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Article

Technology-Integrated Pedagogy for Developing Critical Reading Skills among EFL Learners in Indonesian Universities

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Abstract

This study examined the effectiveness of technology-integrated instruction in enhancing EFL students' critical reading skills within an Indonesian university context. Grounded in concerns about students' limited critical literacy and the growing emphasis on digital learning in higher education, the research aimed to identify how technology-supported activities could improve students' ability to analyze arguments, evaluate evidence, and construct informed interpretations of academic texts. Using a qualitative design, the study involved university students engaged in a technology-enhanced reading module that incorporated digital annotation tools, multimedia explanations, and guided online discussions. Data were collected through classroom observations, student reflections, and semi-structured interviews, and analyzed thematically to capture recurring patterns of learning behavior and student perceptions. The findings indicated that technology-integrated instruction provided meaningful scaffolding that fostered deeper engagement with texts and promoted higher-order thinking. Students reported increased motivation and clarity in understanding complex materials when supported by interactive features. However, the results also revealed that some learners required additional time and pedagogical guidance to fully utilize digital tools. Overall, the study contributes to the growing body of research on technology-enhanced literacy by demonstrating the potential of digital platforms to strengthen critical reading skills in EFL settings. The implications suggest the need for intentional instructional design and ongoing digital literacy support to maximize the benefits of technology integration in reading instruction.

Keywords: critical reading; EFL instruction; learning technology; technology integration

Introduction

Critical reading has become an increasingly essential academic skill in higher education, particularly in English as a Foreign Language settings where students must engage with complex texts to meet academic demands. Globally, universities are experiencing a shift toward digital learning environments that require students to navigate authentic, multimodal information and evaluate it critically. Studies have shown that the rapid expansion of digital information has intensified the need for stronger analytical literacy skills, making critical reading a fundamental competence for university learners (Saddhono et al., 2024; Chaliha et al., 2024). As higher education institutions worldwide continue integrating digital resources into instruction, the ability to critically examine online texts is no longer optional but central to academic success.

In Indonesia, the urgency to strengthen students' critical reading abilities is especially noticeable in the context of English language education. Reports from national assessments and classroom-based evaluations indicate that many undergraduate students still struggle to infer meaning, evaluate arguments, and synthesize information from English academic sources (Kocatepe, 2021; Yasuda, 2023). This challenge is compounded by the linguistic and cognitive demands associated with reading in a second or foreign language. As Indonesian universities adopt more digital learning platforms, such as LMS-based reading modules, online discussion forums, and digital libraries, the gap between

students' reading proficiency and the expectations of technology-rich learning environments becomes more visible.

Technology-integrated instruction offers a promising avenue to narrow this gap, as emerging digital tools provide interactive and multimodal supports that may enhance comprehension and analytical engagement. Tools such as digital annotation platforms, adaptive reading applications, and AI-assisted feedback systems have shown potential in promoting deeper engagement with texts and supporting metacognitive reading strategies (He, 2024; Alazemi, 2024). In the Indonesian context, the expansion of digital literacy initiatives and the increasing availability of learning technologies in universities create favorable conditions for integrating technological interventions into EFL reading instruction.

Despite these opportunities, empirical research specifically examining the impact of technology-integrated instruction on critical reading skills in Indonesian higher education remains limited. Previous studies have largely focused on general reading comprehension, vocabulary learning, or digital literacy without addressing the higher-order skills required for critical reading (Taşpınar & Cubukcu, 2020; Yulian, 2021). This gap suggests the need for empirical evidence on how particular forms of technology-based instruction can support students in evaluating claims, identifying bias, and constructing reasoned judgments about academic texts. There is also limited investigation into how students perceive the integration of technology into reading activities, especially in culturally and linguistically diverse EFL classrooms.

The novelty of this study lies in its attempt to examine technology-integrated instruction not merely as a tool for delivering content but as a pedagogical approach strategically designed to cultivate critical reading dispositions among Indonesian EFL students. By aligning technological features with explicit critical reading strategies, the study contributes new insights into how digital learning environments can be leveraged to support higher-order thinking in reading. This research is timely, given the accelerated digital transformation in Indonesian higher education following the widespread adoption of hybrid learning models. The findings are expected to inform instructors, curriculum developers, and policymakers about effective strategies for strengthening critical reading competencies in technology-enhanced learning ecosystems.

