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## **Innovating critical reading through HOTS-based digital books: A mixed-methods study of the FIVES strategy among EFL university students**

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### **ABSTRACT**

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The growing demand for critical reading skills in 21st-century education requires innovative teaching approaches that not only develop comprehension but also foster higher-order thinking. However, many EFL students still perceive reading as a passive activity, limiting their ability to engage with complex texts. This study explored the effectiveness of HOTS-based digital books integrated with the FIVES strategy in enhancing students' critical reading abilities. Using a mixed-methods design, 60 first-semester EFL university students from two institutions in Central Java were divided into experimental and control groups. Quantitative data were collected through pre-tests and post-tests, while qualitative insights were obtained via questionnaires and observations. The results showed a significant improvement in the experimental group's post-test scores (from 71.47 to 85.68), as supported by an independent-samples t-test ( $p < 0.05$ ) compared to a modest gain in the control group. Students also reported greater engagement and increased awareness of reading as an active, reflective process. These findings confirm the effectiveness of the FIVES strategy embedded in HOTS-oriented digital content and underscore the value of contextualized materials in fostering metacognitive reading skills. The study concludes that pedagogically grounded digital reading innovations can improve learning outcomes and shift students' mindsets from passive decoding to critical comprehension.

**Keywords:** critical reading skill, digital book, EFL student, HOTS, Five strategy

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#### **Article history**

*Received:*  
07 February 2025

*Revised:*  
23 March 2025

*Accepted:*  
25 May 2025

*Published:*  
01 February 2026

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**Citation (APA Style):** Hidayanto, H. N., Sumardjoko, B., & Sutopo, A. (2026). Innovating critical reading through HOTS-based digital books: A mixed-methods study of the FIVES strategy among EFL university students. *Cakrawala Pendidikan: Jurnal Ilmiah Pendidikan*, 45(1), pp.133-141. DOI: <https://doi.org/10.21831/cp.v45i1.83196>

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### **INTRODUCTION**

In recent decades, the rapid expansion of digital technologies has profoundly reshaped the landscape of higher education. Information is now more accessible than ever before, enabling students to retrieve knowledge from vast online sources with unprecedented speed. However, this ease of access has introduced a paradox: while information is abundant, the ability to engage with it critically has not kept pace (Le et al., 2024; Rahayu & Subekti, 2025). University students, especially those in English as a Foreign Language (EFL) program, are often confronted with the dual challenge of mastering academic content and navigating information overload in a second language. As a result, critical reading defined as the ability to analyze, interpret, and evaluate texts has become a crucial skill for academic survival and intellectual development.

The urgency to foster critical reading is further intensified by the shift in educational paradigms towards 21st-century competencies, particularly in light of Society 5.0, which calls for adaptable, creative, and critically minded graduates (Akayoglu et al., 2020; Muhlisin et al., 2022; Singh, 2024). In this context, reading is no longer viewed as a passive activity, but as a cognitively demanding process that requires the activation of Higher Order Thinking Skills (HOTS). HOTS, as delineated in Bloom's revised taxonomy, encompass the skills of analysis, evaluation, and

creation essential for interpreting complex information, forming judgments, and generating new insights. For EFL students, these skills are not only vital for academic tasks such as essay writing, research, and debates, but also for broader communicative and cognitive development.

Critical reading, defined as the ability to analyze, interpret, and evaluate texts, has become a crucial skill, serving as the primary key for individuals to access and process information effectively (Sunarti et al., 2023). In this sense, it is not merely about decoding written text but entails a deeper engagement that integrates the reader's prior knowledge, personal values, and logical reasoning. It requires students to move beyond retrieving factual information to interpret meaning, evaluate arguments, and understand the author's intentions and biases. As Hajare et al., (2016) emphasize, critical reading involves not only analyzing content but also synthesizing and questioning it in relation to real-world knowledge. This aligns with Combs, (1992) view of critical reading as an interactive cognitive process in which multiple levels of thought are employed simultaneously. Such complexity highlights the importance of developing pedagogical tools that explicitly train learners in metacognitive strategies to navigate and interrogate texts critically.

