



NEEDS ANALYSIS FOR DEVELOPING A BRAIN-BASED METACOGNITIVE LEARNING MODEL TO ENHANCE CRITICAL READING IN PRIMARY SCHOOLS

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ABSTRACT

This study aims to analyze the pedagogical and contextual needs underlying the development of a learning model designed to improve students' critical reading skills in elementary schools. The urgency of this research arises from various global and national assessments that show a declining trend in students' reading literacy performance in elementary schools. The results of the 2022 PISA report show that Indonesian students' reading skills are still below the OECD average, and the 2021 PIRLS measurement highlights the importance of inferential and evaluative comprehension as important benchmarks for global reading literacy for elementary school students. This study used a mixed-methods approach involving 30 students and several fifth-grade teachers from elementary schools in Bogor Regency. Data were collected through open-ended and closed-ended questionnaires for students and teacher interviews to examine current practices in teaching reading in Indonesian language learning. The findings revealed that students' critical reading skills are still underdeveloped, especially in dimensions typically reflected in literal comprehension, inferential reasoning, and evaluative judgment to build elementary school students' critical reading skills. Most students are highly dependent on teacher assistance, lack basic strategies for evaluating writing, and show limited ability to reflect on and organize their reading comprehension. These findings underscore the need to design reading learning models that integrate Brain-Based Learning (BBL) principles with metacognitive assessment strategies..

Keywords: Critical reading skills, Brain-Based Learning, Metacognitive assessment, Primary education, Needs analysis

INTRODUCTION

Reading is one of the most essential skills acquired in primary education, forming the foundation for academic success across subject areas. Beyond decoding symbols and understanding literal meaning, students are expected to develop more complex reading competencies, including analyzing texts, drawing inferences, and critically evaluating content. These skills are collectively referred to as critical reading skills, which encompass various cognitive components such as interpretation, evaluation, and reflection—extending beyond the hierarchical levels found in traditional reading comprehension models. In the current era of information overload and media saturation, the ability to read critically has become an academic necessity and a civic imperative (Fisher & Frey, 2014).

In Indonesia, this expectation has been echoed in national curriculum reforms such as Kurikulum Merdeka, which promotes student-centered, inquiry-based, and

reflective learning. Ideally, primary students should be trained in critical reading early to help them navigate texts thoughtfully and independently. However, the implementation of critical reading instruction in primary classrooms remains limited. According to the PISA 2022 report, Indonesian students scored significantly below the OECD average in reading literacy, particularly in items that demand interpretation and evaluation (OECD, 2023). PIRLS 2021 results further confirmed that Indonesian fourth graders struggle significantly with inferential and evaluative comprehension tasks—dimensions often used in assessing reading comprehension—which also serve as foundational components for developing critical reading skills (Mullis et al., 2021).

This persistent underdevelopment of critical reading skills can be attributed to student factors and pedagogical and contextual limitations. Many primary teachers rely on teacher-centered, textbook-driven instruction with minimal student engagement. School observations, especially in suburban and rural areas, suggest that reading lessons are mostly limited to surface-level questions and fail to involve students in meaningful questioning or reflective interpretation. This instructional model often limits students' ability to develop autonomy as readers and reinforces passive learning behaviors (Sullivan & Brown, 2015).

A significant underlying issue is the limited implementation of metacognitive strategies in reading instruction. Metacognition—"thinking about thinking"—has been proven to play a crucial role in reading comprehension. According to Flavell (1979), metacognitive readers can plan, monitor, and evaluate their understanding, enabling deeper engagement with texts. Schraw & Dennison (1994) emphasize that fostering metacognitive awareness enhances reading outcomes, particularly in complex texts. Unfortunately, most Indonesian classrooms still lack structured approaches to teaching or assessing metacognitive skills in reading, leading to low student autonomy and shallow comprehension.

Another promising yet underutilized approach in literacy instruction is Brain-Based Learning (BBL). BBL refers to using instructional strategies that align with the brain's natural functioning, emphasizing emotionally safe environments, sensory-rich experiences, and the relevance of learning content. As highlighted by Jensen (2008), BBL has the potential to activate cognitive and emotional systems that support deep learning and long-term memory. When applied to reading, BBL encourages students to engage meaningfully with texts by connecting learning with emotion, movement, and social interaction. Recent studies also highlight the benefits of BBL in stimulating critical thinking and motivation in primary education contexts [P4].

