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Reciprocal Teaching as a Catalyst for Cognitive Transformation: Enhancing Reading Comprehension and Critical Thinking Among Indonesian Pre-College Students

Fatimah Firdaus*, Absharini Kardena, Melyann Melani, Widya Syafitri
Universitas Islam Sjech M. Djamil Djambek Bukittinggi, Indonesia
Email: fatimahfirdaus2@gmail.com*, absharinikardena@yahoo.co.id, melyannmelani@uinbukittinggi.ac.id, widyasyafitri@uinbukittinggi.ac.id

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Reciprocal Teaching Strategy; Reading Comprehension; Critical Thinking; Pre-College Students.

Abstract
This quasi-experimental study investigated the effect of the Reciprocal Teaching Strategy (RTS) on the reading comprehension abilities and critical thinking skills of Indonesian pre-college students in Kecamatan Ampek Angkek, West Sumatera. Against a national backdrop in which only 6.06% of Indonesian students demonstrate reading proficiency, this study addressed a critical educational need. A sample of 42 students was divided into experimental and control groups. Pre- and post-test instruments assessed both reading comprehension (20 multiple-choice items) and critical thinking (open-ended HOTS items aligned with Bloom's Taxonomy levels C4–C6). Statistical analyses included Shapiro–Wilk normality tests, Levene's homogeneity tests, paired-samples t-tests, independent-samples t-tests, and multivariate analysis of variance (MANOVA). For reading comprehension, the experimental group's mean score increased from 47.75 to 65.50 ($t = -6.427$, $p < .001$), while the control group achieved a mean score of 65.3 compared with 78.5 for the experimental group ($t = 4.223$, $p = .001$). For critical thinking, mean scores increased from 48.25 to 64.75 ($t = -7.422$, $p < .001$), with the experimental group outperforming the control group by 11.8 points ($t = 5.690$, $p < .001$). Multivariate analysis (MANOVA; Wilks' $\Lambda = .018$, $F = 616.06$, $p < .001$) confirmed a robust and statistically significant effect of RTS on both outcomes simultaneously. These findings provide compelling evidence that RTS is a transformative pedagogical intervention capable of fostering higher-order literacy skills in high-stakes pre-college contexts. The implications for curriculum integration, teacher professional development, and national literacy policy in Indonesia are discussed.

INTRODUCTION

Reading comprehension and critical thinking are foundational cognitive competencies that underpin academic achievement across all disciplines. For pre-college students in Indonesia, mastery of these skills is particularly consequential: national university entrance examinations (SNBT — *Seleksi Nasional Berdasarkan Tes*) now explicitly prioritize reasoning and analytical abilities over rote memorization. Yet, empirical data consistently reveal a profound literacy crisis. The Indonesian National Assessment Programme (2022), as cited in Kurniati et al. (2023), found that a mere 6.06% of Indonesian students reached proficient reading levels, while nearly half (47.11%) remained in the mediocre category. This discrepancy

between expected and actual literacy performance demands urgent, evidence-based instructional intervention.

Preliminary assessment data collected in January 2024 from 20 pre-college students in Kec. Ampek Angkek corroborated this national trend with stark clarity. The cohort recorded a mean reading comprehension score of only 37 out of 100, with 11% of students scoring below 20 and no student exceeding 60. This performance deficit carries compounding consequences: students unable to extract meaning from texts during their preparation year face significantly diminished prospects for higher education access and, by extension, professional mobility. The situation is exacerbated by pedagogical practices that emphasize recall over comprehension and by insufficient teacher preparation in strategies that promote metacognition and analytical reasoning (Arifiyanti, 2020; Budiasih & Dewi, 2019).

The Reciprocal Teaching Strategy (RTS), first systematized by Palinscar and Brown (1984), addresses these deficiencies through a structured reciprocal dialogue in which students cyclically assume the role of instructional leader. The strategy's four core components — predicting, questioning, clarifying, and summarizing — are internationally recognized as scaffolding techniques that develop both surface-level comprehension and higher-order critical engagement with texts (Oczkus, 2003; Pilten, 2019; Sriwahyuni et al., 2020). While RTS has been validated across diverse educational contexts globally, its application to the specific profile of Indonesian pre-college students preparing for high-stakes national examinations remains underexplored.

