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DIGITAL LITERACY AND AI UTILIZATION IMPACTS ON ENGLISH WRITING PROFICIENCY IN INDONESIAN HIGHER EDUCATION

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ABSTRACT

The rapid integration of artificial intelligence in education has transformed how Indonesian university students approach academic writing. This study investigates the influence of digital literacy and the utilization of artificial intelligence on English writing proficiency. Using a quantitative explanatory survey design, data were collected from fifty-five undergraduate students selected through purposive sampling at a private university. The study employed a structured questionnaire to measure information evaluation, ethical awareness, and artificial intelligence usage patterns. Data analysis was conducted using Structural Equation Modeling based on Partial Least Squares. The results demonstrate that digital literacy significantly enhances writing proficiency by enabling students to evaluate sources and maintain ethical standards. Similarly, the utilization of artificial intelligence positively impacts writing outcomes, particularly in improving grammatical accuracy and lexical sophistication. Furthermore, the simultaneous interaction of these variables serves as a strong predictor of overall writing competence. The findings conclude that while artificial intelligence provides essential technical support, digital literacy remains the critical cognitive foundation for effective usage. These insights suggest that higher education institutions should prioritize integrated curriculums that combine technical training with robust digital literacy education to foster independent and proficient academic writers.

Keywords: Digital Literacy, Artificial Intelligence, Writing Proficiency, Higher Education.

ABSTRAK

Integrasi kecerdasan buatan yang pesat dalam pendidikan telah mengubah cara mahasiswa universitas di Indonesia mendekati penulisan akademik. Studi ini menyelidiki pengaruh literasi digital dan pemanfaatan kecerdasan buatan terhadap kemampuan menulis bahasa Inggris. Dengan menggunakan desain survei penjelasan kuantitatif, data dikumpulkan dari lima puluh lima mahasiswa S1 yang dipilih melalui pengambilan sampel bertujuan di sebuah universitas swasta. Studi ini menggunakan kuesioner terstruktur untuk mengukur evaluasi informasi, kesadaran etika, dan pola penggunaan kecerdasan buatan. Analisis data dilakukan menggunakan Pemodelan Persamaan Struktural berdasarkan Kuadrat Terkecil Parsial (Partial Least Squares). Hasil penelitian menunjukkan bahwa literasi digital secara signifikan meningkatkan kemampuan menulis dengan memungkinkan mahasiswa untuk mengevaluasi sumber dan menjaga standar etika. Demikian pula,

pemanfaatan kecerdasan buatan berdampak positif pada hasil penulisan, khususnya dalam meningkatkan akurasi tata bahasa dan kecanggihan leksikal. Lebih lanjut, interaksi simultan dari variabel-variabel ini berfungsi sebagai prediktor yang kuat dari kompetensi menulis secara keseluruhan. Temuan menyimpulkan bahwa meskipun kecerdasan buatan memberikan dukungan teknis yang penting, literasi digital tetap menjadi fondasi kognitif yang penting untuk penggunaan yang efektif. Wawasan ini menunjukkan bahwa lembaga pendidikan tinggi harus memprioritaskan kurikulum terintegrasi yang menggabungkan pelatihan teknis dengan pendidikan literasi digital yang kuat untuk membina penulis akademik yang mandiri dan mahir.

Kata Kunci: Literasi Digital, Kecerdasan Buatan, Kemampuan Menulis, Pendidikan Tinggi.

A. Introduction

The digital transformation of higher education has fundamentally reshaped the landscape of English language pedagogy globally, and particularly within the developing context of Indonesia. In this rapid shift, digital literacy has evolved from a supplementary skill to a core competency required for academic success, especially as universities integrate more complex digital ecosystems for instruction (Bachtiar, 2025). However, the adoption of these technologies in Indonesia remains uneven, characterized by significant infrastructural barriers and varying levels of lecturer and student readiness (Taridi et al., 2025; Nurtanto et al., 2025). Recent studies highlight that while digital integration offers opportunities to bridge educational gaps, it also exposes challenges related to the "digital divide" and the effective implementation of technology in local curriculums (Fatonah, 2025; Hamid et al., 2025).