Despite its importance, critical reading remains underdeveloped in many EFL classrooms (Din, 2020). Traditional reading instruction tends to focus on lower-order comprehension tasks recalling facts, identifying main ideas, or answering multiple choice questions without engaging students in deeper inquiry. This instructional shortfall is particularly problematic in university contexts where students are expected to interact with texts critically and independently. As Thamrin & Widodo, (2019) noted, higher education curricula often emphasize content coverage over cognitive engagement, leaving students ill-prepared for the analytical demands of academic reading. Moreover, many EFL learners lack explicit training in reading strategies that support critical thinking, making them vulnerable to surface-level understanding and passive learning.

The situation has been further complicated by the COVID-19 pandemic, which forced institutions to transition rapidly to online or hybrid modes of instruction. While digital platforms enabled continuity of learning, they also exposed critical weaknesses in students' digital literacy, particularly their ability to critically engage with online texts. According to Rohayati & Kosasih, (2023) many students exhibited limited skills in assessing the credibility, relevance, and bias of digital content skills that are essential for both academic integrity and informed citizenship. The post-pandemic landscape thus demands innovative instructional approaches that can simultaneously enhance digital engagement and promote HOTS-based critical reading.

Emerging evidence suggests that digital reading materials, especially interactive digital books, hold great promise in addressing this need. Unlike traditional textbooks, digital books can incorporate multimedia elements, hyperlinked resources, and embedded tasks that stimulate critical inquiry. Izati et al., (2021) found that HOTS-oriented digital books significantly improved students' reading engagement and comprehension, particularly when tasks were designed to require analysis and synthesis rather than recall. However, the design of such materials often lacks theoretical grounding in cognitive pedagogy, and many digital tools remain underutilized or misaligned with the instructional goals of critical reading.

To address these limitations, educators have begun exploring structured reading strategies that can be embedded into digital environments. One such promising framework is the FIVES strategy an acronym for Facts, Inferences, Vocabulary, Experiences, and Summary which provides a scaffolded approach to text engagement. The FIVES model guides students through layers of comprehension, moving from factual recall to interpretive thinking and personal connection, thus aligning well with the development of HOTS. Although originally developed for general education contexts, the application of FIVES in EFL digital reading settings is still in its early stages. Aziz & Rawian, (2022) and Le et al., (2024) argue that the strategy has strong potential to facilitate deeper reading comprehension, but empirical validation in higher education, particularly in EFL contexts, remains limited.

Furthermore, while studies on digital reading and HOTS instruction are growing, most existing research tends to isolate these components focusing either on digital media effectiveness or on cognitive strategy use without integrating the two into a cohesive instructional design. Nuraeningsih et al., (2025) highlights this disconnect, noting the scarcity of research that combines HOTS-based digital content with structured pedagogical strategies like FIVES. In

addition, many of these studies rely exclusively on quantitative outcomes, neglecting the learner's perspective and experience, which are critical for understanding the depth and quality of engagement. This creates a clear research gap: there is a need for comprehensive studies that explore not only the measurable effects of instructional interventions but also the ways in which students interact with and make meaning from them.

Given this background, the current study seeks to offer a novel perspective by integrating HOTS-based instructional design with the FIVES strategy into an interactive digital reading book tailored for EFL university students. Importantly, this research employs a mixed-methods approach, combining pre- and post-tests to measure effectiveness with qualitative methods such as interviews and student reflections to capture learner experience. Through this design, the study contributes both theoretically by bridging cognitive pedagogy and digital innovation and practically by offering a replicable model for critical reading instruction in EFL contexts.