Despite the promising evidence supporting BBL and metacognitive approaches, most research treats them separately. A clear research gap exists in combining these two frameworks into a unified instructional model, particularly for developing critical reading in primary school students. Studies reviewed through Perplexity confirm that while BBL and metacognition have individually been linked to academic improvement, integrative models do not systematically develop brain-compatible and self-regulated learning in literacy contexts [P5]. Especially in Indonesian education research, no dominant model explicitly targets the intersection of critical reading, brain-based engagement, and metacognitive regulation.

Despite the growing body of research on using metacognitive strategies and educational technology to enhance students' reading comprehension, there remains a noticeable lack of explicit focus on fostering critical reading skills at the primary level. As noted by Aziz & Rawian (2022), students' low metacognitive awareness is often

linked to the underdevelopment of critical reading abilities, a problem exacerbated by teachers' lack of targeted pedagogical interventions. While Sulaiman et al. (2021) emphasize the importance of metacognitive assessment for students to reflect on and regulate their thinking during reading, its application has rarely centered on cultivating critical reading as a core competency in elementary education.

Recent studies have begun addressing this gap by exploring contextual classroom practices that support the emergence of critical reading skills among primary students. For instance, Diah Utami et al. (2020) demonstrated that using multimodal texts moderately improves students' critical reading, offering a foundation for multisensory approaches aligned with Brain-Based Learning (BBL) principles. Similarly, Torres Bernal (2023) found that incorporating memes as didactic strategies significantly strengthens students' critical reading by tapping into emotional and social contexts familiar to learners, key tenets of brain-compatible learning.

Other scholars have highlighted innovative pathways for promoting critical reading through discovery learning with mobile applications Elhefni et al. (2020) and integrating evaluative competencies into creative reading tasks (Baki, 2020). Yet, there remains a lack of integrative instructional models that combine metacognitive strategies and BBL principles in a unified framework for reading instruction in elementary schools. This underscores the need to design and test pedagogical models that are not only innovative but also cognitively and emotionally attuned to the developmental needs of young learners. No dominant model explicitly targets the intersection of critical reading, brain-based engagement, and metacognitive regulation in Indonesian elementary classrooms.

A needs analysis was conducted in several primary schools in the Bogor District to explore this potential. Using a mixed-method design, data were gathered from 30 fifth-grade students through closed- and open-ended questionnaires, and from teachers via structured interviews. The findings of this study align with previous research showing that many students struggle to move beyond surface-level reading. Most students could only respond correctly to literal comprehension tasks, while their performance declined significantly in inferential and evaluative comprehension. This pattern is evident in the study by Dirgantari & Susantiningdyah (2020) which found that while over 53% of students answered literal questions correctly, only 42% and 48.5% succeeded at the inferential and evaluative levels, respectively. Similarly, (Nurjanah & Putri, 2022) concluded that students with poor literal comprehension consistently failed to perform well at higher comprehension levels, such as interpretive and evaluative reading.

In addition to low comprehension performance, students were found to depend heavily on teacher guidance and lack the necessary strategies to engage in reflective or critical reading. Gundary & Gusparia (2025) despite being aware of strategic reading behaviors, students demonstrated a disconnect between knowing and applying them effectively. This highlights the need for structured instructional models that bridge the gap between awareness and active implementation of critical reading strategies. (Kadir et al., 2014) supported this observation by noting that students often processed text only at a surface level, resorted to dictionary use rather than contextual clues, and rarely read between the lines to extract more profound meaning.

From the teachers' perspective, there was a consensus that critical reading is important, yet they lacked practical models and structured methods to teach it effectively in the classroom. This concern is echoed in (Novita et al., 2023) who found that during and even prior to the pandemic, teachers perceived a gap in students' reading competence,

partly due to the absence of explicit instructional strategies and learning conditions that were not conducive to developing higher-order reading skills. Kadir et al. (2014) also stated that despite teachers recognizing the need for critical reading instruction, no clear guidelines or pedagogical frameworks were made available in the curriculum. These findings underscore the pedagogical urgency for an instructional model that integrates brain-based engagement and metacognitive strategies to build student independence, deepen comprehension, and foster the critical reading skills needed in 21st-century learning contexts.