This study therefore aimed to fill this gap by empirically examining whether the Reciprocal Teaching Strategy produced statistically significant improvements in both reading comprehension and critical thinking skills among pre-college students in Kec. Ampek Angkek. Specifically, the study tested three hypotheses: (H1) RTS significantly enhances reading comprehension; (H2) RTS significantly enhances critical thinking; and (H3) RTS has a significant simultaneous effect on both outcomes. The study contributes to the growing body of evidence on metacognitive strategy instruction and offers actionable implications for educators, curriculum designers, and policymakers committed to improving literacy outcomes in Indonesia.

Reading Comprehension and Its Challenges in Indonesia

Reading comprehension is not a passive decoding activity; rather, it is an active, constructive process through which readers integrate incoming textual information with prior knowledge to generate meaning (Snow, 2002). Koda (2005) identifies five essential dimensions of reading comprehension: determining the main idea, locating specific information, making inferences, identifying referential relationships, and understanding vocabulary in context. Proficiency across these dimensions is a prerequisite for academic success in all content areas (Dole et al., 1991; Herlina et al., 2017).

Despite its recognized importance, reading comprehension remains a persistent challenge in Indonesian education. Structural factors — including an exam-oriented curriculum that privileges memorization, limited access to diverse reading materials, and inadequate time for sustained reading practice — combine to hinder the development of deep comprehension skills (Budiasih & Dewi, 2019; Metsäpelto et al., 2017). The cultural dimension of reading disengagement further compounds this issue: Kurniati et al. (2023) found a significant positive

correlation between reading interest and comprehension ability, suggesting that motivational and affective factors are as important as instructional factors.

Critical Thinking in the Context of Reading

Critical thinking, defined by Paul and Elder (2002) as disciplined, self-directed thinking that produces intellectual standards of clarity, precision, accuracy, and relevance, is increasingly recognized as a core twenty-first-century competency. Within the reading comprehension literature, critical thinking manifests as the ability to interrogate authorial intent, evaluate the logic of arguments, identify assumptions, and synthesize information across multiple sources (Mohseni et al., 2020; Yousefi & Mohammadi, 2016).

Bloom's Taxonomy, particularly its higher-order categories of analysis (C4), evaluation (C5), and creation (C6), provides a useful framework for operationalizing critical thinking in the classroom. Students who engage in text analysis, argument evaluation, and creative synthesis demonstrate the cognitive flexibility required by contemporary university entrance standards and professional environments (Cakici, 2018). In Indonesia, however, Arifiyanti (2020) documented that classroom discourse rarely extends beyond C1–C3 (knowledge, comprehension, and application), with critical analysis and evaluation receiving insufficient instructional attention.

Reciprocal Teaching Strategy: Theoretical and Empirical Foundations

Developed by Palinscar and Brown (1984), Reciprocal Teaching is grounded in Vygotsky's zone of proximal development and social constructivist learning theory. The strategy operationalizes collaborative meaning-making through structured turn-taking in which students sequentially employ four comprehension strategies: (1) predicting — activating prior knowledge and generating expectations about text content; (2) questioning — formulating and articulating text-based and inferential questions; (3) clarifying — identifying and resolving lexical, syntactic, or conceptual ambiguities; and (4) summarizing — distilling the essential propositions of a text segment.

These four strategies collectively activate metacognitive monitoring, the process by which readers evaluate and regulate their own comprehension in real time (Mokhtari & Reichard, 2002). Oczkus (2003) describes them as global reading strategies that scaffold both fluency and depth of engagement. Crucially, the reciprocal structure — in which students rotate into the teacher role — fosters collective accountability, deepens cognitive engagement, and builds communicative competence simultaneously (Pilonieta & Medina, 2009).

Empirical evidence for the efficacy of RTS is substantial. Pilten (2019) demonstrated significant improvements across all dimensions of the Reading Comprehension Evaluation Scale among twelfth-grade students following RTS implementation. Sriwahyuni et al. (2020) reported that RTS positively impacted critical reading skills through enhanced peer support and collaborative questioning. Lestari (2019) found that embedding critical thinking within the RTS framework produced marked improvements in comprehension among Indonesian high school students at MAN 1 Kendari. Okkinga et al. (2021) further documented the strategy's effectiveness with low-achieving adolescents across a two-year implementation study. Dew et al. (2021) concluded in an integrative review that RTS consistently outperformed conventional instruction for reading comprehension across varied educational settings.

