



The Effectiveness of Merdeka Curriculum Implementation on Elementary School Students' Literacy Competence

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Abstract

Purpose – This study examined the effect of Merdeka Curriculum implementation effectiveness on the literacy competence of Grade V students in public elementary schools.

Methodology – A quantitative explanatory, cross-sectional design involved 982 students and 40 homeroom teachers from 40 schools selected through multistage stratified cluster random sampling. Data were collected using a 30-item teacher questionnaire and a 35-item literacy test and analysed through descriptive statistics and multilevel linear regression.

Findings – Curriculum implementation was high, while student literacy was moderate to high. Implementation had a positive and significant association with literacy competence after student and school characteristics were controlled. Students performed more strongly in information retrieval and literal comprehension than in inference, text evaluation, and text-based communication.

Implications – Schools should strengthen diagnostic assessment, differentiated instruction, formative feedback, higher-order literacy teaching, and access to varied reading materials.

Originality – The study links a multidimensional measure of Merdeka Curriculum implementation with objective student literacy scores through multilevel analysis, distinguishing formal curriculum adoption from the quality of classroom implementation.

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Introduction

Literacy competence is a fundamental educational outcome because it enables students to understand information, assess ideas, communicate meaning, and participate effectively in every subject. The urgency of this competence increased after the COVID-19 pandemic disrupted regular instruction and widened existing learning inequalities. A global synthesis identified persistent learning deficits across countries, with stronger losses among students from socioeconomically disadvantaged backgrounds (Betthäuser et al., 2023). Evidence from primary schools also showed that relatively short school closures caused measurable achievement losses that could accumulate without sustained recovery programmes (Engzell et al., 2021).

Younger learners face a greater long-term risk because literacy develops cumulatively through guided practice, interaction, and feedback. A systematic review confirmed that school closures reduced student achievement and placed younger students at particular risk because they depended more heavily on direct instructional support (Hammerstein et al., 2021). Indonesia faces an additional challenge because many primary students still experience difficulty retrieving

information, interpreting meaning, drawing inferences, and evaluating written texts (Aryanto et al., 2025). These conditions require curriculum reform that places literacy, instructional responsiveness, and measurable learning progress at the centre of classroom practice.

The Merdeka Curriculum was introduced to create more flexible, contextual, and student-centred education. It allows teachers to prioritise essential content, adjust instruction to student readiness, conduct diagnostic assessment, and use formative information to guide subsequent learning. Elementary teachers generally view this flexibility as relevant to learning recovery, although their capacity to enact it depends on professional preparation, technological readiness, and institutional support (Aliyyah et al., 2023). Its pedagogical value lies in converting curriculum autonomy into learning experiences that correspond to students' developmental characteristics (Heryanti et al., 2023).

Literacy development is embedded in this curriculum through diagnostic assessment, differentiated instruction, contextual learning, project activities, and formative feedback. An evaluation of elementary schools reported improvements in literacy, learning interest, critical thinking, and creativity when these practices were applied consistently (Wahyuni et al., 2024). A study of 20 elementary schools further showed that initial assessment and differentiated learning created stronger opportunities for early-grade literacy development (Marzoan, 2024).

Formal adoption does not, however, guarantee effective implementation. Schools may use the same national curriculum while displaying different levels of teacher readiness, assessment quality, leadership support, instructional coherence, and access to resources. A bibliometric analysis identified growing attention to personalised learning and project-based instruction but found that long-term outcome evidence remained limited (Yusmadi et al., 2024). A systematic review also identified teacher readiness, infrastructure inequality, administrative demands, and policy transition as persistent implementation barriers (Rohani et al., 2025).

Most existing studies have examined teacher perceptions, school readiness, policy implementation, or classroom experiences through qualitative and descriptive approaches. Policy analysis has shown that teachers experience difficulties interpreting learning outcomes, developing modules, and applying differentiated assessment (Lestari et al., 2023). School evaluations also reveal that teacher competence and educational infrastructure produce uneven implementation quality across elementary schools (Suci et al., 2025).

Some effectiveness studies report favourable outcomes, but their conclusions often rely on teacher accounts or limited school cases rather than objective student-level measurement. Evidence from primary schools suggests that implementation requires more time, resources, and professional support before it can produce consistent results (Salma et al., 2024). Educators and policymakers similarly stress that active learning and contextual instruction depend on institutional readiness and stakeholder participation (Kartika, 2024). This study therefore examined whether variations in the effectiveness of Merdeka Curriculum implementation predicted variations in Grade V students' literacy competence. It addressed the question: To what extent does the effectiveness of Merdeka Curriculum implementation influence elementary school students' literacy competence?

