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The Effectiveness of Digital Literacy to Improve Students' Reading Comprehension and Critical Thinking

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Abstract

This study examines whether integrating digital literacy–based activities into English for Academic Purposes (EAP) instruction enhances undergraduate students' academic reading skills and critical thinking. Addressing a gap in the literature where academic reading and critical thinking are often treated as separate outcomes and digital literacy is frequently reduced to tool use, this study conceptualizes digital literacy as a pedagogical framework that supports higher-order engagement with academic texts. Eight sessions of digitally enhanced EAP instruction were implemented in an experimental class (n = 44), focusing on students' abilities to critically access, evaluate, and construct meaning from academic readings, while the other class (n = 45) received conventional EAP instruction. The results revealed that the experimental group achieved significantly greater gains than the control group in both academic reading (U = 596.50, p = 0.001) and critical thinking (U = 253.00, p < 0.001). These findings suggest that digital literacy functions as a mediating pedagogical approach that deepens students' engagement with academic texts and fosters higher-order reasoning. Conceptually, the study extends EAP instructional models by demonstrating that academic reading and critical thinking can be developed simultaneously through integrated digital literacy practices. The study recommends that EAP instructors systematically embed digital literacy–oriented activities to strengthen students' academic literacy.

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INTRODUCTION

Academic reading and critical thinking are foundational competencies for undergraduate success, particularly in academic contexts where students are required to engage with English scholarly texts (Afflerbach et al., 2015; Grabe & Stoller, 2019; Kim, 2001). For many undergraduate students in English as a Foreign Language (EFL) settings, however, comprehension of academic texts and the ability to analyze, synthesize, and evaluate arguments remain underdeveloped (Hyland, 2019; Zhang & Zhang, 2020). These challenges are further intensified by the rapid digital transformation of higher education, where students increasingly access academic materials through digital platforms and technology-mediated learning environments (Selwyn, 2016).

English for Academic Purposes (EAP) is specifically designed to equip undergraduate students with the linguistic, cognitive, and strategic competencies required for participation in academic communities ((Hyland & Shaw, 2016). Unlike general English instruction, EAP emphasizes mastery of academic genres, discourse conventions, and higher-order cognitive processes such as critical reading, synthesis, and evaluation of information(Hyland & Shaw, 2016). Nevertheless, several studies indicate that EAP instruction in many contexts continues to prioritize language form and surface-level comprehension, with comparatively limited emphasis on systematic development of critical thinking skills(Atkinson, 2018; Wallace, 2012).

Parallel to developments in EAP, digital literacy has emerged as a core competency for academic success in the 21st century. Digital literacy is broadly defined as the ability to locate, evaluate, interpret, and produce information using digital technologies, encompassing procedural, cognitive, and metacognitive dimensions(UNESCO, 2017). Research suggests that when embedded pedagogically, digital literacy can foster deeper engagement with academic texts by supporting source evaluation, information synthesis, and reflective strategy use (Leu et al., 2015; Yang & Warchauer, 2020). In EAP contexts, this integration offers a promising avenue for linking academic reading with higher-order thinking processes.

From a theoretical perspective, integrating digital literacy into EAP aligns with sociocultural theory, which views learning as mediated through tools and social interaction(Vygotsky, 1978). It is also consistent with constructivist and connectivist perspectives that conceptualize knowledge as actively constructed and distributed across networks of texts, tools, and learners. Digital academic environments require learners to evaluate source credibility, identify bias, and synthesize multiple perspectives—abilities that are central to critical thinking

(Facione, 2016; Luke, 1012). Thus, digital literacy in EAP should be understood not as an add-on, but as a pedagogical means of operationalizing established learning theories.