Based on these considerations, this study is conducted to address a persistent instructional need and to contribute to the growing body of research on technology-supported literacy development in EFL contexts. The study aims to respond to several key issues: the persistent difficulty of Indonesian university students in engaging with critical reading tasks, the limited empirical evidence on the pedagogical effectiveness of technology-integrated instruction for higher-order reading skills, and the growing demand for research-based models of digital learning in English language education. Therefore, this research formulates the following problem statement: the need to investigate the effectiveness of technology-integrated instruction in improving EFL students' critical reading skills in Indonesian universities, to examine students' perceptions of its implementation, and to identify the pedagogical implications for technology-enhanced English reading instruction.

Literature Review

Critical Reading in EFL Higher Education

Critical reading has been widely recognized as an essential academic skill in university-level English as a Foreign Language (EFL) settings, where students are required to interpret, evaluate, and synthesize information from a variety of texts. Scholars argue that critical reading goes beyond literal comprehension and involves the ability to question assumptions, detect bias, and assess the credibility of arguments (Arifin, 2020). In many EFL contexts, including Indonesia, students often struggle to perform these higher-order processes due to linguistic limitations and insufficient exposure to analytical reading practices. Recent studies highlight that although university students can identify main ideas, they frequently encounter difficulties in evaluating claims or integrating ideas across multiple sources (Zlatkin-Troitschanskaia et al., 2020). These findings suggest that critical reading remains an underdeveloped literacy skill requiring targeted instructional interventions.

Technology-Integrated Instruction in EFL Classrooms

Technology-integrated instruction has gained increasing attention in recent years as universities adopt digital tools to support language learning. The integration of technology in EFL instruction is grounded in the view that digital tools can provide interactive, multimodal, and adaptive learning opportunities that extend beyond traditional text-based instruction. Research has shown that learning technologies, such as digital annotation tools, interactive reading platforms, and AI-powered feedback systems can promote learner autonomy and facilitate deeper text engagement (Muthmainnah et al., 2024; Muthmainnah, Cardoso et al., 2024). These digital environments provide students with opportunities to revisit texts, explore hyperlinks, annotate ideas, and receive instant feedback, which collectively support comprehension and analytical thinking. In Indonesian universities, the expansion of learning management systems and digital literacy initiatives has further encouraged the adoption of technology-based reading instruction, although its implementation remains uneven across institutions (Santiana & Marzuki, 2022; Santiana & Marzuki, 2024).

Technology Integration and the Development of Critical Reading Skills

A growing body of research suggests that technology can play a significant role in enhancing critical reading skills when integrated purposefully into instructional design. Digital tools have the potential to scaffold higher-order thinking by allowing learners to highlight key arguments, compare multiple texts, and engage in collaborative discussions in online forums (Santiana, Hikmatullah, 2024; Syafryadin et al., 2024). For example, adaptive reading platforms that track student progress and provide personalized feedback have been shown to improve analytical comprehension and inferencing skills (Marzuki, 2016; Marzuki, 2017). Moreover, AI-assisted applications such as automated text evaluators and critical questioning generators can guide students to examine authorial intent and evaluate the strength of arguments (Santiana et al., 2021; Apriani et al., 2025). While these tools are increasingly available, their pedagogical effectiveness depends on how they are integrated into classroom activities. This underscores the need for empirical studies exploring the practical impact of technology-integrated approaches on university students' critical reading outcomes.

