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Teachers' Attitudes and Competencies as Catalysts for Inclusive Science Education: A Case Study of Public Elementary Schools in West Sumatra

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Abstract: This study examines the contribution of teacher attitudes and competencies as catalysts for inclusive science education in public elementary schools in West Sumatra, Indonesia. Using a quantitative correlational design, data were collected from 190 teachers across 152 inclusive schools through validated Likert-scale questionnaires. Multiple linear regression analysis revealed that teacher attitudes and competencies together explain 60.0% of the variance in the implementation of inclusive education ($R^2 = 0.600$, $F = 140.0$, $p < 0.001$). Teacher competencies demonstrated a strong, significant partial effect ($\beta = 0.725$, $p < 0.001$), while attitudes showed a smaller but statistically significant contribution ($\beta = 0.153$, $p = 0.035$). All regression assumptions were met, confirming the model's robustness. The findings underscore that while positive attitudes are necessary, professional competencies—particularly in pedagogical adaptation, collaboration, and inclusive assessment—are the dominant driver of effective inclusive practice. The study concludes that sustainable implementation of inclusive science education requires integrated professional development that simultaneously strengthens both attitudinal readiness and technical expertise.

Keywords: Elementary School; Inclusive Education; Teacher attitude; Teacher competence; Science Education.

Introduction

Inclusive education has emerged globally as a fundamental human right and a core strategy for achieving equitable, quality learning for all children regardless of ability, background, or circumstance (Artiles & Dyson, 2005). Grounded in the principles of social justice, dignity, and non-discrimination, inclusive education seeks not merely to integrate students with disabilities into mainstream classrooms but to transform educational systems so they actively respond to learner diversity (Ainscow, 2021). In Indonesia, this vision is enshrined in Law No. 20/2003 on the National Education System and reinforced by Permendiknas No. 70/2009, which mandates inclusive practices in regular schools (Hata et al., 2021; Iqbal et al., 2021). Despite these policy commitments, the effective implementation of inclusive education remains uneven, particularly in regions where systemic support and teacher readiness intersect in complex ways (Mansouri et al., 2024; Taghap & Pabalan, 2025).

At the heart of this implementation gap lies the teacher. As the primary mediators of classroom practice, teachers determine whether inclusion becomes a transformative pedagogical reality or a procedural formality (Scheiner, 2022; Wildemeersch & Koulaouzides, 2023). Their influence is twofold: psychological (attitudes toward diversity, equity, and student potential) and professional (competence in adapting curricula, differentiating instruction, and collaborating with support personnel). While global literature affirms the centrality of both factors (Loreman

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et al., 2014; Smale-Jacobse et al., 2023), their relative and combined contributions**, especially** in the context of science education in low-resource settings, remain underexplored.

This gap is particularly salient in Indonesia's public elementary schools, where inclusive education is expanding rapidly but often without adequate preparation (Rahmi et al., 2024; Somad et al., 2024). West Sumatra, for instance, reported 12,580 children with special needs and 243 inclusive schools in 2025 (Dinas Pendidikan Sumatera Barat, 2025), yet many teachers enter inclusive classrooms with limited training and variable dispositions. Science education presents an additional layer of complexity: inquiry-based, hands-on learning demands specialized adaptations to ensure accessibility for learners with diverse sensory, cognitive, or motor profiles (Alhomairi, 2024; Morris, 2025). Yet inclusive science pedagogy is rarely addressed in teacher preparation or policy discourse.

While prior studies have examined teacher attitudes or competencies in isolation (Anggun et al., 2024; Supriyanto, 2019), few have empirically modeled their synergistic role in shaping inclusion outcomes. Moreover, most existing research focuses on general inclusive practices, neglecting domain specific contexts like science were accessibility and engagement hinge on pedagogical innovation and resourcefulness. This omission limits the design of targeted, evidence-based interventions.