The urgency of strengthening digital literacy within EAP classrooms has been amplified by several converging trends. The expansion of online and blended learning following the COVID-19 pandemic has made digital engagement a prerequisite for academic participation(Bond et al., 2021; Peng & Yu, 2022). Furthermore, higher education institutions and employers increasingly expect graduates to critically evaluate information, solve complex problems, and navigate digital environments with discernment (F. Rahayu et al., 2022). Despite these demands, language curricula in many EFL contexts remain heavily focused on vocabulary, grammar, and translation, with limited attention to digital source evaluation and critical reasoning (Wallace, 2012; Widodo, 2016).

Empirical research has demonstrated positive relationships between digital literacy, student engagement, and academic achievement in higher education(Getenet et al., 2024; Hatlevik & Christophersen, 2013; Holm, 2024). In EFL and EAP contexts, pedagogical interventions such as critical thinking instruction and flipped classroom models have been shown to improve reading comprehension and critical thinking outcomes (Moghadam et al., 2023; A. Yulian, 2024; R. Yulian, 2024). However, despite these advances, few quasi-experimental studies have simultaneously examined academic reading comprehension and critical thinking as joint outcomes within EAP instruction, particularly through a digital literacy–based pedagogical framework.

Addressing this gap, the present quasi-experimental study investigates whether integrating structured digital literacy activities into EAP instruction leads to greater gains in undergraduate students' academic reading skills and critical thinking compared to conventional EAP instruction. By examining both outcomes concurrently, this study seeks to contribute empirical evidence to EAP pedagogy and clarify the role of digital literacy as a mediating approach for developing academic literacy in higher education.

METHODS

This study employed a quasi-experimental pretest–posttest control group design involving two intact classes enrolled in an English for Academic Purposes (EAP) course. One class was designated as the experimental group and received digital-literacy-enhanced EAP instruction, while the other served as the control group and followed conventional EAP instruction. This design enabled comparison

of learning gains between groups while accommodating institutional constraints that precluded individual random assignment (Em, 2018; Sugiyono, 2017).

The participants were 89 undergraduate students from non-English-major programs at a private university in Banjarmasin, South Kalimantan. The experimental group consisted of 44 students, and the control group comprised 45 students. Purposive sampling was employed because class groupings were administratively predetermined, and all participants were required to be enrolled in the EAP course during the same academic semester. To ensure baseline equivalence despite the absence of randomization, several procedures were implemented. First, pretest scores in academic reading and critical thinking were analyzed using homogeneity and equivalence tests, which confirmed that there were no statistically significant differences between the two groups prior to the intervention. Second, both groups were provided with identical course objectives, instructional time, academic texts, and assessment schedules. Third, participants in both groups had comparable access to digital devices and internet connectivity. Together, these measures strengthened the internal validity of the study.

Two instruments were used to collect quantitative data: an academic reading test and a critical thinking test. The academic reading test consisted of 25 multiple-choice items aligned with CEFR reading descriptors at the B1–B2 levels. It assessed four constructs: literal comprehension, inferential comprehension, identification of author stance, and synthesis across texts. Each correct response was awarded one point, yielding a maximum score of 25. The test included short academic passages followed by tasks requiring students to identify main ideas, interpret implicit meanings, evaluate arguments, and integrate information across multiple paragraphs. Content validity was established through expert judgment involving two EAP lecturers and one language assessment specialist. A pilot test was administered to 30 students from a comparable cohort, and item difficulty indices were analyzed to ensure a moderate level of difficulty. Reliability analysis using Cronbach's alpha produced a coefficient of .82, indicating good internal consistency.

The critical thinking test comprised 20 multiple-choice items adapted from Bloom's revised taxonomy and the Watson–Glaser Critical Thinking framework. The instrument assessed three core skills: inference, evaluation, and deduction. Items were scored dichotomously (1 for correct and 0 for incorrect), resulting in a maximum possible score of 20. Test tasks required students to evaluate claims, draw logical conclusions, and identify underlying assumptions based on short academic scenarios or argumentative texts. The instrument underwent expert validation by two education researchers and one assessment expert, followed by

pilot testing to refine item clarity and discrimination. Reliability analysis yielded a Cronbach's alpha of .79, indicating acceptable reliability for research purposes.