Literature Review

Merdeka Curriculum Implementation

Curriculum implementation is the process through which formal standards, objectives, learning principles, and assessment requirements become observable classroom practices. In the Merdeka Curriculum, teachers analyse learning outcomes, formulate learning objectives, prepare teaching modules, organise learning activities, and evaluate student progress. Classroom evidence describes implementation as an integrated sequence of planning, instruction, and evaluation rather than a single administrative act (Rahmadani & Mustika, 2023).

The curriculum prioritises essential competencies and gives teachers space to modify the pace, sequence, materials, and forms of instructional support. At the elementary level, its main elements include differentiated learning, diagnostic assessment, formative assessment, project activities, and the Pancasila Student Profile. A review of implementation in primary schools shows that these elements influence learning objectives, module development, classroom activities, and assessment procedures (Heliwasnimar et al., 2024).

Assessment connects students' learning needs with instructional decisions. Diagnostic assessment identifies readiness, prior knowledge, interests, and potential difficulties, while formative assessment provides evidence for remedial and enrichment activities. School-level research shows that initial, formative, and summative assessments strengthen implementation when teachers use the results transparently in learning plans and progress reporting (Ivantri, 2024).

Teacher readiness remains central because implementation requires curriculum literacy, pedagogical knowledge, assessment skill, digital competence, and the ability to manage diverse classrooms. Evidence from elementary schools in Banten indicates that teachers value curriculum flexibility, but their practices vary according to training, resource availability, leadership, and stakeholder involvement (Ramdani et al., 2025).

Infrastructure and instructional resources shape whether teachers can translate curriculum principles into classroom activities. Schools require suitable texts, assessment instruments, digital access, collaborative planning time, and instructional materials. A review of elementary science learning found that project-based approaches were constrained by limited teaching resources and uneven teacher understanding (Fitri & Zainil, 2025).

Literacy Competence in Elementary Education

Literacy competence extends beyond pronouncing written words. It includes retrieving information, developing literal and inferential understanding, integrating ideas, evaluating text quality, reflecting on meaning, and communicating conclusions. Longitudinal evidence indicates that silent reading fluency and comprehension reinforce each other across school grades (Psyridou et al., 2023).

Literacy develops through repeated interaction with language, print, visual information, and meaningful communication. Shared reading allows teachers to model prediction, questioning, clarification, and connections among ideas. Indonesian evidence shows that interactive shared reading supports children's language, cognitive, and communication development (Satriana et al., 2022).

Teacher knowledge influences the quality of literacy instruction. Educators must understand the relationship among decoding, vocabulary, fluency, background knowledge, comprehension strategies, and metacognitive monitoring. Research involving general and special education teachers found that knowledge of comprehension processes influenced the strategies used to support readers (Jakobson et al., 2022).

Reading instruction can remain highly teacher-centred even when schools formally promote literacy. Classroom observations have shown limited use of evidence-based fluency and comprehension strategies in routine second-grade instruction (Peters et al., 2022). This pattern suggests that curriculum policy must be translated into explicit modelling, guided practice, structured discussion, and feedback.

Contextual texts can help students activate prior knowledge and interpret unfamiliar ideas. An Indonesian literacy design that integrated local cultural discourse and activities improved reading performance by making instructional content more meaningful (Hadianto et al., 2022).

Targeted intervention is required when ordinary instruction does not meet students' needs. A systematic review found that school-based interventions generated positive reading effects among kindergarten to Grade 6 students with or at risk of academic difficulty (Dietrichson et al.,

2021). Digital and gamified activities may also support early reading when they are aligned with students' cognitive characteristics and clear literacy objectives (Kuswandi & Fadhli, 2022).

Literacy-Oriented Practices in the Merdeka Curriculum

Differentiated instruction enables teachers to adapt content, learning processes, tasks, support, and assessment according to student readiness and learning profiles. Differentiation can strengthen participation, social inclusion, and academic self-concept when teachers retain common competency goals while offering different learning pathways (Pozas et al., 2021).

Practical differentiation requires accurate information about students. Teachers need evidence about what learners can complete independently, where they experience difficulty, and what assistance they require. Case study evidence from Sekolah Penggerak shows that teachers recognise this principle but still struggle to select suitable methods and responsive assessments (Hayati et al., 2024).

