



Innovative Deep Learning–Driven Indonesian Language Instruction: Development and Effectiveness in Improving Elementary Reading Literacy

Ni Ketut Desia Trisiantari^{1*}, Dani Gunawan², Decenni Amelia³, Ni Wayan Monik Rismadewi⁴, Komang Sujendra Diputra⁵, Gusti Ayu Putu Sukma Trisna⁶

^{1*,4,5,6}Universitas Pendidikan Ganesha, Indonesia.

²Institut Pendidikan Indonesia, Indonesia.

³Universitas Bhayangkara Jakarta Raya, Indonesia.

*Corresponding Author. Email: ketut.desia@undiksha.ac.id

Abstract: This study aims to develop an innovative Indonesian language learning design based on a deep learning approach and to evaluate its effectiveness in improving elementary school students' reading literacy. The study employed a Research and Development (R&D) method using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The research participants included two content experts, two instructional design experts, and 65 elementary school students. Data were collected through validation questionnaires to assess product feasibility and multiple-choice tests to measure students' reading literacy skills. The data were analyzed using descriptive quantitative techniques and the normalized gain (N-Gain) test. The results revealed that: (1) students' initial reading literacy achievement, as measured by the pre-test, was categorized as moderate, with a mean score of 63.61; (2) the developed learning design was rated as highly feasible by expert validators, achieving an average score of 4.63 out of 5.00; (3) students' post-test performance improved substantially, reaching a mean score of 84.54 and falling within the very high category; and (4) the N-Gain value was 0.58, indicating a moderate level of improvement. These findings indicate that the deep learning-based Indonesian language learning design is effective in enhancing elementary school students' reading literacy. This study highlights the potential of integrating cognitive and affective dimensions through a deep learning approach to foster a more meaningful learning environment. Such an approach enables students not only to comprehend texts but also to critically analyze, evaluate, and reflect on information. Therefore, the proposed learning design may serve as a valuable reference for educators seeking to transform literacy instruction into a more student-centered and meaningful learning experience at the elementary school level.

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Introduction

Reading literacy is the primary foundation of the basic education process, as it serves as a prerequisite for mastering various other fields of knowledge. Reading literacy is no longer interpreted merely as the ability to recognize and pronounce text; rather, it encompasses the ability to understand, interpret, evaluate, and critically reflect on information (Leu et al., 2017; OECD, 2017). In the context of 21st-century learning, reading literacy also plays a vital role in shaping higher-order thinking skills, which enable students

to adapt to the complexity of information in the digital era (Rahman et al., 2020; Steiner et al., 2022).

Nevertheless, reality on the ground indicates that students' reading literacy skills remain relatively low. PISA results show that Indonesian students' reading literacy scores are still below the international average, with a mean score of 359, falling significantly behind the OECD average of 487 (OECD, 2023). Similar data from the Alibaca program revealed that the reading proficiency of students in Bali remains at the basic level (Puslitjakdikbud, 2019). According to the Minimum Competency Assessment (AKM) data for Buleleng Regency, 52 % of elementary school students have achieved adequate literacy levels, whereas 48 % remain in the basic or intensive intervention categories (Pemprov Bali, 2022).

This problem stems from the tendency of Indonesian language instruction to focus on surface-level reading activities, such as identifying explicit information, without providing sufficient space for students to explore meaning in depth (Rohman et al., 2022; Scherer, 2016). Furthermore, learning processes are often mechanistic and lack context, failing to optimally build students' emotional and cognitive engagement (Marhaeni et al., 2020; Trisiantari et al., 2023). Consequently, students lack motivation, become easily bored, and encounter significant difficulties in understanding reading content comprehensively.

One relevant approach to address these issues is the implementation of deep learning-based instruction. Deep learning is a pedagogical approach that emphasizes meaningful, reflective, and applicative understanding (Lin & Chen, 2022). It focuses on the perception of the learning environment and a conscious learning process that is mindful, meaningful, and joyful, integrating intellectual (thinking), ethical (heart), aesthetic (feeling), and kinesthetic (physical) development in a holistic and integrated manner (Rahmawati, 2025). This approach does not only focus on academic aspects but also involves students' affective, social, and life skill dimensions (Fullan et al., 2018; Hussain et al., 2019). Furthermore, deep learning engages students in experiences that foster curiosity, collaborative problem-solving, and the creative utilization of technology and resources (Drummy, 2020; X. Zhang & Cao, 2021).

