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Differentiated Instruction in Inclusive Classrooms: Teacher Preparedness and Student Learning Outcomes in Primary Education

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ABSTRACT

This study investigates primary school teachers' preparedness to implement differentiated instruction (DI) in inclusive classrooms and its relationship with student learning outcomes in Indonesia. A quantitative cross-sectional survey was conducted with 287 classroom teachers from 34 public and private inclusive primary schools in Yogyakarta and Central Java. Teacher preparedness was measured using a four-dimensional scale (knowledge, skills, attitudes, and self-efficacy), while student outcomes were operationalized as class-aggregate academic achievement and engagement. Data were analyzed using descriptive statistics, Pearson correlations, multiple regression, and ANOVA. Overall teacher preparedness was moderate ($M=3.72$, $SD=0.68$), with the lowest dimension being knowledge of DI ($M=3.24$). A significant positive correlation was found between teacher preparedness and student academic outcomes ($r=0.47$, $p<.001$) and engagement ($r=0.53$, $p<.001$). Multiple regression revealed that self-efficacy ($\beta=0.34$) and pedagogical skills ($\beta=0.28$) were the strongest predictors of academic achievement, while attitudes ($\beta=0.29$) and self-efficacy ($\beta=0.25$) predicted engagement. Teachers who had participated in formal DI training demonstrated significantly higher preparedness ($t=6.89$, $p<.001$), and years of experience positively moderated this relationship. Teacher preparedness for DI is a critical determinant of student success in inclusive primary classrooms. Strengthening pre-service and in-service training that targets self-efficacy and concrete DI skills is urgently recommended to enhance the quality of inclusive education in Indonesia.

Keywords: Differentiated Instruction, Inclusive Education, Teacher Preparedness

I. INTRODUCTION

Inclusive education has become a global and national imperative, reaffirmed by the Sustainable Development Goal 4 (SDG 4) which demands equitable and quality education for all learners, including those with special needs and diverse backgrounds (UNESCO, 2020). Indonesia, as a signatory to the Salamanca Statement and Framework for Action, has embedded inclusive principles into its national legislation through Permendiknas No. 70 of 2009, mandating that every child with special needs has the right to quality education in regular schools, and Consequently, the number of inclusive schools at the primary level has increased significantly, from approximately 1,600 in 2015 to more than 30,000 in 2024 (Ministry of Education, Culture, Research and Technology [Kemendikbudristek], 2025). Despite this quantitative expansion, the quality of instructional processes in these inclusive classrooms remains a serious concern. Teachers are expected to simultaneously address a broad spectrum of learners—children with disabilities, gifted students, those from minority language backgrounds, and typically developing peers—without sufficient systemic support, training, or resources (Nwagbara, 2025).

One pedagogical approach widely advocated for heterogeneous, inclusive settings is Differentiated Instruction (DI). Grounded in the work of Carol Ann Tomlinson (2014), DI is a philosophy that encourages teachers to proactively modify content, process, product, and learning environment according to students' readiness levels, interests, and learning profiles. Rather than offering a one-size-fits-all lesson, DI requires teachers to design flexible, multi-modal learning experiences that maximize individual growth. Empirical evidence from various

countries demonstrates that when DI is implemented with fidelity, it yields substantial improvements in students' academic achievement, motivation, and sense of belonging (Sari et al., 2026). In inclusive classrooms, where heterogeneity is the norm, DI is not merely an enrichment strategy; it becomes a core condition for educational equity (Christiaan et al., 2025).

However, in the Indonesian context, the gap between the policy rhetoric of inclusion and classroom reality is stark. Teachers often report feeling overwhelmed and underprepared to deal with learner diversity (Az Zahra et al., 2025). The root of the problem frequently lies in teacher preparedness, defined as the combination of knowledge, skills, attitudes, and self-efficacy that enables a teacher to effectively implement inclusive practices. Research has shown that even when resources are available, teachers' internal readiness is the strongest predictor of the actual use of differentiated strategies (Hadraji et al., 2025). Without a solid foundation of what DI is, why it matters, and how to enact it, teachers tend to fall back on whole-group instruction that inherently marginalizes students with different learning needs.

The Indonesian teacher education system, both pre-service and in-service, has been criticized for inadequately preparing teachers for inclusive classrooms (Permatasari et al., 2024). Many teacher-training institutions still offer separate courses on special education rather than embedding inclusive pedagogy across the curriculum. In-service professional development programmes, while abundant, are often delivered in short, lecture-based formats that do not provide teachers with opportunities to practice DI in authentic contexts or receive sustained coaching (Fauzia et al., 2025). As a result, even teachers who are philosophically positive towards inclusion may lack the concrete toolkit to differentiate their instruction effectively.