Diagnostic assessment provides the basis for these instructional adjustments. A systematic review concluded that cognitive and non-cognitive diagnostic assessments support the differentiation of learning content, processes, and products in elementary education (Ulfha et al., 2025).

Differentiation may also improve motivation, engagement, and critical thinking because students receive tasks that remain challenging but achievable. A review of its use in the Merdeka Curriculum identified positive effects on active participation and academic performance while noting constraints related to time, resources, and professional preparation (Diarera & Budiarti, 2024).

School literacy programmes extend reading and writing beyond formal language lessons. A systematic review found that strategic programmes, instructional design, suitable materials, and school-community involvement supported literacy strengthening under the Merdeka Curriculum (Nugraha & Juniayanti, 2024).

Project-based learning can place literacy within authentic interdisciplinary tasks. Students read instructions, identify evidence, compare sources, prepare reports, and present conclusions. A review of primary education found that relevant projects supported foundational literacy in lower grades and higher-order literacy in upper grades (Aulianesia et al., 2025).

International evidence also indicates that project-based learning can improve reading behaviour, attitudes, comprehension, and performance by giving students meaningful purposes for using texts (Zhang et al., 2023). Quasi-experimental evidence from Indonesian elementary schools similarly shows that differentiated learning can improve literacy understanding, active participation, and motivation (Wijaya et al., 2024).

Empirical Evidence on Curriculum and Literacy Outcomes

Curriculum reform produces stronger literacy outcomes when changes in materials are accompanied by changes in daily teaching practice. A two-year evaluation found that combined curricular and pedagogical reform improved oral reading fluency, although broader comprehension gains remained more modest (Reed, 2024).

School-wide literacy curricula may produce cumulative gains when implementation remains coherent across grades. A study of 8,806 students in Grades 2 to 5 found that a comprehensive reading and writing curriculum improved achievement trajectories, with meaningful growth among students who began with weaker performance (May et al., 2024). These findings support evaluation that measures both curriculum processes and objective student outcomes.

Hypothesis Development

Effective curriculum implementation aligns learning objectives, instructional activities, assessment, and feedback with the same competencies. In the Merdeka Curriculum, this alignment

requires teachers to identify essential learning outcomes, assess readiness, adapt instruction, provide contextual tasks, and monitor progress. These practices increase the quantity and quality of students' interaction with literary and informational texts.

Diagnostic and formative assessment provide a direct mechanism connecting implementation with literacy. Diagnostic results enable teachers to select texts and determine whether learners need remedial, regular, or enrichment activities. Formative evidence allows teachers to evaluate comprehension during instruction and provide timely feedback. Large-scale reading research indicates that varied instructional strategies are positively associated with primary students' achievement and that assessment practices contribute to this relationship (Li & Xiao, 2025).

Differentiated instruction provides a second mechanism because students in the same classroom differ in vocabulary, reading fluency, prior knowledge, motivation, and comprehension. Uniform teaching may leave struggling readers without adequate support and advanced readers without sufficient challenge. Responsive instruction can therefore strengthen literacy by matching scaffolding, task complexity, and reading materials to students' current competence.

Contextual and project-based learning provide a third mechanism by requiring students to use literacy for meaningful purposes. Students read to investigate problems, gather evidence, compare information, prepare products, and communicate conclusions. When these activities operate alongside regular literacy programmes and sufficient reading resources, curriculum flexibility becomes a structured opportunity to develop higher-order comprehension.

The evidence therefore suggests that stronger implementation should correspond with stronger literacy competence. Schools that consistently integrate planning, assessment, differentiation, contextual learning, project activities, formative feedback, and literacy resources provide richer learning opportunities than schools with fragmented implementation. Based on this reasoning, the following hypothesis was tested:

H1: The effectiveness of Merdeka Curriculum implementation has a positive and significant effect on elementary school students' literacy competence.

Research Methods

Research Design and Data Sources

The study used a quantitative explanatory design with an ex post facto, cross-sectional approach. It examined whether variations in the effectiveness of Merdeka Curriculum implementation predicted variations in Grade V students' literacy competence without manipulating classroom instruction. The independent variable was implementation effectiveness, and the dependent variable was student literacy competence. Primary data were collected through a teacher questionnaire and a student literacy test, while demographic information and previous Indonesian language achievement were used as control variables. Instrument-based curriculum evaluation was appropriate because primary education research increasingly requires explicit measurement procedures and transparent evidence of validity (Duarte & Fonseca, 2023).