Despite this global evidence base, no study has specifically examined the effects of RTS among Indonesian pre-college students preparing for national university entrance examinations

— a high-stakes, time-pressured context that places unique demands on both reading comprehension speed and critical reasoning quality. This study addresses this gap.

METHOD

Research Design

This study employed a quasi-experimental pretest–posttest control group design to examine the effect of the intervention in an educational setting where random assignment was not feasible (Creswell, 2009; Gay et al., 2012). The design enabled comparisons of pretest and posttest scores within and between groups, including the experimental group receiving RTS and the control group receiving conventional instruction.

Table 1. Quasi-Experimental Research Design

Group	Pre-test	Treatment	Post-test
Experimental	O_1	X (RTS)	O_2
Control	O_3	— (Conventional)	O_4

Note. O = observation/test; X = reciprocal teaching strategy intervention.

Population, Sample, and Sampling

The accessible population comprised pre-college students in Kecamatan Ampek Angkek, Kabupaten Agam, West Sumatera, enrolled in preparation programs for the SNBT national university entrance examination during the 2023–2024 academic year. Preliminary homogeneity and normality screening of population score distributions confirmed the suitability of the pool for quasi-experimental analysis.

Table 2. Population Distribution Across Institutions

Institution	Number of Students
Institution A	20
Institution B	22
Total	42

A total of 42 students were purposively selected and assigned to the experimental group (n = 22) and control group (n = 20) based on institutional affiliation. Both groups were verified to be comparable on baseline characteristics through preliminary homogeneity (Levene's test, p = .866 for reading; p = .723 for critical thinking) and normality (Shapiro-Wilk) analyses.

Instruments

Two instruments were developed and validated for this study. The Reading Comprehension Test consisted of 20 multiple-choice items aligned with Koda's (2005) five-indicator framework: (1) determining the main idea, (2) locating specific information, (3) making inferences, (4) identifying referential language, and (5) understanding vocabulary and detailed meaning. Each item was scored at 5 points, yielding a maximum score of 100. Argumentative texts were selected as the reading stimulus genre, given their prevalence in SNBT and their complexity relative to narrative texts.

Table 3. Reading Comprehension Assessment Framework (Koda, 2005)

Indicator	Item Numbers	Items (n)	Score per Item	Max Score
Main Idea Identification	1, 6, 11, 16	4	5	20
Specific Information Retrieval	2, 7, 12, 17	4	5	20
Inference Making	3, 8, 13, 18	4	5	20
Referential Language	4, 9, 14, 19	4	5	20
Vocabulary & Detail Comprehension	5, 10, 15, 20	4	5	20
Total	—	20	—	100

The Critical Thinking Test comprised 10 open-ended items calibrated to Bloom's Taxonomy higher-order levels (C4–C6): Analyzing, Evaluating, and Creating. Items were scored on a 0–2 rubric, with criteria specifying the quality of argumentation, evidence integration, and originality of synthesis. Both instruments underwent expert content validation (three validators) and reliability analysis (Cronbach's alpha), confirming adequate psychometric properties prior to deployment.

Table 4. Critical Thinking Scoring Rubric (HOTS Framework)

Indicator	Score 2	Score 1	Score 0
Analysis (C4)	Critical, well-supported analysis with relevant detail	General analysis with partial support	Vague or irrelevant analysis
Synthesis/Evaluation (C5)	Clear new ideas/judgments with precise supporting evidence	Emergent ideas with unclear support	No new ideas or judgment expressed
Creation (C6)	Coherent, original predictions/conclusions from textual and personal knowledge	Predictions present but partially inconsistent	No inferential production

Procedures

The study proceeded in three phases. During pre-treatment, baseline data were collected via simultaneous administration of both instruments to experimental and control groups under standardized conditions. During treatment, the experimental class participated in three structured RTS sessions. In each session, students formed small groups of four to five. Within groups, one student assumed the role of discussion leader, guiding peers through the four-strategy cycle (predict → question → clarify → summarize) applied to a selected argumentative text. The teacher circulated to monitor group dynamics and provide scaffolding as needed. Formative checks were administered at the close of each session to monitor comprehension progression. The control class received equivalent content exposure through conventional teacher-led instruction without reciprocal strategy scaffolding. During post-treatment, both groups completed the same instruments administered at pre-test under equivalent conditions.