The study was conducted over eight instructional sessions, each lasting 100 minutes. Before the intervention, both groups completed pretests in academic reading and critical thinking. During the treatment phase, the experimental group received EAP instruction integrated with digital literacy activities, whereas the control group followed conventional EAP instruction. In the experimental group, digital literacy components were systematically embedded into each session and included source evaluation tasks using credibility checklists and online academic databases, collaborative online annotation of academic texts through LMS-based tools, and multimedia synthesis tasks that required students to integrate information from multiple digital sources into short presentations or written summaries. These activities were supported by tools such as LMS discussion forums, Zoom breakout rooms, Kahoot, and Canva. Instructional fidelity was monitored through lesson plans, observation checklists, and consistent implementation of tasks across sessions.

In contrast, the control group received teacher-led EAP instruction that emphasized vocabulary explanation, grammar clarification, text comprehension questions, and individual written exercises. Although both groups used the same academic texts, learning objectives, and instructional duration, the control group did not receive explicit digital literacy instruction or technology-mediated tasks beyond basic content delivery. At the end of the treatment period, both groups completed posttests in academic reading and critical thinking.

Quantitative data were analyzed using statistical software. Descriptive statistics were calculated to summarize students' scores. Independent-samples t-tests were conducted to examine baseline equivalence between the groups, while paired-samples t-tests were used to analyze within-group pretest–posttest gains. Independent-samples t-tests were also applied to compare gain scores between the experimental and control groups. Effect sizes were calculated using Cohen's to determine the magnitude of the intervention effects, and statistical significance was set at $p < .05$.

RESULTS AND DISCUSSION

Results

Preliminary Analysis

Prior to hypothesis testing, normality and homogeneity analyses were conducted to determine appropriate statistical procedures. As shown in Table 1, several pretest and posttest datasets did not meet the assumption of normal distribution ($p < .05$). Therefore, non-parametric analysis using the Mann–Whitney U test was employed.

Table 1. The Result of Normality Test

Variable	Group	*Sig. (p)*
ART Pretest	Exp	.003
ART Pretest	Cont	.025
CTT Pretest	Exp	.050
CTT Pretest	Cont	.071
ART Posttest	Exp	.000
ART Posttest	Cont	.004
CTT Posttest	Exp	.018
CTT Posttest	Cont	.051

Homogeneity tests were then conducted on pretest scores to ensure baseline equivalence between the experimental and control groups. As presented in Table 2, the significance values for academic reading ($p = .671$) and critical thinking ($p = .484$) exceeded .05, indicating no statistically significant differences between groups prior to the intervention.

Table 2. Homogeneity Testing

Variable	F	*Sig. (p)*
ART Pretest	0,354	0,671
CTT Pretest	0,472	0,484

Based on the table above, it confirms that the two group were comparable at the beginning of the study.

Academic Reading Skill

The results of the effectiveness test of digital literacy in the EAP course on students' academic reading skills are presented in Tables 3 and 4 below.

Table 3. Mann–Whitney U Test for Academic Reading Gain Scores

Group	N	Mean Rank	Sum Of Ranks
Experimental	44	53.94	2,373.50
Control	45	36.26	1,631.50
Total	89		

As shown in Table 3, the experimental group obtained a higher mean rank (53.94) than the control group (36.26), indicating greater gains in academic reading.

Table 4. Statistics Test for Academic Reading Gain Scores

	Gainscore_Reading
Mann–Whitney U	596.500
Wilcoxon W	1,631.500
Z	–3.254
Asymp. Sig. (2-Tailed)	0.001

As shown in Tables 4, the Mann–Whitney U test yielded U = 596.50, Z = –3.254, p = 0.001 (p < 0.05), indicating a statistically significant difference in academic reading gains between groups.