To address this lacuna, this study investigates how teacher attitudes and competencies jointly function as catalysts for inclusive science education in public elementary schools in West Sumatra. Drawing on a sample of 190 teachers across 152 schools, the research tests three core propositions: (1) that teacher attitudes—encompassing cognitive, affective, and conative dimensions—positively predict implementation quality; (2) that teacher competencies—spanning pedagogical, social, professional, and personal domains—exert a stronger, more direct influence; and (3) that the combined model explains a substantial portion of variance in inclusive practice, thereby identifying leverage points for systemic improvement.

Method

This study employed a quantitative correlational design to examine the relationship and combined contribution of teacher attitudes and competencies toward the implementation of inclusive science education in public elementary schools in West Sumatra, Indonesia. The correlational approach was selected to systematically measure the strength and direction of associations among the key variables without manipulating them, aligning with the study's objective to identify predictive factors in inclusive practice (Shields, 2024).

Population and Sampling

The target population comprised elementary school teachers actively involved in inclusive classrooms across public elementary schools in West Sumatra. At the time of data collection (September–October 2025), there were 3,893 public elementary schools in the province, with 152 officially designated as inclusive schools. Using cluster sampling, these 152 schools served as primary clusters. Within each cluster, purposive sampling was applied to select teachers who (1) taught in inclusive classrooms, (2) had direct experience instructing students with special needs, and (3) had participated in inclusive education programs for at least one semester. This procedure yielded a total sample of 190 teachers.

Variables and Operational Definitions

Independent Variables: Teacher Attitudes toward Inclusive Science Education, measured through cognitive (e.g., understanding of inclusion principles), affective (e.g., comfort with student diversity), and conative (e.g., willingness to adapt instruction) dimensions. Teacher Competencies in Inclusive Science Education, assessed across four domains: pedagogical (lesson planning, differentiated instruction), professional (content mastery, use of assistive tools), social (collaboration with GPKs and parents), and personal (empathy, resilience).

Dependent Variable: Implementation of Inclusive Science Education, evaluated based on school policy alignment, adaptive instructional practices (e.g., modified lesson plans, inclusive assessment), and availability/use of inclusive resources (e.g., accessible facilities, assistive technology).

Instruments and Data Collection

Three validated Likert-scale questionnaires (1–5: Strongly Disagree to Strongly Agree) were used, each containing 20 items: Teacher Attitude Scale ($\alpha = 0.862$), Teacher Competency Scale ($\alpha = 0.971$), Inclusive Science Education Implementation Scale ($\alpha = 0.904$). Items included both favorable and unfavorable statements to reduce response bias. Instruments were pilot-tested with 30 teachers and refined based on content validity (expert judgment) and empirical validity (item-total correlation, $r > 0.30$). Cronbach's Alpha confirmed high internal consistency for all scales. Data were collected online via Google Forms, distributed through school coordinators and WhatsApp groups, with informed consent obtained from all participants.

Data Analysis

Data were analyzed using Jamovi 2.6.6. Descriptive statistics (mean, SD, min/max) summarized participant profiles and variable distributions. Multiple linear regression was employed to test: The individual (partial) effects of attitudes and competencies on inclusive implementation (via t-tests), Their simultaneous (combined) effect (via F-test), The proportion of variance explained (R^2). Assumptions of normality (Shapiro-Wilk), homoscedasticity (Breusch–Pagan), absence of multicollinearity (VIF < 5), and independence of errors (Durbin–Watson ≈ 2) were confirmed prior to regression modeling. A significance threshold of $p < 0.05$ was adopted.

Results and Discussion

Data were collected from 190 elementary school teachers across 152 inclusive public elementary schools in West Sumatra using validated Likert-scale questionnaires ($\alpha > 0.86$ for all instruments). Multiple linear regression was conducted in Jamovi 2.6.6 to examine the influence of teacher attitudes (X_1) and teacher competencies (X_2) on the implementation of inclusive education (Y).