In the educational context, deep learning refers to a learning process that promotes profound conceptual understanding, inter-conceptual connectivity, and the ability to transfer knowledge to new situations (Nugroho, 2025; Trisiantari et al., 2025). Deep learning-based instruction emphasizes not only learning outcomes but also students' reflective thinking processes and metacognitive awareness (Chen & Singh, 2024; Putri, 2024). Consequently, this approach has the potential to enhance the quality of reading literacy in a more meaningful manner.

Although the deep learning framework has gained research attention, existing studies remain fragmented, rarely integrating its three core principles, joyful, meaningful, and mindful learning, into a single operational model for elementary schools. Psychologically, however, these three elements must work simultaneously as interconnected cognitive catalysts during reading activities: the joyful aspect lowers the affective filter to spark interest, the mindful aspect maintains executive control during text decoding, and the meaningful aspect deepens semantic processing for long-term retention. Therefore, testing the effectiveness of an instructional design that fully integrates these three deep learning principles on students' reading literacy skills serves as a crucial novelty that addresses a significant gap in current literature.

Based on this research gap, the present study aims to develop an innovative Indonesian language learning design grounded in a deep learning approach that integrates joyful, meaningful, and mindful principles, and to evaluate its effectiveness in improving



elementary school students' reading literacy skills. The results of this study are expected to provide a theoretical contribution to the development of deep learning-based instructional models, as well as a practical contribution for teachers in designing more innovative, contextual, and literacy-oriented Indonesian language instruction.

Research Method

This study employs a Research and Development (R&D) approach aimed at developing and evaluating the effectiveness of a deep learning-based Indonesian language instructional design in improving the reading literacy skills of elementary school students. The development process follows the ADDIE model, which comprises five primary stages: analysis, design, development, implementation, and evaluation (Branch, 2010; Creswell, 2014). This model was selected for its systematic structure, which facilitates the development of instructional products that are valid, practical, and effective in meeting field-based needs.

The analysis stage was conducted to identify learning needs through an analysis of the elementary school Indonesian language curriculum, student characteristics, and reading literacy issues. The design stage focused on formulating the deep learning-based Indonesian language instructional design. In the development stage, product feasibility testing was performed. The implementation stage was carried out through limited field trials using a one-group pretest–posttest design to operationally test the application of the developed product. Finally, the evaluation stage was conducted to assess the overall quality of the product, encompassing both the feasibility and the effectiveness of the implemented design.

The participants in this study consisted of two subject matter experts, two instructional design experts, and 65 elementary school students in Bali. These subjects were selected using a purposive sampling technique to meet the specific requirements of the research. Data were collected using questionnaires to measure product feasibility and multiple-choice tests to assess students' reading literacy skills. All instruments underwent a validation process to ensure reliability and accuracy in measuring the research variables. The validation sheets for product development were evaluated based on several aspects: content suitability, deep learning integration, the implementation of joyful, meaningful, and mindful learning, linguistic appropriateness, presentation feasibility, and evaluation. These validation questionnaires were measured using a Likert scale. The reading literacy test was developed using format aligned with the four PIRLS assessment domains: Retrieving Information, Making Inferences, Interpreting and Integrating, and Evaluating and Reflecting (PIRLS, 2021). This instrument was specifically structured to map students' baseline cognitive capabilities and diagnose targeted comprehension deficits across these progressive levels.

Data analysis was conducted using descriptive quantitative. The expert validation data were analyzed by calculating the mean scores to determine the product's feasibility level, categorized as highly valid (4.20 – 5.00), valid (3.40 – 4.19), fair (2.60 – 3.39), or poor (1.00 – 2.59). Meanwhile, the effectiveness of the instructional design was analyzed using the N-Gain test to determine the improvement in students' reading literacy skills.

Results and Discussion

Analysis Stage

The baseline distribution of students' reading literacy achievement across the four PIRLS cognitive levels is presented in Figure 1. This initial data mapping serves to identify specific areas of weakness in students' text comprehension before the instructional intervention.