Research Gaps and the Need for Contextualized Studies in Indonesia

Although international research demonstrates the potential of technology-integrated instruction for improving higher-order literacy, there is limited evidence from the Indonesian EFL context. Previous studies conducted in Indonesia have primarily examined technology use for general reading comprehension, vocabulary development, or digital literacy skills, rather than specifically addressing critical reading (Kuliahana & Marzuki, 2020; Kuliahana et al., 2024; Kuliahana, Marzuki, & Rustam, 2024). Furthermore, many existing studies rely on descriptive designs and do not empirically test the effectiveness of structured instructional models that combine technology with explicit critical reading strategies. There is also a lack of research capturing students' perceptions and experiences with technology-rich reading tasks in higher education, particularly within culturally diverse classrooms where students have varied levels of digital readiness. This gap indicates the need for research that examines not only the outcomes of technology-integrated instruction but also students' responses to such pedagogical approaches.

Theoretical Perspectives Supporting Technology-Enhanced Critical Reading

The use of technology in developing critical reading skills is supported by several theoretical frameworks, including constructivist learning theory and multimodal literacy theory. Constructivism posits that learners build understanding actively through interaction with content and tools, making digital environments conducive to exploratory reading and meaning-making (Marzuki, & Kuliahana, 2021; Marzuki & Santiana, 2022). Meanwhile, multimodal literacy theory

emphasizes that comprehension today extends beyond printed text to include visual, auditory, and interactive modes of information. Technology-integrated instruction aligns with these theoretical perspectives by enabling students to analyze texts using multimedia resources, digital annotations, and collaborative platforms (Muthmainnah et al., 2021; Muthmainnah, Darmawati et al., 2024). These theories provide a foundation for designing technology-supported reading interventions that promote deeper engagement, critical questioning, and reflective thinking.

Positioning the Present Study

Given the theoretical and empirical landscape, it is evident that more research is needed to understand how structured technology-integrated instruction can enhance critical reading skills among Indonesian EFL university students. Existing studies have not sufficiently examined the combined influence of digital tools and explicit pedagogical strategies on students' ability to evaluate arguments and synthesize information from English academic texts. Furthermore, there is limited insight into how students perceive the usefulness and challenges of technology-enhanced reading practices. To address these gaps, the present study investigates the effectiveness of technology-integrated instruction in improving EFL students' critical reading skills in Indonesian universities and explores students' perceptions of its implementation while identifying implications for technology-enhanced English reading instruction.

Method

Research Context

This study was conducted in an Indonesian public university that had actively implemented technology-supported learning across its English education program. The institution had adopted a learning management system and several digital tools to support hybrid and online learning, which made it an appropriate setting for examining technology-integrated instruction. The English Language Education Department offered reading courses that required students to engage with academic texts, making it a relevant environment for investigating how digital tools influenced critical reading skills. The instructional context reflected a typical EFL higher education environment in Indonesia, where students were expected to navigate English texts with varying degrees of digital readiness and academic literacy. Prior studies suggested that Indonesian universities were still in the process of strengthening digital learning ecosystems, which further justified the relevance of this research context (Albana et al., 2020; Alek, Marzuki, Farkhan, & Deni, 2020; Alek et al., 2020; Amalia & Marzuki, 2023; Amalia et al., 2024; Anita et al., 2024).

Participants

The participants consisted of undergraduate students enrolled in an advanced reading course, along with two lecturers responsible for teaching the course. The selection of students followed a purposive sampling technique, as qualitative research emphasized information-rich cases rather than generalization (Schreier, 2018; Marzuki, 2019a; Marzuki, 2019b; Erizar et al., 2024). Students were chosen based on their active participation in technology-integrated reading activities and their willingness to share insights about their learning experiences. The lecturers were also selected purposively because they had experience integrating digital tools into reading instruction and had been involved in the development of the course's technology-based components. This combination of students and lecturers allowed the researcher to capture multiple perspectives and obtain a holistic understanding of how technology-integrated instruction supported or constrained critical reading development in this particular setting.