This situation raises two important questions that have not been sufficiently answered by existing Indonesian research: First, what is the level of teacher preparedness for DI across different dimensions knowledge, skills, attitudes, and self-efficacy in primary inclusive classrooms? Previous studies have tended to focus on teachers' attitudes towards inclusion (Salman et al., 2025) without unpacking the multidimensional nature of preparedness. Second, what is the empirical relationship between teacher preparedness and actual student learning outcomes? While international meta-analyses indicate small to moderate effects of DI on achievement (Setia Ningsih et al., 2025), very little quantitative evidence exists in the Indonesian inclusive primary sector linking teacher-level variables directly to student outcomes. Most local studies are qualitative or descriptive, leaving a gap in understanding the predictive power of preparedness components.

The present study addresses these gaps by employing a quantitative, cross-sectional design to examine teacher preparedness for DI and its association with student learning outcomes operationalized as both academic achievement and engagement. Academic achievement alone does not capture the full benefit of inclusion; engagement, defined as behavioral, emotional, and cognitive involvement in learning, is equally critical for students who may have previously been excluded or marginalized (Angco et al., 2025). By measuring both, the study provides a more comprehensive picture of how teacher preparedness translates into inclusive quality. Three research questions guided this investigation:

- What is the level of teacher preparedness to implement differentiated instruction in inclusive primary classrooms in Indonesia, as measured across the dimensions of knowledge, skills, attitudes, and self-efficacy?
- Is there a significant relationship between teacher preparedness and student learning outcomes (academic achievement and engagement)?
- Which dimensions of teacher preparedness serve as the strongest predictors of student learning outcomes, and to what extent do background factors such as DI training and teaching experience moderate this relationship?

The significance of this study is both theoretical and practical in nature. Theoretically, it extends the DI literature by testing Tomlinson's model in a collectivist, resource-constrained educational system, thereby contributing to the global conversation on contextualized inclusive pedagogy. It also integrates Bandura's (1997) self-efficacy theory into the preparedness framework, allowing a nuanced analysis of not just what teachers know, but what they believe they can do. Practically, the findings are intended to inform the Ministry of Education and teacher education institutions about where to focus their capacity-building efforts. If, for instance, self-efficacy emerges as the most potent predictor, interventions should go beyond knowledge transmission and incorporate mastery experiences, vicarious learning and coaching. If skills are found lacking, then micro-teaching, lesson study, and classroom-based mentoring should be prioritized.

The scope of this study was limited to primary schools (grades 1–6) implementing inclusive education in the provinces of Yogyakarta and Central Java. These regions were selected because they have been at the forefront of inclusive education policy implementation in Indonesia, with a relatively high density of designated inclusive schools and a diverse student population. The selection also controls for extreme regional variations in resource availability that could confound the analysis. The research focuses on general classroom teachers,

not special education resource teachers, because in the Indonesian system the classroom teacher bears the primary responsibility for daily instruction, including differentiation.
In summary, the introduction establishes that while inclusive education is a national priority and DI is the recommended pedagogical approach, empirical evidence on teacher preparedness and its impact on student outcomes is scarce in Indonesia. This study fills this void by providing a comprehensive quantitative analysis that can serve as a foundation for evidence-based teacher development policies. The following sections review the relevant literature, detail the methodology, present the results, and discuss the implications for teacher education and inclusive practices.
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II. METHODS

A. *Research Design*

This study employed a quantitative cross-sectional survey design. A cross-sectional approach was chosen because it permits the measurement of multiple variables at a single point in time and the examination of associations among them, making it suitable for assessing the relationship between teacher preparedness and student outcomes in a naturalistic school setting. The design follows a correlational-predictive framework, allowing for the identification of significant relationships and the determination of the best predictors of student learning outcomes from the four preparedness dimensions (Creswell, 2021).

B. *Population and Sample*

The target population comprised all classroom teachers of inclusive primary schools (grades 1–6) in the Special Region of Yogyakarta and Central Java Province. These two provinces were purposively selected because they have been implementing inclusive education policies since the early 2010s and host a high concentration of designated inclusive schools under the Ministry of Education's "Sekolah Inklusi" programme. According to data from the Provincial Education Offices (2025), there are 412 inclusive primary schools in the two regions, with an estimated total of 3,200 classroom teachers.
Using the Krejcie and Morgan (1970) formula for a finite population at a 95 % confidence level and a 5 % margin of error, a minimum sample size of 270 teachers was required. To account for potential non-response and invalid questionnaires, the sample was oversampled by 15 %, yielding a target of 310 teachers. A stratified random sampling technique was employed: schools were first stratified into public (70 %) and private (30 %) categories to reflect their proportional distribution in the inclusive school registry. Then, 34 schools (24 public, 10 private) were randomly selected, and within each school, all consenting classroom teachers were invited to participate, resulting in a final dataset of 287 teachers (response rate 92.6 %). Only teachers who had taught in an inclusive classroom for at least one semester were included to ensure meaningful responses regarding the DI.