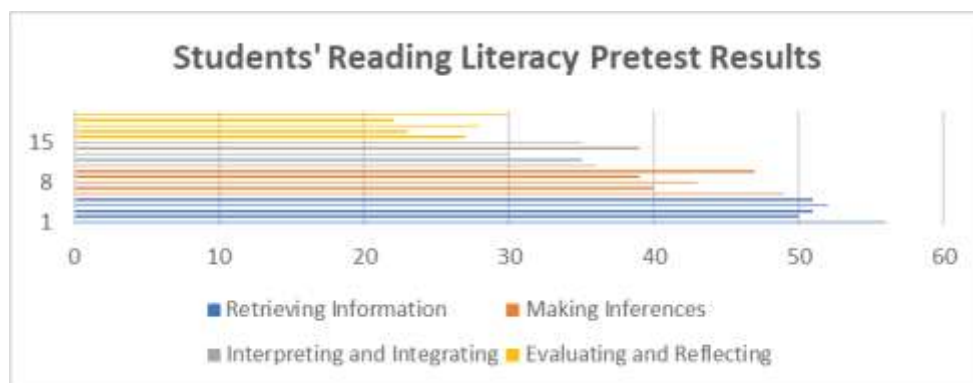


Figure 1. Students' Reading Literacy Pretest Results

Based on the initial data analysis (pre-test), the overall reading literacy skills of fourth-grade students fell into the “Moderate” category, with an average score of 63.61. Statistically, the score distribution showed significant variation, ranging from 50 to 80. Although the mode (the most frequent score) was 70, the high standard deviation of 8.61 indicates that literacy proficiency among individuals in the classroom remains uneven or heterogeneous. The recapitulation of the students’ average pre-test scores for each reading literacy indicator is presented in Table 1.

Table 1. The Recapitulation of Pre-test Scores for Each Reading Literacy Indicator

No.	Reading Literacy Indicators (PIRLS)	Maximum Score	Mean Score	Achievement Percentage
1	Retrieving Information	25	23.00	92.0%
2	Making Inferences	25	16.77	67.1%
3	Interpreting and Integrating	25	13.73	54.9%
4	Evaluating and Reflecting	25	10.12	40.5%
	Accumulative Average	25	15.91	63.6%

Based on the analysis in Table 2, a significant downward trend in student performance is evident as the cognitive complexity of the reading process increases. While students demonstrated excellent mastery in the “Retrieving Information” aspect with an achievement of 92.0%, this proficiency declined drastically, reaching its lowest point in the “Evaluating and Reflecting” aspect at only 40%. The achievement gap across these indicators underscores the urgent need for a pedagogical reconstruction that shifts focus from merely finding factual information toward more complex cognitive processing.

Design Stage

Building upon the initial findings, which highlighted students' low proficiency in interpretation and critical evaluation, this study reconstructs instructional design through the implementation of a Deep Learning model. This innovative design is developed by integrating the core principles of Deep Learning, Joyful, Mindful, and Meaningful Learning, into every stage of students' literacy activities. This integration aims to create a learning ecosystem that focuses not only on outcome mastery but also on the depth of thinking processes and students' emotional engagement. The operational framework of this instructional is presented in the following table 2.

Table 2. Deep Learning-Based Instructional Design for Indonesian Language Learning

Learning Syntax	Deep Learning Principles	Student Activities	Correlation with Literacy Aspects
Stimulation	Joyful Learning (Building positive emotions and curiosity)	Predicting text content based on visual stimuli and discussing their expectations regarding the reading material.	Training students' attention to identify key elements to be searched for within the text.

Exploration	Meaningful Learning (Discovering patterns and connections)	Reading the text independently, marking essential information, and relating new vocabulary to previously known contexts.	Students begin to find explicit information and make logical initial inferences from inter-paragraph relationships.
Deep Processing	Mindful & Meaningful (Conceptual connection and metacognition)	Analyzing character motives, comparing text content with social reality/local wisdom, and discussing different perspectives in groups.	Focusing on the ability to link ideas within the text with knowledge outside the text to form a complete new understanding.
Reflection	Mindful Learning (Cognitive awareness and self-evaluation)	Writing reflective journals on the utility of the information for their lives and assessing whether the author's arguments are logical.	Building critical capacity to evaluate the content, language, and reliability of the text based on the student's personal perspective.
Creation	Joyful & Meaningful (Creative application and self-expression)	Reconstructing text content into other forms (e.g., drama scripts, infographics, or creative solutions to problems presented in the reading).	Demonstrating deep understanding through the creation of a creative product.