Data Analysis

Data were analysed using IBM SPSS Statistics. Assumption testing preceded inferential analysis: the Shapiro-Wilk test evaluated univariate normality; Levene's test assessed homogeneity of variance. For within-group pre-post comparisons, paired-samples t-tests were employed. For between-group comparisons at post-test, independent-samples t-tests were used. To assess the simultaneous effect of RTS on both dependent variables, a one-way MANOVA

was conducted, with Box's M test evaluating the assumption of homogeneity of variance-covariance matrices. Alpha was set at $p < .05$ for all analyses.

RESULTS AND DISCUSSION

Assumption Testing: Normality and Homogeneity

Prior to inferential analysis, the Shapiro-Wilk test confirmed that all four score distributions (Reading Pre-test: $p = .167$; Reading Post-test: $p = .108$; Critical Thinking Pre-test: $p = .081$; Critical Thinking Post-test: $p = .085$) satisfied the normality criterion (all $p > .05$). Levene's test for homogeneity of variance similarly yielded non-significant results for both reading comprehension (Based on Mean: $F = .029$, $p = .866$) and critical thinking (Based on Mean: $F = .126$, $p = .723$), confirming the appropriateness of planned parametric procedures.

Table 5. Shapiro-Wilk Normality Test Results

Variable	Statistic	df	p
Reading Pre-test	.960	40	.167
Reading Post-test	.955	40	.108
Critical Thinking Pre-test	.951	40	.081
Critical Thinking Post-test	.951	40	.085

Note. All $p > .05$ indicate normal distribution.

Table 6. Levene's Homogeneity of Variance Test Results

Variable	Levene F	df1	df2	p
Reading Comprehension	.029	1	78	.866
Critical Thinking	.126	1	78	.723

Note. All $p > .05$ confirm homogeneous variance.

Effect of RTS on Reading Comprehension (Within-Group Analysis)

A paired-samples t-test was conducted to examine the pre-post difference in reading comprehension scores within the combined experimental sample ($N = 40$ observations). Results demonstrated a statistically significant and practically meaningful improvement: the mean reading score increased from 47.75 ($SD = 12.50$) at pre-test to 65.50 ($SD = 14.58$) at post-test, representing a mean gain of 17.75 points.

Table 7. Paired-Samples T-Test: Reading Comprehension

	Pre-test M (SD)	Post-test M (SD)	Mean Diff.	t	df	p
Reading Comprehension	47.75 (12.50)	65.50 (14.58)	−17.75	−6.427	39	.000

Note. 95% CI for difference [−23.34, −12.16]. $p < .001$.

The t-value of −6.427 with a two-tailed significance of $p < .001$ confirms that the null hypothesis (H_0: no significant pre-post difference) is rejected. The 95% confidence interval for the mean difference [−23.34, −12.16] does not include zero, providing additional evidence that the improvement is not attributable to sampling error. Hypothesis 1 (H1: RTS significantly enhances reading comprehension) is therefore supported.

Effect of RTS on Critical Thinking (Within-Group Analysis)

An analogous paired-samples t-test was conducted for critical thinking scores. The mean critical thinking score rose from 48.25 ($SD = 15.00$) at pre-test to 64.75 ($SD = 13.96$) at post-

test, a mean gain of 16.50 points. The pre-post correlation was moderate and significant (r = .531, p < .001), indicating that the improvement systematically tracked initial performance levels and cannot be attributed to regression to the mean or random fluctuation.

Table 8. Paired-Samples T-Test: Critical Thinking Skills

	Pre-test M (SD)	Post-test M (SD)	Mean Diff.	r	t	df	p
Critical Thinking	48.25 (15.00)	64.75 (13.96)	−16.50	.531***	−7.422	39	.000

Note. 95% CI for difference [−20.997, −12.003]. *** p < .001.

The t-value of −7.422 (p < .001) supports rejection of the null hypothesis for critical thinking. The confidence interval [−20.997, −12.003] further corroborates the reliability of the observed gain. Hypothesis 2 (H2: RTS significantly enhances critical thinking) is supported.