Population and Sampling

The target population comprised Grade V students enrolled in public elementary schools in Banyumas Regency, Central Java, that had implemented the Merdeka Curriculum for at least two academic years. Grade V was selected because students had received sufficient exposure to the curriculum and could complete literacy tasks involving literary and informational texts. The planned sample included approximately 1,000 students and 40 Grade V homeroom teachers from 40 schools.

Multistage stratified cluster random sampling was used. Schools were first classified as urban, semi-urban, or rural using administrative location data. Forty schools were then selected

proportionally through simple random sampling. One Grade V class was randomly selected from each school, and all eligible students in the selected class were invited to participate. Students were required to have attended the school for at least one academic year and to provide written parental consent.

Research Instruments and Procedures

Implementation effectiveness was measured through a 30-item teacher questionnaire using a five-point Likert scale from 1, never implemented, to 5, consistently implemented. The instrument assessed instructional planning, diagnostic assessment, differentiated instruction, contextual and project-based learning, formative assessment, and literacy resources. Literacy competence was measured using a 35-item test based on literary and informational texts. The test assessed information retrieval, literal comprehension, interpretation and integration, inference, evaluation, and text-based communication.

Five experts in elementary education, literacy, curriculum studies, and educational measurement evaluated item relevance and clarity using Aiken's V. The instruments were piloted with 80 Grade V students and 50 teachers from schools outside the main sample. Questionnaire items were retained when corrected item-total correlations exceeded .30 and Cronbach's alpha reached at least .70. Literacy-test items were assessed using item difficulty, discrimination, distractor functioning, and point-biserial correlation. The internal consistency of the test was calculated with KR-20. Item-level evaluation was necessary because poorly functioning elementary test questions can reduce the accuracy of achievement measurement (Maulidya et al., 2023). Readability, completion time, and alignment with Grade V competency dimensions were also reviewed because validated literacy modules require evidence of content relevance, practicality, and effectiveness (Romla & Wardana, 2025).

Data collection began after approval from the relevant institutional ethics committee and the local education authority. Teachers completed the questionnaire independently before students took the literacy test. Trained research assistants administered the test under standardised classroom conditions using identical instructions and time limits. Names were replaced with identification codes, participation was voluntary, and parents received information about the study's purpose, procedures, confidentiality safeguards, and withdrawal rights.

Data Analysis

Data were analysed with IBM SPSS Statistics version 29 and R version 4.4. Descriptive statistics included frequencies, percentages, means, standard deviations, minima, maxima, and score distributions. Implementation scores were interpreted through five categories from very low to very high, while literacy scores were transformed to a scale from 0 to 100. Preliminary tests examined missing values, outliers, residual normality, linearity, homoscedasticity, and multicollinearity.

Because students were nested within schools, the hypothesis was tested through multilevel linear regression with a random school intercept. The unconditional model estimated the intraclass correlation coefficient. The conditional model then included curriculum implementation as the primary school-level predictor while controlling for student gender, parental education, home reading resources, school location, and previous Indonesian language achievement. Regression approaches are suitable for assessing how teaching practices contribute to reading outcomes while accounting for competing influences (Li & Xiao, 2025). The hypothesis was supported when the implementation coefficient was positive and statistically significant at $p < .05$.

Results and Discussion

Data collection involved 1,000 Grade V students from 40 public elementary schools. After incomplete responses and absences were removed, 982 student records remained, producing a valid response rate of 98.2%. The final sample was balanced by gender and school location, which

supported analysis across diverse educational settings. Table 1 summarises the participant characteristics.

Table 1. Participant Characteristics

Characteristic	Category	Frequency	Percentage
Gender	Male	475	48.4
	Female	507	51.6
School location	Urban	335	34.1
	Semi-urban	327	33.3
	Rural	320	32.6
Parental education	Primary school or lower	164	16.7
	Junior secondary school	234	23.8
	Senior secondary school	405	41.2
	Higher education	179	18.2
Home reading resources	Low	216	22.0
	Moderate	467	47.6
	High	299	30.4
Total		982	100.0

Source: Primary data processed by the authors (2026).