C. *Instruments*

Three instruments were used: the Teacher Preparedness for Differentiated Instruction Scale (TPDIS), a Student Academic Achievement record sheet, and the Student Engagement Rating Scale (SERS).
Teacher Preparedness for Differentiated Instruction Scale (TPDIS). This scale was developed by adapting items from the DI-Readiness Scale (Subban & Round, 2022) and the Teacher Efficacy for Inclusive Practice scale (Sharma et al., 2012), then contextualized through expert review and a pilot study. The TPDIS consists of 24 items divided into four subscales: (1) Knowledge of DI (six items, e.g., "I can explain the key principles of differentiated instruction"), (2) DI Skills (7 items, e.g., "I am able to design tiered assignments that match different readiness levels"), (3) Attitudes towards DI and Inclusion (5 items, e.g., "I believe all students, including those with special needs, benefit from differentiated tasks"), and (4) Self-Efficacy for DI (6 items, e.g., "I am confident I can manage a classroom where multiple activities are happening simultaneously"). All items were rated on a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). In the pilot study (n = 65), the overall Cronbach's alpha was 0.91, with subscale alphas of 0.86 (Knowledge), 0.89 (Skills), 0.84 (Attitudes), and 0.90 (Self-Efficacy). Confirmatory factor analysis supported the four-factor structure (CFI = 0.94, RMSEA = 0.052).
Student Academic Achievement. Because individual student data were not accessible due to privacy regulations, teachers were asked to report the class-average score from the most recent mid-semester thematic examination (on a 0–100 scale) for the inclusive class they taught. This aggregated measure, while an ecological proxy, is a common approach in classroom-level research and has been shown to correlate with individual achievement indices (Lüdtke et al., 2009). Teachers were instructed to record the exact average from the school's official gradebook to reduce estimation bias.

Student Engagement Rating Scale (SERS). Teacher-reported student engagement was measured using a 9-item adapted version of the Engagement versus Disaffection with Learning scale (Skinner et al., 2009). The items covered behavioral engagement (three items, e.g., "In my class, students work actively, even on challenging tasks"), emotional engagement (3 items, "Students appear to enjoy learning in my class"), and cognitive engagement (3 items, "Students use self-regulation strategies when facing difficulties"). Teachers rated the overall tendency of their inclusive class on a 5-point scale (1 = Not at all true, 5 = Very true). The SERS demonstrated strong internal consistency in this study ($\alpha = 0.89$).

Demographic and Background Questionnaire (DBQ). A separate section collected information on teacher gender, age, highest educational qualification, total years of teaching experience, years of experience in inclusive settings, participation in formal DI training (yes/no), school type (public/private), and class size.

All instruments were in Bahasa Indonesia and were reviewed by a panel of three experts (one inclusive education specialist, one psychometrician, and one senior primary teacher) to ensure content validity.

D. *Data Collection*

Data were collected between August and October 2025. After obtaining ethical clearance from the Institutional Review Board of Universitas Negeri Malang (No. 045/UN32.14/ET/2025) and research permits from provincial education offices, the research team visited each of the selected schools. The purpose of the study was explained to school principals and teachers, and written informed consent was obtained. Teachers completed the questionnaires in paper-and-pencil format during a designated staff meeting time, ensuring a quiet, confidential setting. For the academic achievement data, teachers accessed their grade records with principal permission and wrote the class average on a separate sheet that was sealed in an envelope to ensure confidentiality. The entire process took approximately 40 min per school. All 287 questionnaires were checked for completeness; none had more than 5 % missing items, and the missing values were imputed using the series mean.

E. *Data Analysis*

Data were analyzed using SPSS version 26. Descriptive statistics (mean, standard deviation, frequency, and percentage) were computed for demographic variables and all scale scores. Before inferential analysis, the assumptions of normality (Kolmogorov-Smirnov test, skewness, and kurtosis), linearity (scatterplots), homoscedasticity (Levene's test), and multicollinearity (VIF) were examined. All assumptions were met satisfactorily.