This instructional design demonstrates a coherent pedagogical flow aimed at transforming students' reading activities from mere information acquisition toward deep comprehension. Through the integration of joyful principles at the initial stage, students' affective barriers are minimized, fostering mental readiness to enter the exploration phase. Furthermore, the main strength of this design lies in the stages of deep processing and reflection, where the principles of meaningful and mindful learning are actualized to bridge cognitive gaps in text interpretation and evaluation, areas that were previously identified as students' weaknesses. Thus, this design functions not only as a technical guide for teachers in the classroom but also as a framework that ensures every literacy activity is clearly oriented toward enhancing students' engagement in critical thinking and metacognitive processes.

Development Stage

The constructed Deep Learning instructional design was validated through expert judgment involving two reading literacy experts and two instructional design experts to assess its feasibility across eight aspects. The resulting descriptive analysis of the Likert-scale questionnaire data serves as the baseline product feasibility before field trials, with the detailed average scores presented in Table 3.

Table 3. The Recapitulation of the Average Scores from the Experts' Assessments

No	Aspect	Literacy Experts	Design Experts	Overall Mean	Category
1	Material Relevance	5.00	4.50	4.75	Very Feasible
2	Deep Learning	4.50	4.50	4.50	Very Feasible
3	Joyful Learning	5.00	5.00	5.00	Very Feasible
4	Meaningful Learning	4.50	5.00	4.75	Very Feasible
5	Mindful Learning	4.50	4.00	4.25	Very Feasible
6	Language	4.50	5.00	4.75	Very Feasible
7	Presentation	4.00	5.00	4.50	Very Feasible
8	Evaluation	4.50	4.50	4.50	Very Feasible
Overall Mean		4.56	4.69	4.63	Very Feasible

While the expert judgment quantitatively confirms the high feasibility of the Deep Learning instructional design, qualitative refinements were made to optimize teacher

guidelines for metacognitive reflection and adjust syntax durations for field efficiency. Consequently, this refined model is validated and fully prepared for the implementation stage to evaluate its effectiveness in enhancing students' reading literacy.

Implementation and Evaluation Stage

Following validation, the Deep Learning instructional design was implemented and evaluated with 65 elementary school students to test its effectiveness in a real classroom setting. The resulting reading literacy achievements of the students following this instructional intervention are presented in Figure 2.

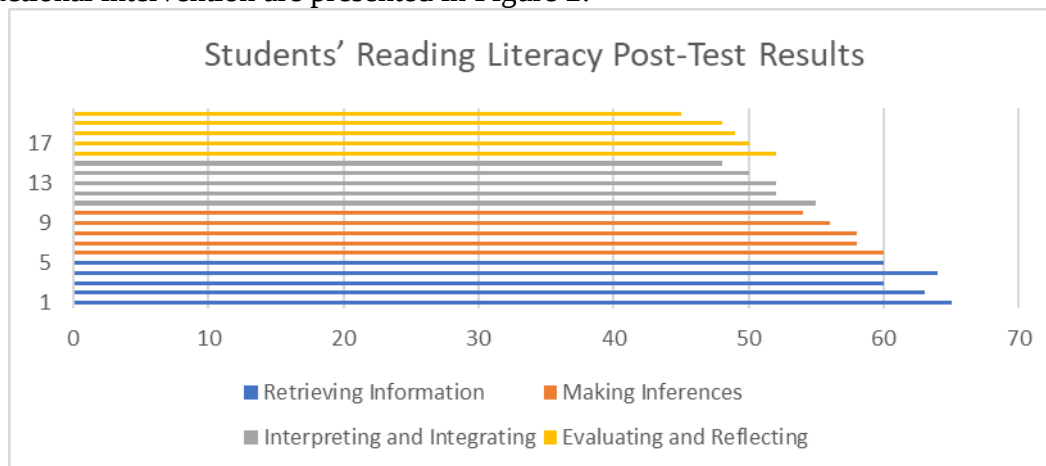


Figure 2. Students' Reading Literacy Post-Test Results

The implementation stage yielded highly positive outcomes, with a mean score of 84.54 placing students' reading literacy in the 'Very High' category. Furthermore, the low standard deviation ($SD = 7.65$) confirms a homogeneous data distribution, indicating a minimal literacy gap among the 65 subjects as detailed across each indicator in Table 5