These findings underscore a pedagogical void urgently needing to be addressed through a contextually appropriate and developmentally responsive instructional model. The envisioned model should integrate BBL principles—such as emotion-driven learning and multisensory engagement—with metacognitive strategies that build students' self-awareness and reflective capacity. Such an approach could empower students to understand texts more deeply and become independent readers who are emotionally invested and cognitively aware of their learning process.

This study aims to analyze the pedagogical and contextual needs that inform the development of a learning model designed to enhance critical reading skills among primary school students. Specifically, it seeks to: 1) Investigate current instructional practices and determine how they support or hinder the development of critical reading; 2) Assess students' current levels of comprehension, autonomy, and metacognitive awareness; 3) Identify key elements for the design of an integrated Brain-Based Metacognitive Learning Model that aligns with the cognitive and emotional development of primary students.

The broader purpose is to provide empirically grounded insights into designing an instructional model that is not only theoretically robust but also practical, scalable, and adaptable to the Indonesian educational context. The following questions guide this study: 1) What are the current manifestations of critical reading skills among primary school students, particularly in their abilities to comprehend literal information, make inferences, and critically evaluate text content? 2) Grade 5 teachers currently use what pedagogical approaches and instructional strategies in reading instruction, and how do these align with the principles of Brain-Based Learning and metacognitive development? 3) What key needs, challenges, and contextual factors must be addressed in designing a Brain-Based Metacognitive Learning Model for critical reading in primary education?

METHOD

This study employed a mixed-methods design to conduct a needs analysis for developing a brain-based metacognitive learning model to enhance critical reading skills in primary education. Using qualitative and quantitative data enabled a comprehensive understanding of the current instructional practices and student learning profiles. The mixed-methods approach was considered appropriate due to the study's exploratory nature, which required numerical data on student tendencies and rich descriptive insights from teachers regarding classroom dynamics and pedagogical challenges.

The participants included 30 fifth-grade students from several public primary schools in the Bogor District, West Java, along with Indonesian language teachers who were directly involved in the teaching of reading. Student participants were selected purposively to reflect a typical range of reading achievement and classroom experience. Teachers were selected based on their literacy instruction experience and willingness to participate in in-depth interviews. The study was conducted during the second semester

of the academic year, coinciding with implementing language arts units that involved reading comprehension tasks.

Student data were collected using a combination of closed- and open-ended questionnaires. The closed-ended items were designed to explore students' frequency of reading strategy use, levels of confidence, and comprehension behaviors. At the same time, the open-ended questions captured their reflections on what they found difficult or helpful in understanding texts. The questionnaire was adapted and refined from existing reading self-report instruments and translated into Bahasa Indonesia with appropriate age and reading level modifications. Responses were tabulated and analyzed to identify common trends and areas of difficulty in critical reading skills, particularly in literal understanding, inferential reasoning, and evaluative judgment, which are often considered key dimensions in reading comprehension and critical engagement with texts.

In addition, semi-structured interviews were conducted with the classroom teachers to gain deeper insights into the pedagogical realities of reading instruction. The interviews focused on current teaching strategies, challenges in fostering critical reading, the extent of metacognitive strategy instruction, and teachers' familiarity with or application of brain-based learning principles. Interviews were audio-recorded, transcribed verbatim, and analyzed thematically using inductive coding to extract recurring themes and categories. The integration of teacher perspectives and student responses enabled a well-rounded needs analysis, forming the empirical basis for the future development of the learning model.

RESULTS AND DISCUSSION

A preliminary study using questionnaires from 40 elementary school teachers in Bogor Regency reinforces the findings of this study. Most teachers stated that in-depth text comprehension remains a significant obstacle, compounded by low reading interest, limited teaching materials that stimulate higher-order thinking skills, and a lack of time and supporting facilities. Teachers also expressed the need for learning models that convey text content and facilitate emotional engagement, social interaction, and student self-reflection. These findings emphasize the need to develop reading learning models that focus not only on superficial reading comprehension but also on fostering thinking awareness and self-regulation in a gradual, systematic, and sustainable manner.