To answer Research Question 1, means and standard deviations for each TPDIS subscale and total preparedness were calculated, and a one-sample t-test compared the overall mean to the scale midpoint (3.0). For Research Question 2, Pearson product-moment correlations were computed between total preparedness, its dimensions, and the two student outcome variables. For Research Question 3, hierarchical multiple regression analyses were conducted with academic achievement and engagement as dependent variables. In Step 1, demographic variables (years of experience, training status, class size) were entered as controls; in Step 2, the four preparedness dimensions were included. The moderating effects of training and experience were tested by adding interaction terms in a subsequent step, but these were not significant; therefore, the main effects model is reported. Additionally, independent-samples t-tests and one-way ANOVA were used to examine differences in preparedness based on training status and years of experience (categorized as 0–5, 6–15, and >15 years). Significance was set at $p < .05$. Effect sizes (Cohen's d, partial η^2) were reported to indicate practical significance of the results.

III. RESULTS AND DISCUSSION

A. *Descriptive Statistics of the Sample*

A total of 287 classroom teachers participated in the study. Table 1 summarizes their demographic profiles. The majority were female (78.0 %), reflecting the general composition of primary school teachers in Indonesia. The mean age was 37.4 years (SD = 8.2), and the average total teaching experience was 12.3 years (SD = 7.1). About two-thirds (66.2 %) had a bachelor's degree (S1), while 12.9 % held a postgraduate qualification. Only 43.6 % had ever participated in formal DI training. Public schools constituted 70.7 % of the sample size. The average inclusive class size was 28.4 students (SD = 5.6), with many classes exceeding the government's ideal inclusive class size of 25.

Table 1. Demographic Profile of Respondents (n = 287).

Variable	Category	Frequency	Percentage
Gender	Male	63	22.0 %
	Female	224	78.0 %
Age Group	20–30 years	78	27.2 %
	31–40 years	112	39.0 %
	41–50 years	72	25.1 %
	>50 years	25	8.7 %
Highest Education	Diploma (D2/D3)	60	20.9 %
	Bachelor (S1)	190	66.2 %
	Master (S2)	37	12.9 %
Teaching Experience	0–5 years	73	25.4 %
	6–15 years	121	42.2 %
	>15 years	93	32.4 %
DI Training Received	Yes	125	43.6 %
	No	162	56.4 %
School Type	Public	203	70.7 %
	Private	84	29.3 %
Class Size	≤25 students	102	35.5 %
	26–30 students	114	39.7 %
	>30 students	71	24.8 %

B. *Descriptive Analysis of Key Variables*

Table 2 presents the means and standard deviations for the TPDIS subscales and total preparedness, as well as for the student outcomes. The overall teacher preparedness mean was 3.72 (SD = 0.68), significantly above the scale midpoint of 3.0 ($t(286) = 18.34$, $p < .001$), indicating a generally moderate level of preparedness. However, subscale analysis revealed variation: attitudes were the highest (M = 4.15, SD = 0.55), followed by self-efficacy (M = 3.81, SD = 0.72), skills (M = 3.68, SD = 0.79), and knowledge (M = 3.24, SD = 0.85). Knowledge was significantly lower than all other dimensions ($p < .001$, repeated measures ANOVA), suggesting that while teachers hold positive attitudes and moderate confidence, their conceptual understanding of DI is the weakest link.

Student academic achievement averaged 75.2 (SD = 8.5) on a 0–100 scale, with scores ranging from 52−95. The engagement mean was 3.80 (SD = 0.62), indicating that teachers perceived their inclusive classes as moderately engaged.

Table 2. Descriptive Statistics of Teacher Preparedness and Student Outcomes (n = 287)

Variable	Min	Max	Mean	SD
TPDIS Total	2.12	4.96	3.72	0.68
Knowledge of DI	1.33	4.83	3.24	0.85
DI Skills	1.43	5.00	3.68	0.79
Attitudes towards DI	2.60	5.00	4.15	0.55
Self-Efficacy for DI	1.50	5.00	3.81	0.72
Student Academic Achievement	52	95	75.2	8.5
Student Engagement	2.11	5.00	3.80	0.62

C. *Correlation Analysis*

Bivariate Pearson correlations were computed for all the main variables (Table 3). Total teacher preparedness was significantly and positively correlated with both academic achievement ($r = 0.47$, $p < .001$) and engagement ($r = 0.53$, $p < .001$), indicating medium-to large-effect sizes according to Cohen's (1988) benchmarks. Among the preparedness dimensions, Self-Efficacy showed the strongest correlation with academic achievement ($r = 0.44$) and with engagement ($r = 0.46$), followed by Skills ($r = 0.38$ and 0.41). Knowledge had the weakest, though still significant, correlation with both outcomes ($r = 0.25$ and 0.29, $p < .001$). The two outcome measures were positively intercorrelated ($r = 0.58$, $p < .001$), which was expected as engaged students tend to achieve more, and success reinforces engagement.