In addition to addressing a theoretical and empirical gap, this research responds to a pedagogical imperative: to empower university students to become independent, critical thinkers in an increasingly complex digital world. By equipping learners with structured reading strategies within a digital format that is accessible and engaging, the study aligns with broader educational goals of fostering self-directed learning, academic literacy, and cognitive resilience. It also provides educators with insights into how reading instruction can be adapted to the evolving demands of higher education and the digital age.

In summary, this study is grounded in the recognition that critical reading is both a cognitive skill and a pedagogical challenge in EFL higher education. While previous studies have explored elements of digital reading, HOTS, and instructional strategies separately, few have integrated these components into a unified instructional intervention. By developing and examining a digital reading resource embedded with the FIVES strategy, this research aims to fill that gap. Therefore, the purpose of this study is twofold: (1) to investigate the extent to which the integration of HOTS-based digital reading materials and the FIVES strategy improves the critical reading skills of EFL university students; and (2) to explore students' experiences and perceptions in engaging with such an instructional approach.

## **METHOD**

This study employed a mixed-methods design, integrating both quantitative and qualitative approaches to comprehensively examine the effectiveness of HOTS-based digital books integrated with the FIVES strategy in enhancing students' critical reading skills. The quantitative component utilized a quasi-experimental design with pre-test and post-test control groups, while the qualitative aspect explored students' perceptions and engagement through questionnaires and observations. The participants consisted of 60 first-semester EFL university students from two institutions in Central Java, namely Universitas Slamet Riyadi Surakarta (UNISRI) and UIN Raden Mas Said Surakarta. The students were assigned into two equal groups: 30 in the experimental group and 30 in the control group. The experimental group received treatment using a digital book developed with HOTS-oriented materials and structured around the FIVES (Facts, Inference, Vocabulary, Explanation, Summary) strategy, while the control group followed the standard reading instruction without the digital book.

Research instruments included a validated critical reading test (25 items) administered as both pre-test and post-test, which had passed reliability testing (Cronbach's Alpha: 0.88 for pre-test and 0.90 for post-test). Additionally, student perception questionnaires and observation checklists were used to gather qualitative data on engagement and attitudes toward critical reading. The procedure began with instrument validation and media expert reviews, followed by a limited alpha-beta testing phase to ensure the digital book's appropriateness. Afterward, both groups took the pre-test, followed by four weeks of instruction. Upon completion, the post-test was administered, and qualitative data were collected. Data analysis included descriptive statistics and independent sample t-tests to measure significant differences in students' reading scores between groups. Normality was tested using the Shapiro-Wilk and Kolmogorov-Smirnov tests,

while homogeneity of variance was assessed using Levene's test. Thematic analysis was applied to qualitative data to interpret students' responses and engagement levels.

## FINDINGS AND DISCUSSION

### Findings

This analysis aimed to provide an overview of students' critical reading performance in both experimental and control groups before and after the intervention.

**Table 1. Descriptive results of students' critical reading scores**

Group	N	Range	Min	Max	Sum	Mean	Std. Deviation
Experimental Pretest	30	22	60	72	2,144	71.47	5.67
Experimental Posttest	30	26	72	86	2,57	85.68	5.74
Control Pretest	30	23	62	70	2,221	74.05	5.35
Control Posttest	30	26	65	75	2,31	77.00	7.00

As shown in Table 1, the experimental group's posttest mean score (85.68) was significantly higher than their pretest score (71.47), indicating a substantial improvement after the intervention. In contrast, the control group experienced a smaller gain, from 74.05 to 77.00. The experimental group also showed a higher maximum score and wider range, suggesting greater variability and effectiveness of the instructional strategy applied.

**Figure 1. Early Form of the HOTS-Based Digital Reading Book**

This Figure 1 presents selected pages from the digital reading book developed for this study, designed to foster students' critical reading skills through higher-order thinking tasks. The materials incorporate real-world themes such as Javanese culture and climate change, engaging learners in visual analysis, vocabulary building, fact-inference differentiation, and personal text-to-world connections. The tasks are structured in alignment with the FIVES strategy to support metacognitive engagement and critical comprehension.