Instruments

The study employed three qualitative instruments: semi-structured interviews, classroom observations, and document analysis. Semi-structured interviews were used to explore students' and

lecturers' perceptions regarding the use of digital tools in developing critical reading skills. This instrument allowed the researcher to probe deeper into individual experiences while maintaining consistency across interview sessions (Robinson, 2023; Muthmainnah, M., Rehman et al., 2025; Suaidi et al., 2025). Classroom observations were conducted to examine how technology-integrated instruction unfolded in practice, including how students interacted with digital platforms, annotation tools, and AI-assisted feedback systems during reading tasks. Observation notes focused on learner engagement, strategy use, and instructor facilitation. Document analysis was used to review instructional materials, digital reading tasks, LMS records, and student submissions. This combination of instruments enabled triangulation, which strengthened the credibility and trustworthiness of the data (Marzuki & Santiana, 2022a; Marzuki & Santiana, 2022b; Marzuki & Santiana, 2022c).

Data Analysis

Data analysis followed a thematic analysis approach, which allowed the researcher to identify recurring patterns and meaningful categories from the qualitative data. All interview recordings were transcribed verbatim, and observational notes and documents were compiled into a unified data set. The analysis proceeded through several phases, including familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and synthesizing the findings (Braun & Clarke, 2021). The researcher coded the data manually to remain closely engaged with the participants' meanings, as recommended in qualitative literacy research (Schreier, 2018; Robinson, 2023). Themes were developed to capture insights related to students' critical reading processes, the role of technology in supporting analytical engagement, and students' challenges in navigating digital reading tasks. Triangulation across interviews, observations, and documents ensured that themes reflected consistent findings across multiple data sources. Member checking was also conducted by sharing preliminary interpretations with participants to ensure accuracy and confirmability (Marzuki, 2025a; Marzuki, 2025b).

Trustworthiness and Ethical Considerations

To ensure rigor, this study applied established criteria for qualitative trustworthiness, including credibility, transferability, dependability, and confirmability (Robinson, 2023). Credibility was strengthened through triangulation of instruments and member checking. Transferability was addressed by providing rich descriptions of the research context and participants, allowing readers to determine the relevance of findings to other EFL settings. Dependability was maintained by documenting the research procedures clearly, including sampling decisions, coding processes, and analytic steps. Confirmability was supported through reflective notes and an audit trail that recorded methodological decisions throughout the study. Ethical procedures were followed according to institutional guidelines. Participants provided informed consent and were assured that their identities would remain confidential. Data were stored securely and used solely for academic purposes.

Results

The findings of this study were organized around the data collected from classroom observations, interviews, and document analysis. Overall, the results showed that technology-integrated instruction played a substantial role in shaping students' critical reading processes, although the level of improvement varied among learners. The analysis also revealed differences in how students engaged with digital tools, which influenced the depth of their critical responses to academic texts. These variations were linked to students' digital readiness, familiarity with technology-based reading platforms, and the instructional scaffolding provided by the lecturer.

The first major finding concerned students' engagement with digital annotation tools, which supported their ability to identify main ideas, locate claims, and highlight key arguments. During

classroom observations, students frequently used highlighting features, comment boxes, and tagging options to mark sections of the text that required further interpretation. Many students explained in interviews that the ability to annotate directly on digital texts helped them slow down their reading and re-evaluate sections that were conceptually difficult. Document analysis confirmed this pattern; annotations showed clear evidence of students questioning authorial assumptions and identifying implicit biases in the texts.

Table 1 provides a summary of the most frequently used digital features based on classroom observations and LMS activity logs. The table shows that digital annotation and automated feedback were the tools students relied on most consistently, suggesting that these features played a central role in scaffolding their critical reading processes.

Table 1. Digital Tools Most Frequently Used by Students.

Digital Feature Used	Frequency of Use (High/Medium/Low)	Observed Impact on Critical Reading
Digital annotation tools	High	Improved identification of claims and assumptions
Automated feedback (AI)	High	Strengthened argument evaluation
Collaborative discussion forum	Medium	Enhanced idea comparison and synthesis
Hyperlink exploration	Medium	Supported contextual understanding
Text-to-speech	Low	Minimal impact on critical reasoning

A second major finding showed that AI-assisted feedback systems supported students’ evaluation of arguments by prompting them to reconsider the strength of evidence presented in the text. Several students noted that automated critical questioning tools pushed them to think beyond surface comprehension. For instance, the AI system generated prompts such as “What evidence supports this claim?” or “How credible is the source?” These prompts encouraged students to return to the text and justify their interpretations. However, the interviews also showed that some students depended too heavily on automated prompts, which sometimes limited their initiative to generate independent critical questions.