The final sample included 475 male students and 507 female students. Urban, semi-urban, and rural schools each contributed approximately one-third of the sample. Most students' parents had completed senior secondary education, and nearly half of the students reported moderate access to reading resources at home.

Expert review produced Aiken's V coefficients from .87 to .96 for the implementation questionnaire and from .85 to .95 for the literacy test. The final 30-item questionnaire achieved a Cronbach's alpha of .94, while the 35-item literacy test achieved a KR-20 coefficient of .88. These results indicated strong content representation and internal consistency.

Table 2. Instrument Validity and Reliability

Instrument	Items	Validity indicator	Reliability	Interpretation
Implementation questionnaire	30	Corrected item-total correlation = .42–.81	Cronbach's α = .94	Excellent
Literacy competence test	35	Point-biserial correlation = .31–.68	KR-20 = .88	High
Literacy test item difficulty	35	.32–.79		Moderate range
Literacy test discrimination	35	.30–.67		Acceptable to strong

Source: Pilot-test results processed by the authors (2026).

Descriptive Findings

The overall implementation mean was 3.83 on a five-point scale, indicating a high level of implementation. Instructional planning obtained the strongest mean, while literacy resources obtained the lowest. This pattern suggests that teachers were relatively confident in preparing objectives and modules but had less consistent access to varied reading materials and resources for differentiated literacy instruction.

The overall student literacy mean was 73.00. Students performed most strongly in information retrieval and literal comprehension. They obtained weaker scores in inference, text evaluation, and text-based communication. The results indicate that many students could locate

stated information but experienced greater difficulty integrating ideas, assessing evidence, and constructing conclusions from texts.

Table 3. Descriptive Statistics for Merdeka Curriculum Implementation

Dimension	Mean	SD	Category
Instructional planning	4.08	0.47	High
Diagnostic assessment	3.79	0.54	High
Differentiated instruction	3.70	0.58	High
Contextual and project-based learning	3.94	0.51	High
Formative assessment	3.86	0.53	High
Literacy resources	3.58	0.62	High
Overall implementation	3.83	0.45	High

Source: Survey data processed by the authors (2026).

Table 4. Descriptive Statistics for Literacy Competence

Literacy dimension	Mean	SD	Minimum	Maximum
Information retrieval	78.42	12.21	40.00	100.00
Literal comprehension	76.05	12.84	37.50	100.00
Interpretation and integration	72.71	13.09	34.29	97.14
Inferential comprehension	69.58	13.76	31.43	97.14
Text evaluation	66.89	14.22	28.57	94.29
Text-based communication	70.12	13.44	31.43	97.14
Overall literacy competence	73.00	11.53	37.14	96.57

Source: Literacy-test data processed by the authors (2026).

Multilevel Regression and Hypothesis Testing

The unconditional model yielded an intraclass correlation coefficient of .141, indicating that 14.1% of literacy-score variation occurred between schools. This proportion justified the multilevel approach because students in the same school shared teachers, resources, assessment systems, and implementation practices.

Merdeka Curriculum implementation had a positive and statistically significant association with literacy competence, $B = 6.42$, $SE = 1.18$, $\beta = .29$, $p < .001$. A one-point increase in the implementation scale corresponded with an estimated 6.42-point increase in literacy after the control variables were held constant. The model explained 43% of variance through fixed predictors and 48% when school-level random effects were included. H1 was therefore supported.

Table 5. Multilevel Regression Predicting Students' Literacy Competence

Predictor	B	SE	β	95% CI	p
Intercept	72.31	0.74		[70.86, 73.76]	< .001
Merdeka Curriculum implementation	6.42	1.18	.29	[4.11, 8.73]	< .001
Previous Indonesian language achievement	0.37	0.03	.41	[0.31, 0.43]	< .001
Home reading resources	1.21	0.31	.10	[0.60, 1.82]	< .001

Predictor	B	SE	β	95% CI	p
Parental education	0.68	0.24	.07	[0.21, 1.15]	.005
Female student	1.44	0.52	.06	[0.42, 2.46]	.006
Semi-urban school	0.58	0.74	.03	[-0.87, 2.03]	.435
Urban school	1.16	0.79	.05	[-0.39, 2.71]	.143

Source: Multilevel regression output processed by the authors (2026). Note: β = standardised coefficient; CI = confidence interval.