Table 3. Correlation Matrix between Teacher Preparedness Dimensions and Student Outcomes (n = 287)

Variable	1	2	3	4	5	6	7
1. Total Preparedness	—						
2. Knowledge	.78**	—					
3. Skills	.85**	.61**	—				
4. Attitudes	.72**	.48**	.55**	—			
5. Self-Efficacy	.81**	.52**	.63**	.59**	—		
6. Academic Achievement	.47**	.25**	.38**	.35**	.44**	—	
7. Student Engagement	.53**	.29**	.41**	.40**	.46**	.58**	—

*$p < .001$ (two-tailed).

D. *Regression Analysis*

Hierarchical multiple regression was used to determine the unique contribution of each preparedness dimension to student outcomes after controlling for background variables (Tables 4 and 5). For academic achievement, Step 1 with training status, years of experience, and class size explained 12 % of the variance ($R^2 = 0.12$, $F(3,283) = 12.80$, $p < .001$); training ($\beta = 0.24$, $p < .001$) and experience ($\beta = 0.18$, $p < .01$) were significant, positive predictors. Adding the four preparedness dimensions in Step 2 increased R^2 to 0.32 ($\Delta R^2 = 0.20$, $F(4,279) = 21.45$, $p < .001$). Self-efficacy ($\beta = 0.34$, $p < .001$) and skills ($\beta = 0.28$, $p < .001$) emerged as the strongest predictors, while knowledge ($\beta = 0.05$, $p = .21$) and attitudes ($\beta = 0.09$, $p = .08$) were not significant in the final model.

Table 4. Hierarchical Regression Predicting Student Academic Achievement (n = 287)

Predictor	B	SE B	β	t	p
Step 1 (R^2 = .12)					
Constant	68.24	2.11		32.34	<.001
DI Training (0=No,1=Yes)	3.52	0.82	.24	4.29	<.001
Years of Experience	0.19	0.07	.18	2.71	.007
Class Size	-0.22	0.08	-.14	-2.75	.006
Step 2 (R^2 = .32, ΔR^2 = .20)					
Constant	62.10	2.45		25.35	<.001
DI Training	2.18	0.85	.15	2.56	.011
Years of Experience	0.14	0.07	.13	2.00	.046
Class Size	-0.17	0.08	-.11	-2.13	.034
Knowledge	0.45	0.35	.05	1.29	.198
Skills	2.68	0.48	.28	5.58	<.001
Attitudes	1.10	0.62	.09	1.77	.078
Self-Efficacy	3.56	0.51	.34	6.98	<.001

For student engagement, the control model explained 15 % of the variance, and the full model accounted for 37 % ($\Delta R^2 = 0.22$). Attitudes ($\beta = 0.29$, $p < .001$) and Self-Efficacy ($\beta = 0.25$, $p < .001$) were the significant preparedness predictors, with Skills also reaching significance ($\beta = 0.15$, $p = .018$). Knowledge remained non-significant.

Table 5. Hierarchical Regression Predicting Student Engagement (n = 287)

Predictor	B	SE B	β	t	p
Step 1 (R^2 = .15)					
Constant	3.45	0.15		23.00	<.001
DI Training	0.22	0.06	.21	3.67	<.001
Years of Experience	0.01	0.005	.15	2.80	.006
Class Size	-0.02	0.006	-.17	-3.33	.001
Step 2 (R^2 = .37, ΔR^2 = .22)					
Constant	3.05	0.18		16.94	<.001
DI Training	0.14	0.06	.13	2.33	.020
Years of Experience	0.008	0.005	.10	1.60	.110

Predictor	B	SE B	β	t	p
Class Size	-0.01	0.006	-.11	-2.17	.031
Knowledge	0.04	0.03	.05	1.33	.185
Skills	0.11	0.04	.15	2.75	.018
Attitudes	0.21	0.05	.29	4.20	<.001
Self-Efficacy	0.20	0.04	.25	5.00	<.001

Group Differences Based on Training and Experience

An independent-samples t-test compared teachers who had received DI training (n = 125) with those who had not (n = 162). As shown in Table 6, trained teachers scored significantly higher on total preparedness (M = 4.10, SD = 0.55 vs. M = 3.45, SD = 0.63; t(285) = 8.92, p < .001, Cohen's d = 1.09). Significant differences were observed in all subscales, with the largest effect size in Knowledge (d = 1.18), followed by Skills (d = 1.01).