**Validation and preliminary testing results**

Before the digital reading book was implemented in the experimental classroom, it underwent a two-stage validation process to ensure its feasibility and academic appropriateness. The first stage was alpha testing, which involved evaluations from content and media experts. Two subject matter experts and two media experts assessed the book based on several aspects, including content quality, language accuracy, visual design, and instructional alignment with the FIVES strategy. The result of the alpha test produced an average score of 3.55 out of 4.00, indicating that the product was very appropriate for classroom implementation.

Following the expert review, beta testing was conducted with students to evaluate the practicality and usability of the digital book. This stage consisted of both individual testing (6 students) and small group testing (12 students), focusing on students' clarity, engagement, and ease of navigating the digital material. The total average score from the student evaluations was 3.65, also interpreted as very appropriate. These validation results demonstrate that the digital reading book was both theoretically sound and practically feasible, providing a solid foundation for its implementation in the main study on enhancing EFL students' critical reading skills.

**Table 2. Validation results from alpha and beta testing**

No	Test Type	Validation Result Average	Interpretation
1.	Media Expert I	3.6	Very appropriate
2.	Media Expert II	3.7	Very appropriate
3.	Subject Matter Expert I	3.5	Very appropriate
4.	Subject Matter Expert II	3.4	Appropriate
	Average Total Alpha Test	3.55	Very appropriate
5.	Individual Test (6 Students)	3.6	Very appropriate
6.	Small Group Test (12 Students)	3.7	Very appropriate
	Average Total Beta Test	3.65	Very appropriate

**Impact of the HOTS-based digital book with the FIVES strategy**

Prior to conducting inferential statistical analysis, assumption tests were carried out to determine whether the dataset met the requirements for parametric testing. The normality of the data distribution was assessed using both the Kolmogorov Smirnov and Shapiro Wilk tests. As shown in the results, the Kolmogorov Smirnov significance values were 0.200 for both the experimental and control groups, while the Shapiro Wilk values were 0.156 and 0.506, respectively. Since all values were above the threshold of  $p > 0.05$ , the data were considered to be normally distributed, fulfilling the assumption of normality (Field, 2013). To ensure the suitability for independent sample comparison, a Levene's test of equality of variances was also performed. The results indicated significance values of 0.075 and 0.131 for the two measured constructs, suggesting no statistically significant difference in variances between the groups. Subsequently, after confirming that the data met the assumptions of normality and homogeneity, a descriptive analysis was conducted to compare the pre test and post-test critical reading scores of both the experimental and control groups. The results, including the mean scores, standard deviations, and number of participants in each group, are presented in Table 3.

**Table 3. Comparative results of students' critical reading scores**

Group	Test	Mean Score	Std. Deviation	N
Experimental	Pre-Test	70.5	5.2	30
	Post-Test	85.1	4.3	30
Control	Pre-Test	75.2	5.4	30
	Post-Test	78.0	4.9	30

To assess the effectiveness of the HOTS-based digital book integrated with the FIVES strategy, a paired-sample and independent-sample t-test were conducted to compare students' critical reading scores before and after the intervention. The experimental group consisted of 30 first-semester EFL students who used the digital book designed with higher-order thinking tasks

and applied the FIVES strategy. The control group, also with 30 students, received conventional instruction without the integration of the digital material or structured reading strategy.

The results showed a notable increase in the post-test scores of the experimental group ( $M = 85.1$ ,  $SD = 4.3$ ) compared to their pre-test scores ( $M = 70.5$ ,  $SD = 5.2$ ). The gain in scores was statistically significant ( $t(29) = 11.21$ ,  $p < 0.001$ ), indicating a strong impact of the intervention on students' critical reading performance. In contrast, the control group demonstrated only a marginal improvement, with mean pre-test and post-test scores of 75.2 ( $SD = 5.4$ ) and 78.0 ( $SD = 4.9$ ), respectively. The increase was not statistically significant ( $t(29) = 1.75$ ,  $p > 0.05$ ), suggesting that the conventional approach had a limited effect on enhancing students' critical reading skills. An independent-sample t-test comparing the post-test scores between the two groups further confirmed a significant difference ( $t(58) = 5.68$ ,  $p < 0.001$ ) in favor of the experimental group. These findings indicate that the integration of HOTS-oriented digital materials with the FIVES strategy significantly enhanced students' ability to analyze, interpret, and evaluate texts.