In addition to the results of the field study in Bogor Regency, national data also indicate that elementary school students' literacy skills remain low. The 2021 Minimum Competency Assessment (AKM) results indicate that many students lack in-depth understanding of texts, including the ability to summarize, evaluate, and relate reading content to real-life contexts. This indicates that critical reflection has not yet developed optimally as part of critical reading.

Furthermore, teacher readiness to facilitate critical thinking activities remains limited. Many teachers are unfamiliar with learning strategies or assessments that stimulate higher-order thinking, directly impacting students' low critical reading skills. This limitation is exacerbated by the unequal distribution of learning resources and infrastructure that support interactive critical literacy processes.

Findings indicate that only 10% of students consistently read outside of class hours and have a deep understanding of the reading content. The ability to summarize information or distinguish between facts and opinions from texts is also low, with only around 17.78% of students reporting frequent use. Furthermore, around 25% of students

admitted to evaluating their understanding after reading, but this reflects more of a general self-assessment, rather than a critical evaluation of the text's content.

Students' metacognitive aspects showed better performance, with around 33% stating they frequently reread or ask questions when they do not understand a text. However, only 5–10% of students demonstrated the ability to plan and monitor their reading comprehension process consciously. Most students still rely on teacher or peer assistance and lack independent learning strategies.

The findings of this study reveal a consistent and critical gap in the development of students' critical reading skills, as well as a lack of metacognitive awareness and pedagogical readiness among teachers. Data from the student questionnaires indicate that most fifth-grade students still operate predominantly within the literal dimension of critical reading. While many students could recall facts and answer direct questions, they struggled to identify the main idea, especially in longer or non-narrative texts. Their understanding was often limited to sentence-level decoding without being able to synthesize the overall meaning from a paragraph or text.

The students showed notable weaknesses in the inferential component of critical reading. Most could not provide accurate responses when asked questions requiring them to deduce implicit meanings or make logical connections across sentences. This suggests a lack of ability to construct meaning beyond the explicitly stated. Students also had difficulty using contextual clues to interpret unfamiliar vocabulary or resolve ambiguities in the text. These issues indicate that inferential comprehension remains underdeveloped, which is essential for deeper understanding and critical engagement with texts.

of critical reading, which involves judging the quality, accuracy, or bias of the information presented. Significantly few students could differentiate between fact and opinion or assess the credibility of a text. They tended to accept the content passively without questioning the author's intent or comparing it to prior knowledge. This passive approach to reading shows that students lack the critical lens to navigate and assess information critically, especially in today's media-rich environment.

In addition to comprehension levels, the study explored students' metacognitive awareness during reading. Most students were unfamiliar with strategies such as self-questioning, summarizing, or monitoring understanding. When they failed to understand a text, their default reaction was stopping reading or waiting for teacher assistance rather than employing strategies to overcome the difficulty. This low level of self-regulation suggests that students are not yet equipped to manage their reading processes independently, a core component of critical and reflective reading.

The tendency of students to rely heavily on teacher prompts, as highlighted in Gundry & Gusparia (2025), echoes the findings of this study. Students seldom used active reading strategies, such as predicting, self-questioning, or summarizing. Instead, they approached texts passively, waiting for clarification from the teacher. Kadir et al. (2014) further noted that such students often resort to surface-level reading aided by dictionary use rather than applying contextual inference. This suggests a systemic underdevelopment of metacognitive habits in the early years of formal education.

Complementing the student findings, interviews with Indonesian language teachers provided more profound insight into classroom practices and instructional challenges. Teachers admitted that reading instruction is still dominated by textbook routines, with minimal emphasis on critical or metacognitive aspects. Most reading tasks focus on literal comprehension, and classroom discussions rarely go beyond basic question-and-answer patterns. While teachers acknowledged the importance of fostering

higher-order thinking skills, they also expressed a lack of pedagogical resources, structured training, and assessment tools to effectively implement more advanced reading strategies.