Table 1. Descriptive Statistics

Variable	N	Min	Max	Mean	SD	Shapiro-Wilk (p)
Teacher Attitudes	190	46	100	63.0	9.61	< 0.001
Teacher Competencies	190	42	100	63.3	10.5	< 0.001
Implementation of Inclusive Education	190	44	98	64.2	10.1	< 0.001

Note: All variables showed non-normal distributions (Shapiro–Wilk $p < 0.05$), but regression assumptions were still met due to sample size (>100) and robustness of linear models (Field, 2018).

Table 2. Instrument Reliability

Instrument	Items	Cronbach's α	Reliability Status
Teacher Attitudes	20	0.862	High
Teacher Competencies	20	0.971	Excellent
Implementation of Inclusive Education	20	0.904	Excellent

Table 3. Multiple regression results

Predictor	B (Standardized)	T	P	95% CI [Lower, Upper]
Teacher Attitudes (X_1)	0.153	2.13	0.035	[0.012, 0.294]
Teacher Competencies (X_2)	0.725	10.18	< 0.001	[0.585, 0.865]

The regression model was statistically significant: $R = 0.775$, $R^2 = 0.600$, $F(2, 187) = 140.0$, $p < 0.001$, indicating that 60.0% of the variance in inclusive education implementation was explained by teacher attitudes and competencies. Teacher competencies had a large, highly significant effect ($\beta = 0.725$). Teacher attitudes had a small but significant effect ($\beta = 0.153$).

Table 4. Assumption checks

Assumption	Test Statistic	Result
Normality (residuals)	Shapiro–Wilk $p = 0.153$	Met
Homoscedasticity	Breusch–Pagan $p = 0.270$	Met
Multicollinearity	VIF = 2.02	No concern
Independence of errors	Durbin–Watson = 1.87	Acceptable

This study demonstrates that teacher attitudes and, more critically, teacher competencies are pivotal catalysts in the implementation of inclusive science education in public elementary schools in West Sumatra. The finding that 60% of the variance in implementation quality is explained by these two teacher-level factors underscores their centrality, yet it also signals that nearly 40% of implementation success hinges on contextual and systemic variables not captured in this model, such as school leadership, resource availability, policy coherence, and community support. This dual insight reframes the discourse on inclusive education: while teacher agency is necessary, it is insufficient without structural enablement.

Competence as the Dominant Driver

The standardized regression coefficient for competence ($\beta = 0.725$, $p < 0.001$) reveals that professional capability outweighs attitudinal disposition in predicting effective inclusive practice.

This finding challenges the common assumption, often implicit in policy rhetoric, that fostering positive attitudes alone will catalyze inclusion. Instead, it aligns with Bandura (1978)'s concept of self-efficacy: teachers may hold favorable views of inclusion, but without the pedagogical tools to differentiate instruction, assess diverse learners, or collaborate with support staff, their goodwill remains inert. In the context of Indonesian inclusive classrooms, where student-to-teacher ratios are high and support personnel (e.g., GPKs) are often scarce technical competence becomes the operational bridge between policy and practice (Woodfork, 2024).

This result resonates with Smale-Jacobse et al. (2023), who identified "adaptive teaching skills" as the core of inclusive teacher competence. It also echoes Zainuddin et al. (2025), who emphasized that pedagogical and professional readiness determines whether inclusive ideals translate into classroom reality. In West Sumatra, where many schools have only recently transitioned to inclusive models, the high competence scores (mean = 63.3) suggest that targeted training—such as those offered by UNP and local education offices has yielded tangible gains. Yet the data also imply a ceiling: competence alone cannot overcome infrastructural deficits or curriculum rigidity.