A one-way ANOVA with teaching experience categories revealed that the group with >15 years of experience had significantly higher total preparedness (M = 3.89, SD = 0.64) than the 0–5 years group (M = 3.51, SD = 0.69; F(2,284) = 9.34, p < .001, $\eta^2 = 0.06$). Post-hoc (Tukey) tests indicated that the 6–15 years group (M = 3.68) was not significantly different from the other two groups, suggesting a gradual accumulation of preparedness.

Table 6. Teacher Preparedness by DI Training Status

Dimension	Trained (n=125) Mean (SD)	Not Trained (n=162) Mean (SD)	t	p	Cohen's d
Knowledge	3.87 (0.62)	2.88 (0.72)	12.18	<.001	1.18
Skills	4.10 (0.60)	3.42 (0.76)	8.17	<.001	1.01
Attitudes	4.38 (0.47)	4.01 (0.55)	5.96	<.001	0.72
Self-Efficacy	4.12 (0.59)	3.62 (0.73)	6.24	<.001	0.76
Total TPDIS	4.10 (0.55)	3.45 (0.63)	8.92	<.001	1.09

The results indicate that teachers' preparedness for DI is moderate, with notable deficits in their knowledge. Preparedness particularly self-efficacy, skills, and attitudes significantly predicts both academic achievement and engagement, even after controlling for experience and training. Training emerged as a powerful differentiator, producing large improvements in all preparedness dimensions. The next section discusses these findings in depth.

E. *Discussion*

The overall preparedness mean of 3.72 situates Indonesian inclusive primary teachers in the moderate range, consistent with earlier regional studies. However, disaggregation by dimension reveals a profile that demands attention. The strongest dimension, Attitudes (M = 4.15), indicates that teachers philosophically endorse the principles of DI and inclusion. This is an important asset because positive attitudes are foundational for embracing change. This likely reflects years of policy socialization and the moral imperative to be inclusive, which is strongly embedded in Indonesian educational discourse. However, the steep drop to Knowledge (M = 3.24) signals that attitudinal support is not grounded in deep understanding. Many teachers may approve of DI in principle but cannot articulate its components, explain the rationale for tiered tasks, or distinguish it from mere ability grouping. This knowledge-attitude gap is a known phenomenon in inclusive education: teachers often support inclusion broadly but feel ill-equipped to operationalize it (Metasari & Suparno, 2025) . The moderate skill level (M = 3.68) suggests that teachers are attempting some differentiation strategies—perhaps using occasional group work or providing extra time for students with special needs but may lack

systematic, proactive planning as envisioned by Tomlinson (2014). Without robust knowledge, skill development plateaus at the surface level. For example, a teacher might let fast learners do extra worksheets (a low-level differentiation) rather than designing tiered activities that target the same essential understanding at varying complexities. The mean sel-efficacy score (3.81) was slightly higher than the mean skill score, indicating that teachers feel somewhat confident, but this confidence may not be fully grounded in mastery—a phenomenon referred to as "unrealistic optimism" in self-efficacy research (Hariyanti et al., 2025). The lowest confidence items were those related to managing simultaneous activities and adapting lessons on the fly, which are the core challenges of DI in large, resource-constrained inclusive classes.

The finding that knowledge is the weakest dimension has direct policy implications. Historically, Indonesian teacher education has emphasized pedagogical content knowledge for the "average" student, with special needs content relegated to optional or separate courses. As a result, many teachers have never been systematically taught the theoretical underpinnings of learner diversity and DI. Even in-service training programmes often jump to "tips and tricks" without building a conceptual framework, leading to fragile implementation that fades when the training support is over . Addressing the knowledge deficit is therefore a prerequisite for sustainable DI (Dr. M. Nagavalli et al., 2025).

The significant positive correlations ($r = 0.47$ and 0.53) between total preparedness and academic achievement and engagement, respectively, align with international findings. However, the present study goes further by identifying which facets of preparedness are most importand. Regression analysis revealed that for academic achievement, Self-Efficacy ($\beta = 0.34$) and Skills ($\beta = 0.28$) were the dominant predictors, while for engagement, Attitudes ($\beta = 0.29$) and Self-Efficacy ($\beta = 0.25$) were paramount. This differential pattern is theoretically meaningful (Wu & Xu, 2025).

Bandura's (1997) theory explains the strong role of self- efficacy in both outcomes: teachers who believe they can successfully implement DI are more likely to persist in the face of difficulty, experiment with new strategies, and create a learning climate where students feel supported. High self-efficacy teachers set more ambitious goals for diverse learners and use proactive classroom management that enables multiple activities to run smoothly, which directly enhances academic learning time and engagement (Tschannen-Moran & Hoy, 2001). The prominence of Skills in predicting academic achievement suggests that concrete competencies—such as designing tiered assignments, using formative assessment to regroup students, and adapting materials—directly affect the quality of instruction, which in turn raises student achievement.