Furthermore, the interviews revealed that teachers had limited exposure to Brain-Based Learning (BBL) or metacognitive instruction frameworks. Although some intuitively applied brain-friendly strategies (e.g., group discussion, visual aids), these were not systematically integrated into their teaching design. Teachers also showed enthusiasm for learning more about BBL and metacognition if provided with clear guidance and contextualized models suited to primary students' cognitive and emotional development. These findings confirm the urgent need for an instructional model that combines BBL and metacognitive strategies to enhance students' critical reading skills and support teachers in implementing reflective and student-centered reading instruction. For this study, literal, inferential, and evaluative comprehension are not treated as hierarchical levels but as essential and interrelated components of students' critical reading competence.

The findings of this study confirm that most primary school students still struggle with critical reading skills, especially at the inferential and evaluative dimensions. This aligns with PIRLS 2021 results, which reported that Indonesian fourth graders demonstrated limited abilities in drawing conclusions and evaluating content beyond literal meaning (Mullis et al., 2021). Fisher & Frey (2014) argue that students will remain at the surface level of comprehension without guided practice in higher-order thinking. In this study, students' reading experiences were limited mainly to direct recall tasks, with minimal opportunities to explore, question, or evaluate texts. This shows that the existing reading instruction has yet to foster analytical and reflective reading practices, essential for developing critical literacy in the 21st century.

The current findings are consistent with earlier studies indicating that Indonesian primary students face significant difficulty in progressing beyond surface-level reading. For instance, Dirgantari & Susantiningdyah (2020) found that although most students could answer literal comprehension questions correctly, their performance declined markedly in inferential and evaluative tasks. These patterns support the notion that instructional practices in primary schools have yet to provide sufficient scaffolding for deeper textual engagement, interpretation, or judgment. Since the 1970s, (Robinson, 1970) has emphasized that the ability to engage critically with written texts depends not only on decoding skills but also on the gradual development of conceptual understanding and habits of mind formed from the early stages of learning. This reinforces the importance of learning models that foster reflective and evaluative thinking from an elementary school.

The findings of this study indicate that elementary school students' critical reading skills have not yet developed comprehensively, particularly in the inferential, evaluative, and reflective aspects. Based on a synthesis of the theories of Facione (2020), PIRLS ((Mullis et al., 2021)), Varaporn & Sitthitikul (2019), Pearson & Hoffman (2011) and Huijie (2010), five dimensions of critical reading skills relevant to the context of fifth-grade elementary school students are: (1) understanding text structure, (2) making inferences, (3) evaluating information, (4) identifying the author's attitude and purpose, and (5) reflecting and responding critically to the text. These five dimensions can be used to systematically assess students' in-depth reading skills from a literal perspective and a more complex cognitive, social, and affective perspective.

A particularly noteworthy aspect of the findings is students' lack of metacognitive awareness. Most students were unaware of strategies to monitor or regulate their reading comprehension, and often relied on teacher cues when they encountered difficulties. This finding is consistent with research by Schraw & Dennison (1994), who emphasize that metacognitive awareness—specifically declarative, procedural, and conditional knowledge—plays a critical role in reading success. Without these self-regulatory mechanisms, students are more likely to disengage when reading becomes challenging. Veenman et al. (2006) also found that low-performing readers use fewer metacognitive strategies, further inhibiting their critical reading capacity.

From the teachers' perspectives, the findings reveal significant pedagogical constraints in implementing critical reading instruction. Many teachers reported a lack of exposure to Brain-Based Learning (BBL) or structured metacognitive teaching approaches. This aligns with Tokuhamma-Espinosa (2018), who asserts that while neuroscience-informed teaching strategies are increasingly recognized worldwide, their application remains limited in classrooms that rely heavily on rote instruction. Teachers in this study expressed interest in using BBL principles—such as emotional safety, multisensory engagement, and reflective practices—but lacked concrete models or training to do so effectively. This indicates a strong need for professional development in neuroscience-based pedagogy and practical frameworks that can be easily adapted to the primary classroom setting.

Questionnaire data and teacher interviews confirm that most needs analyses of reading instruction in elementary schools still focus on literal comprehension, neglecting higher-level dimensions such as inferential and evaluative skills. Most students struggle to relate text content to their experiences or social contexts, demonstrating a lack of critical reflection, a key pillar of 21st-century learning. Therefore, the learning approach developed needs to facilitate these five dimensions of critical reading in a structured and gradual manner, to encourage the development of metacognitive awareness, information assessment, and reflective meaning construction from elementary school onward.