Table 5. The Recapitulation of Post-test Scores for Each Reading Literacy Indicator

No	Reading Literacy Indicators (PIRLS)	Maximum Score	Mean Score	Percentage Achievement
1	Retrieving Information	25	24.00	96%
2	Making Inferences	25	22.00	88%
3	Interpreting and Integrating	25	20.00	80%
4	Evaluating and Reflecting	25	19.00	76%
Cumulative Mean		100	85.00	85%

The evaluation was conducted by comparing students' scores before the treatment (pre-test) and after the implementation of the learning model (post-test). To accurately measure the level of effectiveness and the magnitude of improvement in literacy skills, the data were analyzed using the N-Gain Score (Normalized Gain). The results of the statistical analysis and effectiveness outcomes at this stage are presented in Table 6.

Table 6. The Results of the Statistical Analysis and Effectiveness

Parameter	Value	Description
Mean Pre-test Score	63.61	Category: Moderate
Mean Post-test Score	84.54	Category: Very High
Mean N-Gain Score	0.58	Category: Moderate
N-Gain Percentage (%)	58 %	Interpretation: Moderate

These results confirm that the intervention implemented through the principles of Mindful, Meaningful, and Joyful Learning has effectively helped students overcome their learning difficulties, particularly in literacy indicators that were previously challenging during the pre-test.

Discussion

The improvement in students' reading literacy skills from the "Moderate" category (63.61) to "Very High" (84.54) demonstrates that the developed instructional syntax has strong effectiveness in stimulating cognitive development. This success is rooted in the harmonization of Joyful, Meaningful, and Mindful Learning elements, which consistently activate students' higher-order cognitive processes. In the initial stage, through the Stimulation phase, students' positive emotions are fostered, leading to a strong sense of curiosity. From a neuroscience perspective, the development of positive emotions (Joyful Learning) triggers the release of dopamine, which enhances focus and memory retention (Sun et al., 2024; Tyng et al., 2017). This has been shown to sharpen students' attention on indicators such as focusing on explicitly stated information, where students become more meticulous in identifying text details due to high emotional engagement from the beginning of the learning process. This finding is consistent with previous research emphasizing that student engagement and intrinsic motivation have a significant effect size on literacy achievement (Hattie, 2019). When students feel happy and curious, their affective barriers decrease, enabling foundational skills, such as identifying explicit information, to be achieved optimally.

The Exploration stage, which emphasizes Meaningful Learning, has been shown to significantly improve students' ability to identify explicitly stated information and to draw initial logical conclusions. At this stage, independent reading activities and highlighting key information function as a schema activation process. Theoretically, this aligns with Schema Theory, which posits that text comprehension largely depends on how readers connect new information with the existing knowledge structures in their minds (prior knowledge) (Xiao, 2024; Y. Zhang, 2025). When students relate new vocabulary to familiar contexts, they are building cognitive bridges that facilitate the storage of information in long-term memory. This finding is consistent with previous studies emphasizing that granting students autonomy to actively explore texts can enhance cognitive engagement and early inferencing skills. Exploration strategies that focus on relationships between ideas (pattern seeking) are far more effective in developing reading comprehension than merely memorizing word definitions (Chi et al., 2016; Frantz, 2018; Kendeou et al., 2016). These findings are further supported by prior research indicating that elementary school students demonstrate significant improvements in literacy when they are accustomed to independently exploring texts that are connected to their everyday experiences (Rejeki et al., 2026; Trisiantari et al., 2022). Therefore, the Exploration stage is not merely a reading activity, but a cognitive navigation process that prepares students for deeper levels of processing.

The Deep Processing syntax, which integrates the principles of Mindful and Meaningful Learning, has proven to be a key catalyst in enhancing students' ability to connect ideas within the text to knowledge beyond the text (Interpret and Integrate Ideas). Activities such as analyzing characters' motives and comparing text content with social realities or local wisdom require students to engage in deep-level information processing. Theoretically, this is grounded in the Levels of Processing Theory, which states that the deeper information is processed semantically and connected to personal context, the stronger the memory trace and understanding that are formed (McLaughlin & DeVoogd, 2017; McMaster et al., 2014). The incorporation of local wisdom at this stage serves as a cognitive anchor, making abstract texts more concrete. This finding is consistent with previous studies showing that integrating local wisdom values into literacy learning in elementary schools significantly enhances students' critical interpretation skills. This occurs because students develop a sense of cultural relevance to the learning material, enabling metacognitive



processes, students' awareness of how well they understand the text, to function more optimally (Habibullah et al., 2025; Trisiantari, 2019). Thus, the Deep Processing stage in this design successfully transforms students' roles from passive consumers of information into reflective constructors of meaning.