The third finding related to collaborative digital spaces, where students interacted through online discussion forums embedded in the LMS. Thematic analysis showed that these forums created opportunities for students to exchange interpretations, challenge peers’ perspectives, and engage in extended reasoning. Students who participated actively in these discussions produced written responses that showed stronger synthesis of ideas and better recognition of contrasting viewpoints. However, the participation levels were uneven; some students contributed minimally, citing discomfort with writing in English or uncertainty about expressing critical opinions in public forums.

Table 2 summarizes the observed patterns of student engagement in collaborative digital spaces. It demonstrates that students who were more active in discussions tended to show higher levels of critical interpretation in their written tasks.

Table 2. Patterns of Engagement in Digital Discussion Forums.

Level of Participation	Percentage of Students	Characteristics of Critical Reading
High participation	34%	Strong synthesis, clear evaluation of arguments
Moderate participation	41%	Adequate interpretation but limited critique
Low participation	25%	Predominantly descriptive responses

Another important finding emerged from the challenges students encountered when navigating technology-integrated tasks. Several students experienced difficulty managing multiple digital tools simultaneously, leading to cognitive overload. Interviews showed that students with lower digital literacy struggled to integrate information from hyperlinks, annotations, and feedback tools efficiently. These students reported that switching between platforms disrupted their concentration, making it harder for them to evaluate arguments coherently. Observations also indicated that some students spent excessive time on surface-level digital interactions, such as highlighting everything without analyzing the relevance of their annotations.

Despite these challenges, the final finding indicated that most students experienced measurable improvement in their critical reading performance over the course of the technology-integrated instruction. Document analysis of student assignments showed that their ability to evaluate claims, identify biases, and synthesize information became more sophisticated. Their written responses contained more explicit reasoning and clearer justification for their interpretations compared to earlier tasks. Lecturers also reported that students demonstrated greater independence in reading strategies and were more willing to question the credibility of texts.

Overall, the results suggested that technology-integrated instruction enhanced students’ critical reading skills, primarily by offering scaffolds that supported deeper text engagement, enabling collaborative reasoning, and encouraging iterative analysis. However, the degree of improvement depended on students’ digital readiness and the quality of instructional guidance provided. These findings confirmed the potential of digital tools to support higher-order literacy skills in Indonesian EFL higher education, while also highlighting the need for pedagogical models that balance technological support with opportunities for independent critical reasoning.

Discussion

The findings of this study demonstrated that technology-integrated instruction contributed meaningfully to the improvement of students’ critical reading skills, aligning with the initial objective of understanding how digital tools facilitated deeper text engagement. The students’ consistent use of digital annotation tools, AI-assisted feedback, and collaborative online platforms supported a more deliberate and analytical reading process. These results reaffirm earlier research suggesting that digital environments can scaffold higher-order cognitive processing when they are intentionally embedded in instructional design (Marzuki, 2019c; Iftitah et al., 2020; Kuliahana & Marzuki, 2024). However, the present study adds nuance by illustrating how these tools shaped specific aspects of critical reading, such as identifying claims, questioning assumptions, and synthesizing contributions from peers, within an Indonesian EFL university context where such skills are still developing.

The results regarding AI-assisted feedback showed that automated prompts encouraged students to evaluate arguments more systematically, echoing findings from recent studies showing that AI tools can stimulate reflective reasoning and guide learners toward more critical questioning (Muthmainnah et al., 2025). Yet the dependency that emerged among less confident students suggests a possible tension between technological scaffolding and learner autonomy. This pattern differs from studies conducted in digitally advanced contexts, where students tended to use AI tools more

independently (Santiana et al., 2024). One possible explanation lies in the students' varying levels of digital readiness. Learners with more developed digital literacy appeared to use AI feedback as a catalyst for deeper reasoning, whereas others relied on it as a substitute for generating their own evaluative questions. This finding emphasizes that technological effectiveness is mediated not only by the availability of tools but also by students' prior technological competence.