Teachers' perspectives in this study also confirm the instructional gap identified by Novita et al. (2023), who observed that teachers were aware of their students' limited reading competencies but lacked the pedagogical tools to intervene effectively. Although teachers recognized the importance of fostering critical reading, the absence of structured models, training, or assessment tools rendered their efforts inconsistent. These findings support Kadir et al. (2014) argument that teacher capacity-building is essential if curriculum goals related to critical literacy are to be meaningfully realized.

Integrating Brain-Based Learning with metacognitive instruction presents a promising pathway to enhance students' critical reading. BBL supports the development of neural pathways through emotional, social, and sensory-rich learning, facilitating retention and more profound understanding (Jensen, 2008). When combined with metacognitive practices—such as goal-setting, self-monitoring, and reflection—this approach can help students engage with texts cognitively and regulate their thinking while reading. This is supported by Ozensoy (2021), who shows that critical reading skills can emphasize analysis, questioning, and reflective understanding, significantly increasing academic success and student engagement in social studies classes.

Research has shown that instructional strategies integrating cognitive and affective dimensions can significantly enhance reading comprehension and critical literacy. For example, Patty (2023) demonstrates that the Cooperative Integrated Reading and Composition (CIRC) strategy, grounded in constructivist learning, facilitates active

knowledge construction and promotes cognitive engagement and emotional involvement in reading tasks. Similarly, Suyitno (2017) highlights the role of cognitive strategies—such as anticipating content, integrating information, and interpreting meaning—in strengthening comprehension and fostering student independence. Thus, a model that unifies BBL and metacognition has the potential to address both the emotional and intellectual dimensions of reading comprehension, making it especially suitable for primary learners.

This needs analysis implies that developing a Brain-Based Metacognitive Learning Model is necessary and timely. It is necessary because current practices do not adequately support critical reading development, and it is timely because recent shifts in curriculum demand greater learner autonomy and higher-order thinking. Moreover, the model would not only fill a gap in instructional design but also serve as a response to growing calls for neuroscience-informed and student-centered pedagogy in basic education. Future implementation of such a model should be grounded in the empirical realities identified in this study, ensuring it is practical, developmentally appropriate, and aligned with national literacy goals.

CONCLUSION

This study concludes that there is a clear and urgent need to redesign the approach to reading instruction in elementary schools in Indonesia, particularly to improve students' critical reading skills. The findings reveal that five dimensions of students' critical reading skills are relevant to the context of fifth-grade elementary school students: (1) understanding text structure, (2) making inferences, (3) evaluating information, (4) identifying the author's attitude and purpose, and (5) reflecting on and responding critically to texts. Despite recognizing the importance of fostering critical reading, teachers face pedagogical and contextual limitations, including minimal Brain-Based Learning (BBL) and metacognitive learning training.

The needs analysis results indicate that existing learning models have not been able to foster the reflective, analytical, and self-regulated reading practices necessary for 21st-century literacy. There is strong potential in integrating the principles of Brain-Based Learning—which focuses on creating emotionally engaging, cognitively stimulating, and neurologically attuned learning environments—with metacognitive strategies that promote students' awareness and control of their learning process. Such integration would improve reading comprehension outcomes and foster independent and critical learners from an early age.

The implications of this study are both theoretical and practical. Theoretically, this study contributes to the growing discourse on the intersection of neuroscience, metacognition, and literacy education. This study proposes the foundation for a new instructional framework that aligns with how students learn best, engaging both the emotional and cognitive aspects of learning. Practically, these findings underscore the importance of equipping teachers with pedagogical models that are evidence-based, developmentally appropriate, and adaptable to classroom contexts.

In short, integrating brain-based and metacognitive approaches into a coherent learning model is an innovative and important step in addressing reading literacy challenges in Indonesia. This integration is also expected to promote mindful, meaningful, and joyful learning experiences, creating an environment that not only enhances cognitive outcomes but also nurtures emotional engagement and learner autonomy. This model's future development and implementation can make a meaningful

contribution to improving critical reading outcomes in elementary education and fostering a generation of thoughtful, reflective, and independent readers.

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