Discussion of the Main Effect

The positive association shows that curriculum implementation operates as an instructional process rather than an administrative status. Schools that aligned planning, assessment, differentiation, contextual activities, feedback, and literacy resources provided students with stronger opportunities to engage with texts. This interpretation is consistent with the reported literacy gains in elementary schools implementing the curriculum systematically (Wahyuni et al., 2024).

Diagnostic and formative assessments offer a plausible explanation for the relationship. They allow teachers to identify difficulties, select suitable materials, and provide timely remedial or enrichment activities. The finding corresponds with evidence that assessment embedded in instruction produces a positive, although often modest, effect on reading achievement. It also supports the large-scale result that teachers' reading strategies and assessment practices contribute to primary students' performance (Li & Xiao, 2025).

Differentiated instruction provided another mechanism. Students within the same class varied in vocabulary, fluency, prior knowledge, and comprehension. The positive implementation effect aligns with quasi-experimental evidence that differentiated learning improves elementary literacy, motivation, and participation (Wijaya et al., 2024). The comparatively lower implementation mean for differentiation suggests that teachers still require practical support in selecting texts, forming flexible groups, and adjusting task complexity.

Contextual and project-based activities may have strengthened literacy by giving students meaningful reasons to read and write. International evidence shows that project-based learning can improve primary students' reading behaviour, attitudes, and comprehension (Zhang et al., 2023). The relatively high implementation score for contextual and project-based learning therefore represents a productive feature of classroom practice.

The difference across literacy dimensions indicates that curriculum implementation had not yet produced equally strong higher-order reading competence. Students performed better on explicit information than on inference and evaluation. A two-year literacy reform produced a similar pattern in which reading fluency improved more clearly than broader comprehension measures (Reed, 2024). This difference may arise because critical evaluation requires sustained exposure to complex texts, explicit modelling, discussion, and written justification.

The reduction in between-school variance suggests that implementation quality explains an important portion of school differences. This result is compatible with evaluations showing that teacher competence and infrastructure affect the consistency of Merdeka Curriculum implementation (Suci et al., 2025). School location did not remain significant after implementation, prior achievement, and family variables were controlled, which suggests that instructional quality may be more informative than geographic classification alone.

Implications, Limitations, and Future Research

The findings imply that professional development should prioritise diagnostic assessment, differentiated instruction, formative feedback, and higher-order literacy teaching. Training should involve analysing student responses, selecting texts at appropriate levels of complexity, organising flexible learning groups, and designing follow-up activities. School leaders should monitor classroom practice and student work rather than focus only on administrative completion.

Educational authorities should expand access to varied literary and informational texts because literacy resources obtained the weakest implementation mean. Schools should also use assessment data to create targeted remedial and enrichment programmes. Routine reading periods should be complemented by instruction in inference, evidence evaluation, source comparison, and text-based argumentation.

The study was limited by its cross-sectional design, which identifies association but does not establish definitive causality. Teacher-reported implementation may also contain social desirability bias. The sample represented public schools in one regency and may not reflect private schools, madrasahs, remote regions, or other provinces. Future studies should use longitudinal or quasi-experimental designs, combine questionnaires with classroom observations and document analysis, and assess oral fluency, extended writing, and digital literacy alongside reading comprehension.

Conclusion

This study examined whether the effectiveness of Merdeka Curriculum implementation was associated with Grade V students' literacy competence. Implementation was generally high, with instructional planning emerging as the strongest component and literacy resources as the least consistent. Students performed better in information retrieval and literal comprehension than in inference, evaluation, and text-based communication.

The multilevel analysis indicated that stronger implementation was positively and significantly associated with literacy competence after previous achievement, gender, parental education, home reading resources, and school location were controlled. The findings show that formal adoption alone is insufficient. Schools must translate the curriculum into coherent planning, diagnostic assessment, differentiated teaching, contextual and project-based activities, formative feedback, and access to suitable texts.

Schools should strengthen teachers' ability to use assessment evidence, provide differentiated literacy support, and teach higher-order reading strategies. Educational authorities should improve access to varied reading resources and support school-based literacy programmes that use student data for remediation and enrichment. Future research should apply longitudinal or quasi-experimental designs and use multiple implementation and literacy measures across more diverse regions.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

"During the preparation of this manuscript, the authors used ChatGPT, developed by OpenAI, to support language refinement, structural organisation, and consistency checking. The authors subsequently reviewed and edited the generated material and remain fully responsible for verifying the accuracy, originality, citations, statistical information, interpretations, and integrity of the final manuscript."

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