Concurrent with this digital shift is the unprecedented proliferation of Artificial Intelligence (AI) tools, which have disrupted traditional methods of writing instruction. The availability of AI-powered writing assistants has created a new paradigm where students frequently engage with automated feedback to refine their work (Syafei & Nuraeningsih, 2025). In the Indonesian context, students and teachers generally express positive attitudes toward these tools, viewing them as aids for efficiency and confidence building (Rafida et al., 2024). Yet, this phenomenon brings critical pedagogical tensions; the ease

of access to generative AI often outpaces the students' ethical understanding and critical evaluation skills, leading to concerns about academic integrity and the authenticity of student writing (Yusra & Hanifa, 2025). Consequently, understanding the interplay between a student's digital literacy and their utilization of AI has become an urgent academic necessity.

Digital literacy in this research is defined as a multidimensional construct encompassing the technical and cognitive skills required to navigate the digital world effectively. Specifically, it is measured through five key indicators: the ability to access information, evaluate source credibility, use technology for learning, awareness of digital ethics (including plagiarism), and the capacity to integrate digital information into academic tasks (Nabhan & Habók, 2025). Empirical evidence strongly suggests a positive correlation between digital literacy and English proficiency, where students with higher digital competence demonstrate superior critical thinking and research capabilities (Zhang, 2025; Indah et al., 2022). Furthermore, digital literacy is not merely about consumption but also involves collaboration and the creation of content, which are essential for modern academic writing (Indriyani et al., 2025). However, scholars note that without robust assessment instruments and training, the potential of digital literacy to support academic writing remains underutilized in many higher education settings (Suri et al., 2025; Werdiningsih et al., 2025).

Complementing digital literacy, AI utilization is operationalized in this study through four indicators: frequency of use, types of AI tools employed, perceived ease of use, and perceived usefulness. The literature confirms that when used effectively, AI tools act as powerful scaffolds that enhance learner autonomy and self-regulated learning strategies (Liu & Zhang, 2025; Jamshed et al., 2024). For instance, generative AI has been proven to significantly improve writing quality by providing iterative feedback on grammar and style (Mekheimer, 2025; Amoush & Alhosban, 2025). Nevertheless, the utilization of these tools is a double-edged sword; improper use without ethical guidance can lead to overreliance, potentially eroding students' independent writing abilities (Budiyono et al., 2025).

Therefore, frameworks emphasizing the ethical use of AI are becoming increasingly critical to ensure that technological adoption aligns with educational goals (Amini et al., 2025; Chinoracky & Stalmasekova, 2025).

English Writing Proficiency, the dependent variable, is assessed through four standard international indicators: grammar accuracy, vocabulary use, coherence and cohesion, and clarity of ideas. Research consistently shows that AI writing assistants can dramatically enhance surface-level features such as grammatical accuracy and lexical diversity (Deep & Chen, 2025; Corbita & Al Ghafri, 2025). However, the impact on higher-order skills like coherence and the logical organization of arguments is less distinct and often requires human intervention or advanced digital literacy to perfect (Marzuki et al., 2023). Moreover, while AI can aid in reducing writing anxiety and improving fluency, there is evidence that it must be paired with solid linguistic competence to prevent students from producing formulaic or conceptually shallow content (Abuhussein & Badah, 2025; Pryma et al., 2025).

Despite the extensive individual studies on digital literacy and AI, a significant research gap exists regarding their combined effects within the specific socio-educational context of developing countries like Indonesia. Existing research often treats these variables in isolation or focuses on contexts with well-established digital infrastructures, failing to capture the unique challenges of resource-constrained environments (Roh et al., 2025; Zulianti et al., 2025). There is a lack of cohesive frameworks that integrate "digital ethics" and "information integration" capabilities specifically as moderators of AI utility in academic writing (Nhung & Huong, 2025). Additionally, current literature has not sufficiently addressed how the rapid adoption of AI tools by novice users in Indonesia interacts with their foundational digital literacy to influence long-term writing outcomes (Drajati et al., 2025).

The novelty of this research lies in its integrated approach to examining how digital literacy skills specifically moderate the impact of AI utilization on writing proficiency. Unlike previous studies that focus primarily on the acceptance of

technology, this research highlights the critical role of "ethical awareness" and "source evaluation" as determinants of whether AI usage leads to genuine proficiency or mere dependency (Yusra & Hanifa, 2025). By situating this study in Indonesian higher education, it provides new empirical insights into the "digital divide" and "AI literacy" gaps that are unique to this region (Bachtiar, 2025; Taridi et al., 2025). This study thereby contributes to the development of context-sensitive pedagogical models that balance technological assistance with the preservation of cognitive writing skills (Ali et al., 2025).

The primary objective of this research is to analyze and determine the magnitude of influence exerted by digital literacy and artificial intelligence utilization, both individually and simultaneously, on the English writing proficiency of university students in Indonesia.