Between-Group Comparisons at Post-Test

Independent-samples t-tests were conducted to compare the post-test performance of the experimental and control groups on both outcomes.

For reading comprehension, the experimental group (n = 22) achieved a mean post-test score of 78.5 (SD = 4.55), compared to 65.3 (SD = 5.10) for the control group (n = 20). The between-group difference of 13.2 points was statistically significant (t = 4.223, df = 40, p = .001). Levene's test confirmed equal variances (F = 1.756, p = .186).

Table 9. Independent-Samples T-Test: Reading Comprehension (Post-test)

Group	n	M	SD	t	df	p	Mean Diff.
Experimental (RTS)	22	78.5	4.55	4.223	40	.001	13.2
Control	20	65.3	5.10				

Note. Levene's F = 1.756, p = .186 (equal variances assumed).

For critical thinking, the experimental group mean of 80.2 (SD = 5.00) significantly exceeded the control group mean of 68.4 (SD = 6.10), with a between-group difference of 11.8 points (t = 5.690, df = 40, p < .001). Levene's test again confirmed variance equality (F = .654, p = .422).

Table 10. Independent-Samples T-Test: Critical Thinking (Post-test)

Group	n	M	SD	t	df	p	Mean Diff.
Experimental (RTS)	22	80.2	5.00	5.690	40	.000	11.8
Control	20	68.4	6.10				

Note. Levene's F = .654, p = .422 (equal variances assumed).

Multivariate Analysis: Simultaneous Effect of RTS (MANOVA)

To examine whether RTS produced a statistically significant simultaneous effect on both reading comprehension and critical thinking, a one-way MANOVA was conducted with group membership (RTS vs. control) as the independent variable. Multivariate normality was verified via Shapiro-Wilk tests on all four variables (all p > .05). Box's M test indicated a statistically significant violation of the homogeneity of variance-covariance assumption (Box's M = 46911.37, p < .001); however, the analysis proceeded given the robustness of MANOVA to this violation when group sizes are adequate (Creswell, 2009).

Table 11. MANOVA: Multivariate Test Statistics

Test Statistic	Value	F	Hypothesis df	Error df	p
Wilks' Lambda	.0183	616.057	4	46	.000
Pillai's Trace	.9817	616.057	4	46	.000
Hotelling-Lawley Trace	53.570	616.057	4	46	.000
Roy's Greatest Root	53.570	616.057	4	46	.000

Note. All multivariate criteria significant at $p < .001$. Wilks' $\Lambda = .018$ indicates a very large effect.

All four multivariate test statistics — Wilks' Lambda ($\Lambda = .018$), Pillai's Trace (.982), Hotelling-Lawley Trace (53.570), and Roy's Greatest Root (53.570) — yielded $F = 616.057$ with $p < .001$. The near-zero Wilks' Lambda indicates that the groups differ dramatically on the combined dependent variable space, constituting an exceptionally large treatment effect. Hypothesis 3 (H3: RTS simultaneously and significantly affects both reading comprehension and critical thinking) is supported. The null hypothesis is rejected with very high confidence.

RTS and Reading Comprehension Enhancement

The statistically significant improvement in reading comprehension scores — a 17.75-point mean gain within the experimental group and a 13.2-point between-group advantage at post-test — aligns coherently with the theoretical mechanisms underlying RTS. The strategy's scaffolded cycle of prediction, questioning, clarification, and summarization activates the full range of comprehension processes identified by Koda, (2005): readers must simultaneously construct propositional meaning, monitor comprehension, access relevant prior knowledge, and reorganize information into coherent summaries. Each of these cognitive operations is requisite for the reading skills assessed in this study.

These findings converge with Ayun and Yunus, (2018), who documented significant reading comprehension gains among EFL students following RTS implementation, and with Pilten, (2019), who reported improvements across all RCES dimensions for twelfth-grade students. The consistency across contexts strengthens the argument that RTS effectiveness is not situationally contingent but reflects durable properties of the strategy's metacognitive scaffolding. In the present Indonesian pre-college context, where students must develop the capacity to process complex argumentative texts efficiently under time pressure, the collaborative discourse created by RTS appears particularly well-suited.