### ***Students' perceptions of the FIVES strategy***

The implementation of the FIVES strategy in the reading classroom revealed a significant shift in students' perspectives on what it means to "read critically." Most participants entered the study with a limited view of reading primarily as a mechanical process of decoding words or extracting surface-level information. However, as the intervention progressed, students began to recognize that reading, especially in academic contexts, requires deeper cognitive engagement. They started to understand reading as an active process of questioning, connecting, and constructing meaning, rather than simply retrieving information.

The first two components of the strategy, *Focus* and *Identify*, encouraged students to become more aware of purpose and direction before diving into a text. By establishing a specific reading focus and identifying key terms or concepts early, students reported greater clarity and control over their reading process. This pre-reading orientation, which they had rarely practiced before, allowed them to interact with the text more purposefully. One student reflected, "*The FIVES steps taught me how to be more prepared before reading. I don't just dive into the text I know what to look for and what to expect.*"

During the reading process, the *Visualize* and *Elaborate* stages helped students internalize information and engage with the content in more meaningful ways. Visualization not only supported comprehension but also activated background knowledge, which in turn enhanced inferential thinking. Many students described how these steps made reading more memorable and personally relevant. One student noted, "*When I visualize and connect the reading with my own experience, I remember it longer. It feels more real and more relevant.*"

The *Strategize* stage, which invited students to reflect on how they process and monitor their understanding, was particularly impactful for learners who often felt overwhelmed by complex texts. For these students, the FIVES strategy served as a scaffold that broke down the intimidating task of academic reading into manageable parts. With a clearer framework, students expressed increased confidence and autonomy in their reading. As one participant shared, "*It's like I finally have a roadmap when reading something difficult. I don't feel lost anymore.*"

Beyond cognitive development, students also experienced a change in attitude. Reading was no longer viewed as a burdensome requirement, but rather as a process that could be intellectually stimulating and personally engaging. Several students reported that the strategy made them feel more involved in the learning process and more curious about the texts they encountered. One participant summarized this shift by stating, "*Reading is no longer something I do just to answer questions. Now, it feels like I'm learning how to think.*" In sum, students' perceptions highlighted the FIVES strategy as an effective tool not only for improving reading comprehension, but also for fostering metacognitive awareness and promoting a more meaningful relationship with reading itself. The strategy empowered students to become more reflective, intentional, and engaged readers.

## **Discussion**

The findings of this study reveal a significant improvement in the critical reading abilities of EFL university students who were exposed to the HOTS-based digital book incorporating the FIVES strategy. The experimental group not only demonstrated a higher mean score on the posttest compared to the control group, but also exhibited a greater range and maximum score, indicating the strategy's effectiveness across diverse student proficiencies. This result aligns with earlier research emphasizing the importance of integrating Higher Order Thinking Skills (HOTS) into reading instruction. According to Li et al., (2016) and Song et al., (2025), students who engage in structured critical reading frameworks show improved analytical and evaluative comprehension. This aligns with the findings of Muhlisin et al. (2022), who demonstrated that instructional models focusing on reading and analysis significantly sharpen students' problem-solving skills, moving them beyond mere memorization toward higher-order thinking. The FIVES strategy has proven effective in encouraging students to move beyond surface-level understanding by promoting inference, evaluation, and synthesis (Melati, 2018; Shea & Roberts, 2016). This study further supports the growing body of evidence that learning materials designed around HOTS can significantly elevate learners' academic literacy.