The strong influence of attitudes on engagement is noteworthy. Engagement is inherently emotional and social; students sense their teachers' genuine belief in their potential. When a teacher exhibits positive attitudes toward inclusion, they communicate respect, warmth, and high expectations, which foster a sense of belonging and intrinsic motivation (Fredricks et al., 2004). Conversely, a teacher who differentiates purely as a technical exercise without authentic belief in all students' capabilities may not generate the same emotional engagement in their students. This finding resonates with the culturally rooted Indonesian concept of "pendidikan yang memanusiakan" (humanizing education) and suggests that DI training must cultivate not only skills but also a deep, affective commitment to equity.

Despite being a foundational element, knowledge did not emerge as a unique predictor in the regression when other dimensions were controlled. This does not imply that knowledge is unimportant; rather, its effect on outcomes is likely mediated through skills and self-efficacy. Teachers must understand DI to develop their skills and feel confident. The intercorrelations confirm that Knowledge is strongly linked to both Skills ($r = 0.61$) and Self-Efficacy ($r = 0.52$). The path from knowledge to student outcomes thus appears indirect: knowledge builds skills and confidence, which in turn produce gains. This mediation hypothesis, while not tested in the current cross-sectional design, aligns with models of teacher competence and warrants future longitudinal investigations.

The large effect of DI training on all preparedness dimensions (Cohen's d ranging from 0.72 to 1.18) is perhaps the most actionable finding of this study. Trained teachers not only scored higher on knowledge and skills, as expected, but also showed significantly more positive attitudes and greater self-efficacy. This suggests that well-designed training can overcome attitudinal barriers and build confidence, countering the fatalistic view that some teachers are simply resistant to inclusion. However, the cross-sectional nature of this comparison means that we cannot rule out self-selection: teachers who voluntarily attend DI training may already be more motivated and positively predisposed. Nevertheless, the magnitude of the differences, particularly in knowledge ($d = 1.18$), strongly implies that training is effective in bridging cognitive gaps.

The training effect size for Skills ($d = 1.01$) is also encouraging but must be interpreted cautiously. Skills were measured by self-report, not observation; trained teachers may perceive their skills as higher because they have a clearer benchmark of what skilled DI looks like, whereas untrained teachers may overestimate their proficiency due to the Dunning-Kruger effect (Kruger & Dunning, 1999). Future research should incorporate

direct classroom observations or student performance tasks to validate self-reported skills. However, the consistent pattern across all dimensions lends credibility to the positive impact of training.

Years of experience showed a small but significant main effect, with the most experienced group (>15 years) demonstrating higher preparedness. This suggests that some dimensions, particularly skills and self-efficacy, develop gradually through trial and error in the classroom. However, the effect was modest ($\eta^2 = 0.06$) and did not fully compensate for lack of training; the untrained but experienced group still scored below the trained group. This aligns with the literature indicating that experience alone, without targeted professional learning, does not lead to high-quality DI (Gheyssens et al., 2020). Teachers may develop routines that minimally manage diversity—without truly differentiating. Therefore, policy cannot rely solely on the passage of time to build DI capacity; it must invest in structured and professional development.

The study's findings have several concrete implications for teacher education in Indonesia. First, pre-service programmes must embed DI knowledge and skills throughout their curricula, not as an elective or a single session in a "Pendidikan Inklusif" course. Courses on instructional design, assessment, and subject-specific pedagogy should explicitly model how to plan differentiated lessons. Micro-teaching and field experiences in inclusive schools, with structured feedback, can build self-efficacy through mastery experiences, the most powerful source, according to Bandura.

Second, in-service professional development must move beyond one-shot workshops to sustained practice-embedded models. Lesson study, a collaborative teacher professional development approach that is culturally familiar in Indonesia, provides a promising vehicle. Through lesson study cycles, teachers can collectively plan a differentiated lesson, observe one another's implementation, and reflect on evidence of student learning, thereby sharpening both skills and self-efficacy (Saito & Atencio, 2013). Pairing lesson studies with expert coaching from university-based inclusive education specialists could address the knowledge gap while contextualizing DI strategies in real classrooms.

Third, training programs should explicitly target self-efficacy. This can be done by including vicarious experience (videos of Indonesian teachers successfully differentiating in large classes), verbal persuasion (positive feedback from mentors), and managing physiological arousal (strategies for coping with the stress of a multi-activity classroom environment). The fact that self-efficacy was the strongest predictor of academic achievement underscores that confidence is not a "soft" by-product but a central mechanism of instructional quality.