Notably, the weak and non-significant pre-post correlation for reading comprehension ($r = .175$, $p = .280$) implies that initial ability level was not a strong predictor of improvement. Students who began with lower comprehension scores improved as substantially as higher-ability peers, suggesting that RTS functions as an equalizing intervention that builds foundational strategies accessible to learners at varying proficiency levels. This equity dimension is especially relevant given the heterogeneous ability profiles typical of Indonesian pre-college cohorts.

RTS and Critical Thinking Development

The 16.50-point mean gain in critical thinking and the 11.8-point between-group advantage provide strong evidence that RTS cultivates higher-order cognitive skills beyond comprehension of surface meaning. The moderate-to-strong pre-post correlation for critical thinking ($r = .531$, $p < .001$) indicates that the strategy systematically amplified existing cognitive resources rather than introducing entirely new skills, which is consistent with

Vygotskian learning theory: scaffolded instruction facilitates the internalization and expansion of competencies that students possess in latent form.

The mechanism through which RTS develops critical thinking is theoretically transparent. The questioning phase, in particular, requires students to generate inferential and evaluative questions (Bloom's C4–C6), transforming passive reading into active interrogation of the text. Sriwahyuni et al., (2020) explicitly linked the questioning component of RTS to improvements in critical reading, a finding echoed here. Lestari, (2019) research embedding critical thinking within RTS at MAN 1 Kendari similarly demonstrated that the strategy's collaborative structure creates conditions for the kind of reasoned disagreement, evidence evaluation, and knowledge construction that characterize genuine critical thinking. The present findings extend this evidence to a high-stakes pre-college context in West Sumatera, suggesting transferability of the strategy's benefits across Indonesian educational settings.

Multivariate Evidence and Educational Implications

The MANOVA result — Wilks' $\Lambda = .018$, $F = 616.057$, $p < .001$ — constitutes perhaps the most theoretically significant finding of this study. The near-zero Wilks' Lambda indicates that reading comprehension and critical thinking developed jointly and powerfully in response to RTS treatment, and that the groups are almost entirely separable in the bivariate outcome space. This finding has important implications for how reading instruction should be conceptualized: not as isolated skill development but as integrated cognitive development in which comprehension and critical thinking co-evolve through structured metacognitive practice.

From a practical standpoint, these findings carry concrete recommendations for Indonesian educational policy and practice. First, RTS should be systematically integrated into pre-college preparation curricula, particularly in programs targeting SNBT candidates whose examination success depends on both comprehension speed and analytical depth. Second, teacher professional development programs should equip instructors with the facilitation skills required to implement RTS effectively — including how to prompt student-led discussion, how to scaffold the four strategies, and how to monitor group dynamics. Third, the demonstrated benefits of RTS for both high- and low-ability students suggest its suitability as a universal — rather than compensatory — instructional strategy, applicable across diverse classroom contexts.

Limitations of this study include the relatively brief intervention period (three sessions), which, while sufficient to produce statistically significant effects, may not have allowed the full consolidation of strategy use. Future research should examine longer-term RTS implementation to determine whether gains are sustained and whether additional sessions produce further improvements. Longitudinal designs, mixed-method approaches incorporating qualitative data on student and teacher experience, and comparisons across RTS variations (e.g., with and without digital text platforms) would further enrich understanding of this pedagogical intervention's potential.

CONCLUSION

This quasi-experimental study provided robust evidence that the Reciprocal Teaching Strategy constituted a powerful pedagogical approach for enhancing reading comprehension and critical thinking among Indonesian pre-college students. Across within-group and

between-group analyses, confirmed by multivariate analysis of variance (MANOVA), RTS generated statistically significant and educationally meaningful improvements in both outcomes. The experimental group outperformed the control group by 13.2 points in reading comprehension and 11.8 points in critical thinking at the posttest stage, while MANOVA confirmed that these improvements occurred simultaneously with a very large effect size (Wilks' $\Lambda = .018$).

Given Indonesia's documented literacy challenges and the increasing cognitive demands of national university entrance examinations, integrating RTS into pre-college instruction is not merely beneficial but necessary. The strategy's collaborative and metacognitive architecture equipped students with transferable intellectual skills, including the ability to predict, question, clarify, and synthesize information, which supported academic achievement and lifelong learning. Educators, curriculum designers, and policymakers are encouraged to recognize RTS not merely as a supplementary technique but as an evidence-based literacy instructional approach within Indonesia's evolving educational landscape.

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