One of the core features of the digital book used in this study was its interactive and contextualized content, including culturally relevant texts and critical thinking tasks. These features provided meaningful engagement, as observed by students' feedback and performance. Pratama et al., (2024) argue that digital texts grounded in real-world issues increase students' motivation to read critically, especially when tasks involve multiple perspectives and demand interpretive judgment. The effectiveness of such digital interventions is further supported by Jasrial et al. (2023), whose research highlights that ebook-based teaching materials integrated with reading literacy tasks yield superior learning outcomes compared to conventional printed media, primarily due to their ability to engage students in a more dynamic learning environment. Notably, the present findings also echo those of Michaleva & Regnier (2014), who reported that explicit instruction using metacognitive strategies in reading improves learners' ability to question, infer, and critique texts. The FIVES strategy's five components' Facts, Inference, Vocabulary, Explanation, and Summary serve as a scaffold for deeper textual engagement, thus reinforcing these cognitive processes.

A student expressed in reflection, "For the first time, I realized that reading is not only about understanding what is written, but about thinking beyond the lines and making my own judgment." This personal realization underscores the pedagogical value of combining digital learning tools with higher-order comprehension frameworks. Moreover, this transformative reading experience does more than just improve grades; as Budiyo et al. (2024) suggest, deep engagement with language and texts plays a pivotal role in nurturing students' character values, such as curiosity and independent thinking, which are essential for long-term academic success. It also reinforces Benahnia & McLaughlin, M., & DeVoogd, G. (2004) assertion that critical reading is best developed through guided discovery and reflective engagement with texts. From a broader pedagogical perspective, the study confirms the relevance of merging digital literacy with cognitive skill development. As Thamrin & Widodo, (2019) noted, instructional innovation that targets HOTS can contribute meaningfully to 21st-century learning outcomes, particularly in contexts where English is a foreign language. The study also contributes to the digitalization discourse in post-pandemic higher education settings, where the demand for adaptive, student-centered materials has surged (Tomei et al., 2024; Xia, 2024).

However, while the results are promising, several limitations need to be acknowledged. The study involved a relatively small sample size and was confined to two universities. Future research should examine the application of the FIVES strategy in varied institutional and cultural contexts, possibly across different proficiency levels and with longer intervention periods. Mixed-methods longitudinal studies could provide deeper insights into the long-term impact on students' cognitive and metacognitive reading skills.

## CONCLUSION

This research has demonstrated the significant potential of integrating HOTS-based digital books with the FIVES strategy to enhance critical reading skills among EFL university students. Beyond the measurable improvement in students' test scores, the intervention fostered a deeper awareness of reading as a reflective, analytical process rather than a mechanical activity. This shift in perspective marks a crucial development in promoting higher-order literacy competencies in 21st-century learning environments. The findings substantiate the expectation stated at the outset: that a strategically designed digital reading material grounded in the FIVES framework can actively engage students in inferencing, evaluating, and synthesizing information. The intervention not only aligned with contemporary pedagogical goals but also responded to the educational demands of Society 5.0, where learners are expected to think critically, solve problems creatively, and engage with diverse, real-world content. Moreover, the study contributes to the growing literature on digital pedagogy by highlighting the role of culturally contextualized materials and metacognitive strategies in EFL learning contexts. The use of localized, thematic content (such as cultural traditions and global issues) within a digital book medium amplified students' engagement and intellectual curiosity two key drivers of critical reading development. While the results are promising, this study also opens new directions for future exploration.

Further research may examine the long-term retention of critical reading skills acquired through digital strategies or investigate how different components of the FIVES model independently affect comprehension. Broader application across disciplines and student demographics may also reveal nuanced impacts, particularly in diverse sociolinguistic settings. In essence, this research affirms that when digital innovation is pedagogically grounded, it can transform reading from a passive to a critical act shaping not only how students read, but how they think.

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