Critical Thinking Skill

The results of the effectiveness test of digital literacy in the EAP course on students' critical thinking skills are presented in Tables 5 and 6 below.

Table 5. Mann–Whitney U Test for Critical Thinking Gain Scores

Group	**N**	**Mean Rank**	**Sum of Ranks**
Experimental	44	61.75	2,717.00
Control	45	28.62	1,288.00
Total	89		

Table 5 indicates that the experimental group achieved a substantially higher mean rank (61.75) than the control group (28.62).

Table 6. Statistics Test for Gain Scores of Critical Thinking

	Gainscore_Crtical Thining
Mann–Whitney U	253.000
Wilcoxon W	1,288.500
Z	–6.068
Asymp. Sig. (2-Tailed)	0.000

Inferential results in Table 6 reveal a statistically significant difference between the two groups (U = 253.00, Z = –6.068, p < .001).

Discussion

This study examined the effectiveness of integrating digital literacy activities into an English for Academic Purposes (EAP) course in enhancing undergraduate students' academic reading and critical thinking skills. The results indicate that students in the digital-literacy-enhanced EAP group achieved significantly greater gains in both outcomes than those receiving conventional

instruction. These findings can be meaningfully interpreted in light of existing theories and empirical studies on academic literacy, critical thinking, and digital learning.

Academic Reading Development through Digital Literacy

The significant improvement in academic reading skills among students in the experimental group supports theoretical models of academic reading that emphasize rhetorical awareness, strategic processing, and metacognitive monitoring(Grabe & Stoller, 2019; Hyland, 2019; Jiang & Grabe, 2017; Leu et al., 2015; A. Yulian, 2024). Academic reading requires more than decoding linguistic forms; it involves understanding author stance, evaluating arguments, and synthesizing information across texts (Dewi et al., 2024; Faradella, 2024). The digital literacy activities implemented in this study—such as source evaluation checklists and collaborative online annotation—directly scaffolded these processes.

From a sociocultural perspective, digital tools function as mediational means that extend learners' cognitive capacities(Arifiana & Suryati, 2024; Vygotsky, 1978; Wallace, 2012; Zhang & Zhang, 2020). Learning management systems and online annotation platforms acted as cultural artifacts that enabled students to externalize thinking, negotiate meaning collaboratively, and monitor comprehension in real time. This finding aligns with previous research showing that technology-mediated reading environments promote deeper engagement with academic texts(Hafner et al., 2015; Hockly, 2015; Yang & Warchauer, 2020).

Empirically, the results corroborate studies indicating that digital literacy is positively associated with academic engagement and achievement in higher education(Getenet et al., 2024; Holm, 2024; D. Rahayu et al., 2022; Vu & Fulgencio, 2020). However, the present study extends this literature by demonstrating that digital literacy integration within EAP instruction specifically enhances academic reading performance, rather than merely increasing general engagement.

Critical Thinking Enhancement in Digital-Literacy-Enhanced EAP

The substantial gains in critical thinking skills observed in the experimental group are consistent with established definitions of critical thinking as purposeful, analytical, and self-regulatory judgment(Facione, 2016; Redjeki et al., 2023). The digital literacy tasks required students to evaluate source credibility, identify bias, draw inferences, and synthesize information from multiple digital texts—core components of critical thinking as articulated in both Bloom's revised taxonomy and the Watson–Glaser framework.

These findings resonate with constructivist and connectivist perspectives, which conceptualize learning as an active process of knowledge construction

across networks of information and interaction (A. Yulian, 2024). Digital environments inherently demand evaluative decision-making, particularly when students are exposed to abundant and uneven-quality information. As argued by Luke (2012) and UNESCO (2017), such environments make critical literacy and digital literacy inseparable.