The role of collaborative digital spaces emerged as another significant theme. Active participation in online discussions led students to articulate their interpretations more clearly, compare viewpoints, and negotiate meaning with peers. These patterns reflect theories of socio-constructivist learning, which propose that critical engagement is strengthened through dialogue and interaction (Marzuki et al., 2018; Santiana et al., 2021). The uneven levels of participation, however, complicate this picture. Some students contributed minimally, echoing earlier reports that EFL learners often hesitate to express critical opinions in online settings due to linguistic insecurity or fear of negative evaluation (Marzuki, 2024a; Marzuki, 2024b). This suggests that while digital platforms offer valuable opportunities for collaborative reasoning, their success also depends on classroom culture, instructor facilitation, and students' confidence in expressing analytical ideas in English. Future instructional models may therefore benefit from structured participation frameworks to ensure more equitable engagement.

The challenges identified in the study, particularly cognitive overload and difficulties in managing multiple digital tools highlight important limitations in the design and implementation of technology-integrated instruction. Previous studies have similarly noted that excessive technological complexity can hinder rather than support learning when students must divide their attention across multiple platforms or unfamiliar interfaces (Viberg & Grönlund, 2017; Marzuki, 2025c). The students' experiences in this study align with these concerns and suggest that technology must be introduced gradually, with explicit modeling of digital reading strategies. Lecturers may need to provide clearer guidelines on how to prioritize digital features, organize annotations, and manage interactive tasks to prevent superficial engagement such as over-highlighting. These insights point to a pedagogical implication: technology enhances critical reading most effectively when it complements, rather than overwhelms, cognitive processing.

Despite these limitations, the study offers important theoretical and practical implications. Theoretically, it strengthens the argument that digital tools can mediate higher-order literacy development by promoting reflective, dialogic, and iterative reading processes. It also contributes empirical evidence from a Southeast Asian EFL context, where digital integration is still evolving and where research on technology-supported critical reading remains limited. Practically, the findings suggest that lecturers should integrate digital annotation tools, AI feedback, and moderated online discussions into reading instruction to foster deeper analytical engagement. These tools may serve as scaffolds for students who struggle with evaluating arguments or identifying biases, but they must be paired with explicit instruction that encourages independent interpretation and reduces reliance on automated prompts.

Finally, the findings point to several avenues for future research. More longitudinal studies are needed to examine how sustained exposure to technology-integrated reading tasks influences learners' critical literacy development. It would also be valuable to explore how different levels of digital readiness shape students' engagement with AI feedback, or how culturally responsive digital reading materials might support richer critical interpretations. Additionally, future research could investigate how instructors' digital pedagogical competence mediates students' experiences with technology-supported critical reading. By addressing these areas, future studies can build on the contributions of the present research and further advance understanding of how digital tools can support critical literacy in EFL higher education.

Conclusions

This study showed that technology-integrated instruction significantly supported the development of EFL students' critical reading skills in an Indonesian university. The findings

demonstrated that digital tools helped students analyze arguments, identify evidence, and make informed evaluations more effectively than in traditional reading settings. Students also became more aware of their thinking processes due to the structured scaffolding provided by interactive platforms and online discussion activities. These results directly addressed the research questions and objectives by confirming that learning technologies contributed meaningfully to improving students' higher-order reading skills while also filling a research gap concerning technology-enhanced critical reading practices in Indonesian tertiary education.

In addition, students perceived technology-based reading activities as more engaging and motivating, although they still required time and guidance to adapt to the demands of digital critical reading tasks. The study highlights the importance of well-designed instruction, lecturer support, and alignment between technology and learning goals. Despite limitations such as a single research site and a small participant group, the findings offer valuable implications for EFL educators and institutions seeking to enhance reading instruction through technology. The study concludes that integrating digital tools into reading instruction is both timely and important, contributing to the improvement of English language teaching quality and better preparing students to navigate complex information in academic and real-world contexts.

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