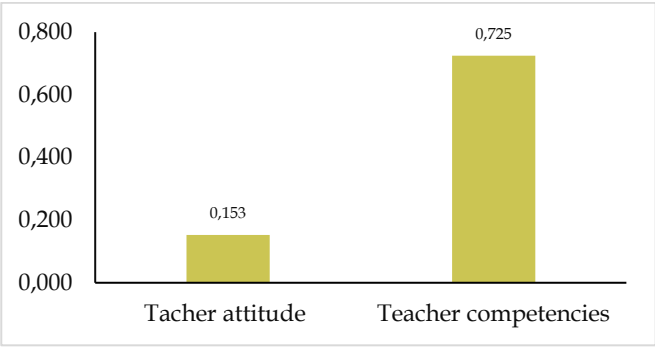

Figure 1. Standardized Regression Coefficients (β) for Predictors of Inclusive Education Implementation

Attitude as a Necessary Enabler

Although attitude exerts a smaller but significant effect (β = 0.153, p = 0.035), its role is foundational. A positive attitude lowers psychological resistance, fosters empathy, and motivates teachers to seek out resources and persist through challenges functions that precede and sustain competence development. This aligns with Loreman et al. (2014); Simpson et al. (2025); Tay et al. (2023), who found that teachers with inclusive mindsets were more likely to engage in reflective practice and seek collaborative solutions.

Importantly, attitude in this study was not merely emotional but included cognitive (e.g., belief in student potential) and conative (e.g., willingness to adapt) dimensions. This tripartite operationalization captures the holistic nature of teacher disposition, reinforcing Allport (1927) original conceptualization. The modest effect size, however, suggests that in contexts of high systemic constraint, such as in many Indonesian public schools, attitude functions more as a necessary condition than a sufficient one.

The Interdependence of Attitude and Competence

The simultaneous model confirms that attitude and competence operate synergistically, not independently. A teacher may possess high competence yet fail to apply it without the motivational and ethical commitment that attitude provides. Conversely, a highly motivated but underprepared teacher may experience burnout or ineffectiveness, as noted by Sari et al. (2023). The case described in the thesis—of a Grade 6 teacher whose personal connection to disability fueled both commitment and professional development epitomizes this synergy. Such cases validate the call by Xamrayeva (2025) for integrated professional development that cultivates both mindset and skill.

These findings caution against fragmented approaches to teacher preparation. Programs that focus solely on attitude (e.g., awareness campaigns) or solely on technical skills (e.g., isolated workshops on differentiation) are likely to yield limited impact. Instead, effective interventions must be holistic, embedding attitude formation within sustained, practice-based competence building—through mentoring, lesson study, and collaborative inquiry. Furthermore, the unexplained 40% of variance highlights the need for systemic investment: reducing class sizes, ensuring consistent GPK deployment, providing assistive technology, and aligning school-level policies with national inclusion mandates. Without these, even the most competent and committed teachers operate under structural duress.

This study contributes empirically to the global discourse on inclusive education by quantifying the relative weight of attitude and competence in a Global South context—specifically, in Indonesia's evolving inclusive education landscape. It moves beyond binary debates (e.g., "attitude vs. skill") to demonstrate their layered interdependence. Moreover, by centering science education—a domain often overlooked in inclusive pedagogy research—it extends the inclusivity agenda to STEM fields, where accessibility for diverse learners remains underaddressed.

Conclusion

This study affirms that both teacher attitudes and competencies serve as critical catalysts for the implementation of inclusive science education in public

elementary schools in West Sumatra. While positive attitudes provide the psychological foundation—fostering openness, empathy, and willingness to include—professional competencies constitute the operational capacity that translates inclusive ideals into effective classroom practice. The findings underscore that inclusive education cannot thrive on goodwill alone; it demands deliberate, sustained investment in teachers' professional capabilities. At the same time, technical competence without a supportive mindset risks procedural compliance devoid of genuine inclusion. Therefore, effective policy and practice must integrate both affective and skill-based dimensions, ensuring that teacher development programs simultaneously nurture inclusive dispositions and strengthen adaptive pedagogical expertise. This dual focus is essential for advancing equitable, responsive, and high-quality science education for all learners in Indonesia's diverse classrooms.

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