanied by differentiated analytical rubrics (Wan, 2017). The “Diagnostic Assessment” domain scored the lowest. Only 22.2% of teachers routinely gather data on students’ interests and learning profiles. Most remain fixated on multiple-choice cognitive pre-tests. These results align with Handayani (2022), who found that 78% of diagnostic assessments by mathematics teachers in Bandung measured only cognitive readiness.

Observation results reinforce the survey data. Of the 40 teachers observed, only 11 teachers, or 27.5%, were seen to implement flexible grouping based on diagnostic data. The rest were taught in a traditional manner using a single worksheet for all students. This finding is consistent with Maulana et al. (2021), who noted that the quality of teacher differentiation in Indonesia remains at a “low implementation” level compared to the Netherlands.

Differences in teachers’ abilities based on “Years of Service” and “Certification” were analyzed using a One-Way ANOVA, which revealed a significant difference in ability based on years of service: $F = 4.217$, $p = 0.017$. The Tukey Post Hoc test confirms that teachers with 6–15 years of service have the highest score ($M = 71.8$) compared to those with 0–5 years ($M = 65.1$) and over 15 years ($M = 66.9$). Senior teachers tend to remain in their comfort zone using traditional methods, while junior teachers are still exploring technical aspects. The t-test also showed that certified teachers ($M = 70.3$) had significantly higher scores than those without certification ($M = 63.4$), with $t = 3.112$, $p = 0.002$. This indicates that certification has an impact on teachers’ self-efficacy (Suprayogi et al., 2017).

Interview results with 12 teachers converged on 5 main themes. Barriers: Administrative Burden—creating differentiated teaching modules in 3 versions causes teacher burnout. Meanwhile, they must also input them into PMM and e-performance systems. This aligns with Van Geel et al. (2019) regarding workload as the primary barrier. Large Class Sizes: Classes with 32–36 students make it difficult for teachers to monitor groups. Before finishing assisting Group 1, Group 3 is already causing a commotion. Suryani & Ishak (2023) reported similar issues in Makassar. Misconceptions: Five out of 12 teachers believed differentiation meant students choosing activities on their own without guidance. “What’s important is that the children are happy; they can do whatever they want.” In reality, differentiation still requires structure from the teacher (Tomlinson & Imbeau, 2010). Lack of Concrete Examples: “The training session yesterday was just theory. We need examples of differentiated Math Instructional Modules for the SPLDV curriculum.”

Supporting Factors, Learning Community: Teachers active in the MGMP scored 8.2 points higher. “In our MGMP, we analyze lesson plans together, so we don’t feel alone.” Principal Support: Schools that allocate a dedicated collaboration period once a week have a better climate for differentiation (Dixon et al., 2014). Digital Tools: Teachers

who utilize Quiz, Liveworksheet, and GeoGebra Classroom find it easier to create tiered assignments (Prast et al., 2018).

The fact that the competency level of junior high school mathematics teachers in Kendari City remains “Moderate” indicates that the Merdeka Curriculum policy has not yet fully taken root at the technical level. The diagnostic assessment domain is the primary weak point. Yet Pozas et al. (2020) emphasize that without accurate diagnostic data, differentiation is merely guesswork. Teachers need training to create simple Google Forms for interest surveys, learning style inventories, and exit tickets.

The finding that teachers with 6–15 years of experience demonstrate the highest level of ability was discussed. In this range, teachers have moved past the survival phase and are entering the experimentation phase of the teacher career cycle (Huberman, 1989, as cited in Gaitas & Martins, 2017). They are confident enough to try new things but have not yet become complacent. This serves as a foundation for the development of Master Teachers specializing in differentiated instruction within the MGMP.

The gap between questionnaire scores and observations is also significant. Survey scores tend to be higher due to *social desirability bias*. Teachers know the ideal answers. However, when observed, their execution is not yet consistent. Therefore, capacity-building programs must be based on coaching in real classrooms, not just workshops (Nurhayati et al., 2021). The Plan-Do-See Lesson Study model has proven effective in enhancing teachers’ pedagogical content knowledge (PCK) for differentiation (Roy et al., 2013).

IV. CONCLUSION

The ability of junior high school mathematics teachers in Kendari City to implement differentiated instruction falls into the “Moderate” category with a score of 68.42. The strongest domains are Product Differentiation (72.8) and Content Differentiation (71.5). The weakest domain is Diagnostic Assessment (64.1). There are significant differences based on years of service and certification status. Teachers with 6–15 years of experience and those who are certified demonstrate higher proficiency. The primary barriers teachers face in implementing differentiated instruction are administrative workload, large class sizes, misconceptions, and a lack of concrete examples from training facilitators. Key enablers include the learning communities, support from the school principal, and the use of technology.

V. RECOMMENDATION

Based on the findings of this study, it is recommended that the Kendari City Education Office establish a “Master Teacher” program for differentiated instruction, with one team per subdistrict consisting of two members. Funding for this initiative can be allocated from the Education Report under Indicator D3. It is further recommended that school supervisors and principals require the implementation of one differentiated teaching module per semester. Furthermore, teachers are expected to create more varied forms of differentiation and to further improve diagnostic and contextual assessment differentiation.

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