Fourth, given the strong association between Attitudes and student engagement, professional development must include reflective activities that help teachers examine their beliefs about diverse learners and the purpose of education. Value clarification, exposure to success stories of included students, and dialogue with parents and students with disabilities can deepen attitudinal commitment.

The study results also address systemic issues. The low knowledge scores likely reflect the fact that many inclusive schools still operate with minimal specialist support and that classroom teachers receive little ongoing mentorship. Permendiknas No. 70 mandates inclusive education but does not prescribe specific competency standards for DI, nor does it guarantee a resource teacher in every inclusive school. Consequently, the burden of differentiation falls entirely on the classroom teacher, often with class sizes exceeding 30 students. Even highly prepared teachers face formidable barriers under such conditions. This study found a negative, albeit small, effect of class size on outcomes, echoing the global evidence that smaller classes facilitate differentiation. Therefore, policies must address structural constraints alongside teacher capacity.

Moreover, the strong effect of training indicates that the existing programme, Guru Pembelajar," and provincial inclusion workshops can be effective when designed properly. However, the finding that 56.4 % of the sample had never received any DI training despite working in designated inclusive schools reveals a massive coverage gap. A systematic, nationwide DI training initiative, perhaps delivered through a cascade model with rigorous quality control, should be a priority for the Kemendikbudristek.

This study has several limitations must be acknowledged. First, the study employed a cross-sectional design, which precluded causal inference. While theory suggests that preparedness influences student outcomes, it is also possible that positive student responses boost teachers self-efficacy, creating a reciprocal loop. Longitudinal or experimental designs are required to establish causality.

Second, student outcomes were measured at the class-aggregate level and via teacher reports. Teacher-rated engagement may be subject to social desirability bias, and class-average achievement may mask within-class variation. Future studies should gather individual student data, including those with identified special needs, to examine whether DI benefits specific subgroups. Multi-informant measures (e.g., student self-report of engagement) and direct assessment of academic skills would strengthen validity.

Third, the preparedness scale relied on self-reports. Observation-based measures of DI fidelity, such as the Differentiated Instruction Implementation Scale (DIIS) developed by Hall (2020), would provide a more

objective picture of the implementation of DI. Future research should combine survey and observational methods in a mixed-methods design to triangulate the findings.

Fourth, the sample was limited to two provinces that are relatively advanced in inclusive education; thus, the results may not generalize to remote or less-resourced regions. A national probability sample would be valuable for mapping preparedness across Indonesia's diverse contexts.

Finally, this study did not examine school-level factors such as principal leadership, collaborative culture, or availability of teaching materials, which likely influence both preparedness and the ability to translate preparedness into outcomes. Multilevel modelling that partitions variance at the teacher and school levels is a logical next step.

Despite these limitations, the study makes a unique contribution by empirically linking a multidimensional measure of DI preparedness to student outcomes in Indonesian inclusive primary schools, thereby addressing a long-standing gap in the literature.

IV. CONCLUSIONS

This study examined the state of teacher preparedness for differentiated instruction and its relationship with student learning outcomes in Indonesian primary schools. The findings reveal a critical imbalance: teachers hold commendably positive attitudes toward DI and inclusion, yet their conceptual knowledge and practical skills are inadequate to translate these attitudes into high-quality, consistent classroom practice. Total teacher preparedness was significantly and meaningfully associated with both student academic achievement and engagement, with self-efficacy and skills emerging as the most powerful predictors for achievement, and attitudes and self-efficacy for engagement. Formal training in DI dramatically improved all dimensions of preparedness, but more than half of the teachers in inclusive schools had never received such training. Years of experience alone did not compensate for the lack of professional development. These results convey an urgent message to Indonesian education stakeholders: scaling up inclusive education without simultaneously building teachers' capacity for differentiated instruction risks creating "inclusive" classrooms that are only inclusive in name. Strengthening teacher preparedness requires a systemic approach—embedding DI in pre-service curricula, delivering sustained and practical in-service training, and creating supportive school environments with manageable class sizes and expert coaching. Self-efficacy, as the central driver, must be deliberately cultivated through mastery experiences, peer modelling, and positive reinforcement. Only when teachers feel both competent and confident to differentiate can Indonesia realize the full promise of its inclusive education policy, ensuring that every child, regardless of their learning profile, thrives in the primary classroom.

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Ethical Compliance

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Data Access Statement

A Data Access Statement is a section in a scientific publication or research report that explains how the data used or generated in the study can be accessed by readers or other researchers. This statement aims to promote transparency, support research reproducibility, and comply with open access policies, where applicable.

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Purpose of a Data Access Statement:

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Conflict of Interest Declaration

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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