The present findings are also consistent with prior EFL and EAP studies demonstrating that pedagogical interventions emphasizing critical thinking can improve reading comprehension and evaluative skills (Moghadam et al., 2023; Rahmawati et al., 2023; A. Yulian, 2024; R. Yulian, 2024). Importantly, this study shows that critical thinking gains can be achieved not through standalone critical thinking instruction, but through the systematic integration of digital literacy tasks into EAP coursework.

Finally, this study adds value to the literature by filling the gap identified in the Introduction—few studies had rigorously tested a combined digital literacy and EAP model on both reading and critical thinking. The evidence here supports an integrated approach that aligns with Hyland's (2019) emphasis on rhetorical awareness in EAP, Facione's (2015) model of critical thinking, and UNESCO's (2017) digital literacy framework. As a result, it contributes a replicable and scalable instructional design that other institutions can adapt to enhance their students' academic success.

Integrated Interpretation and Implications

Taken together, the findings support UNESCO's (2017) conceptualization of digital literacy as a multidimensional competence encompassing procedural, cognitive, and metacognitive skills. In this study, digital literacy did not function merely as a technical add-on, but as a mediating construct that linked academic reading strategies with higher-order thinking processes.

This integrated perspective is consistent with prior calls to reconceptualize EAP instruction beyond language form to include critical engagement with knowledge and discourse practices (Hyland, 2019; Jiang & Grabe, 2017). While previous studies have tended to examine academic reading and critical thinking separately, the present study provides empirical evidence that both skills can be developed simultaneously through carefully designed digital literacy integration.

Theoretically, this study extends existing EAP models by empirically demonstrating that digital literacy can accelerate the co-development of academic reading and critical thinking within a single instructional framework. This addresses a notable gap in the literature, as few quasi-experimental studies have measured both outcomes concurrently in EAP contexts(Peng & Yu, 2022; D. Rahayu et al., 2022).

Practically, the findings offer a replicable and scalable instructional model for EAP instructors. The digital literacy activities employed—online annotation, source evaluation, and multimedia synthesis—are relatively low-cost and adaptable to diverse institutional settings, including private universities with limited resources. The fact that medium to large effects were achieved within eight instructional sessions further demonstrates the feasibility of integrating digital literacy into existing EAP curricula without extensive curricular restructuring.

CONCLUSION

This study contributes to ongoing efforts to reconceptualize English for Academic Purposes (EAP) instruction in response to the demands of digitally mediated academic communication. Rather than positioning digital literacy as a supplementary skill, the findings demonstrate its role as a pedagogical mechanism that enables the simultaneous development of academic reading and critical thinking. In this sense, the study advances EAP pedagogy by offering empirical support for an integrated instructional model in which language, cognition, and digital practices operate as a unified system.

For EAP pedagogy, the findings suggest that not all digital practices are equally impactful. The most essential digital literacy activities are those that explicitly scaffold evaluative and analytical processes, particularly (1) structured source evaluation tasks that guide students in assessing credibility and bias, (2) collaborative online annotation that externalizes comprehension and supports rhetorical awareness, and (3) synthesis-oriented tasks that require students to integrate information across multiple texts and modes. These practices move EAP instruction beyond surface-level comprehension toward deeper academic literacy and can be implemented without extensive curricular restructuring.

From a curricular and institutional perspective, this study offers a practical model that is scalable and feasible within typical semester constraints. The intervention demonstrates that meaningful gains in academic competencies can be achieved through targeted digital literacy integration, even in contexts where resources are limited but digital access is available.

Despite these contributions, the study has several limitations that open avenues for future research. First, the intervention focused on short-term learning gains; future studies are needed to examine whether improvements in academic reading and critical thinking are sustained over time. Second, this study did not examine how individual differences in students' initial digital literacy levels may have influenced learning outcomes. Future research could investigate digital literacy as a moderating variable rather than only an instructional component. Finally, further studies could explore how specific digital tools or task designs

differentially support distinct dimensions of academic reading and critical thinking.

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