The Reflection syntax, grounded in Mindful Learning, has proven to be a key element in developing the highest literacy indicator according to PIRLS, namely the ability to evaluate and reflect on text content (Evaluating and Reflecting). Through reflective journal writing activities, students are encouraged to pause from the flow of information and begin questioning the reliability, logic of arguments, and relevance of the text to their lives. Theoretically, this process represents an implementation of Metacognition Theory, which involves the "active monitoring and consequent regulation" of cognitive processes. In this context, students not only read the text but also become aware of how they evaluate it (Mekala & Radhakrishnan, 2019; Belenkova, 2021). Evaluating the author's arguments is a form of Critical Literacy. Critical literacy is not merely a technical reading skill, but a social practice that involves examining the relationships between language, power, and ideology (Luke, 2012; Rowland, 2015). By providing space for students' personal perspectives, this syntax fosters cognitive autonomy, enabling students not to accept information uncritically. These findings are supported by previous studies indicating that teaching strategies involving self-evaluation and reflection have a high effect size on academic achievement. Students who are accustomed to mindful reflection demonstrate greater acuity in detecting informational bias and assessing the quality of arguments in texts. In the Indonesian context, this is highly relevant to strengthening the *Profil Pelajar Pancasila*, particularly in the dimension of critical reasoning (Margaretha et al., 2026; Tsuraya et al., 2025).

The Creation syntax, which integrates the principles of Joyful and Meaningful Learning, functions as an instrument to demonstrate students' deep understanding through creative products. Activities such as reconstructing text content into drama scripts, infographics, or problem-solving solutions represent the highest cognitive level in the Revised Bloom's Taxonomy, namely Creating (Retnawati et al., 2018; Uddin et al., 2024). Through this syntax, literacy is no longer viewed as a passive activity, but as a creative process that provides students with opportunities to express their understanding in unique ways. Empirically, the effectiveness of the creation stage in literacy is supported by previous studies showing that the integration of reading activities with the production of creative works can significantly enhance information retention and the depth of students' cognitive understanding. Creative products produced by elementary school students, such as short drama scripts based on reading texts, serve as the most valid indicators for teachers to assess the extent to which students understand cause-and-effect relationships and characterization within the text (Choi & Zhang, 2021; Nugroho, 2025).

Overall, this design demonstrates that reading literacy in elementary schools is not merely a technical matter of recognizing letters or words, but rather an issue of depth of thought. By integrating the elements of Mindful, Meaningful, and Joyful Learning, literacy instruction goes beyond achieving academic (quantitative) targets and reaches the essence of character development and students' critical reasoning (qualitative). This model offers a solution to the challenges of modern education in preparing a generation that is not only literate, but also possesses strong literacy intelligence to navigate the complexity of information in the future.

Conclusion

This study successfully developed a deep learning-based Indonesian language instructional design that integrates the pillars of Joyful, Meaningful, and Mindful Learning, with the product feasibility reaching a “very feasible” category (4.63). The findings indicate a significant improvement in students’ reading literacy skills, increasing from the “moderate” category (63.61) in the pre-test to the “very high” category (84.54) in the post-test, with an N-Gain score of 0.58 in the moderate category. This success implies that the integration of cognitive and emotional aspects can transform students’ learning patterns from merely reading texts technically to being able to critically evaluate and reflect on information. Overall, this design has proven effective in creating a deep, student-centered learning ecosystem.

Recommendation

Based on the findings, teachers can implement deep learning to specifically strengthen students’ capabilities at the Evaluating and Reflecting level. This approach is operationally realized by guiding students to critique text quality and connect themes to real-world contexts, rather than focusing solely on literal retrieval. Disseminating this tailored design through teacher learning communities offers a practical strategy for addressing critical reading gaps. For future research, broader-scale trials are recommended to examine the long-term impact of this framework on students’ evaluative reading skills across diverse schools.

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