Based on the empirical evidence and theoretical frameworks reviewed, the hypothesis is formulated as follows. It is hypothesized that digital literacy has a significant positive influence on writing proficiency, as skills in evaluation and integration are crucial for academic writing. Secondly, it is hypothesized that the utilization of AI positively influences writing proficiency, particularly in grammar and vocabulary, provided the usage is ethically grounded. Finally, it is hypothesized that digital literacy and AI utilization simultaneously influence English writing proficiency, where high digital literacy amplifies the benefits of AI tools while mitigating the risks of overreliance, leading to superior overall writing competence.

B. Method

This research adopts a quantitative approach (Rahmansyah et al., 2021) employing an explanatory survey design to empirically investigate the causal relationships between digital literacy, artificial intelligence utilization, and English writing proficiency. The study was conducted at Universitas Panca Marga, specifically targeting active undergraduate students who are currently enrolled in academic writing courses or English proficiency modules. From this population, a sample of 55 respondents was determined utilizing a purposive sampling technique. This non-probability sampling method was strategically chosen to ensure that all

participants met specific inclusion criteria, particularly the requirement of having active experience using AI-based writing assistants such as ChatGPT or Grammarly during their academic studies, ensuring the data reflects genuine user experiences. The primary instrument for data collection was a structured questionnaire, rigorously designed to measure the three latent variables. The items assessed Digital Literacy (focusing on information access, evaluation, and digital ethics), AI Utilization (covering frequency, types of tools, and perceived usefulness), and English Writing Proficiency (evaluating perceived improvements in grammar, vocabulary, and cohesion). All responses were recorded using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing for a nuanced capture of student perceptions. To analyze the collected data, this study employed Structural Equation Modeling (SEM) based on Partial Least Squares (PLS), utilizing the SmartPLS software (Dhany & Rahmansyah, 2022; Hudzafidah, Dhany, et al., 2023; Rahmansyah, Hudzafidah, et al., 2024). This analytical tool was selected due to its robustness in handling smaller sample sizes and its efficacy in predictive modeling. The data analysis process involved a two-stage evaluation (Dhany et al., 2025; Hudzafidah, Rahmansyah, et al., 2023; Rahmansyah, Dhany, et al., 2024; Rahmansyah & Dhany, 2023): first, the assessment of the measurement model (outer model) to verify convergent validity, discriminant validity, and composite reliability; and second, the assessment of the structural model (inner model) to examine the path coefficients, R-square values, and t-statistics, thereby allowing for the accurate testing of the proposed hypotheses regarding the interplay between digital competence, AI adoption, and writing outcomes.

C.Result and Discussion

RESULTS

Measurement Model Evaluation (Outer Model)

The first stage of the analysis involved testing the validity of each indicator through outer loadings. Table 1 below details the loading values for every item used to measure Digital Literacy, AI Utilization, and English Writing Proficiency.

Table 1. Indicator Loadings

Variable	Item Code	Outer Loading
Digital Literacy (X1)	X1.1	0.946
	X1.2	0.919
	X1.3	0.886
	X1.4	0.937
	X1.5	0.922
AI Utilization (X2)	X2.1	0.919
	X2.2	0.849
	X2.3	0.857
	X2.4	0.905
Writing Proficiency (Y)	Y.1	0.904
	Y.2	0.896
	Y.3	0.872
	Y.4	0.929

Based on the data presented in Table 1, the validity of the measurement model is firmly established. All fifteen indicators across the three variables possess outer loading values that significantly exceed the standard threshold of 0.70, ranging from a minimum of 0.849 to a maximum of 0.946. This confirms that every item is statistically valid and contributes meaningfully to the construct it intends to measure, necessitating no removal of indicators from the model.

Following the indicator assessment, the internal consistency and convergent validity of the latent constructs were examined. Table 2 presents the reliability coefficients and the Average Variance Extracted (AVE).

Table 2. Reliability and Convergent Validity Profile

Construct	Cronbach's Alpha	Composite Reliability (ρa)	Composite Reliability (ρc)	AVE
Digital Literacy (X1)	0.956	0.958	0.966	0.851

AI Utilization (X2)	0.905	0.911	0.934	0.779
Writing Proficiency (Y)	0.922	0.927	0.945	0.811

As depicted in Table 2, the model demonstrates excellent reliability and validity. The Cronbach's Alpha and Composite Reliability values for all three variables are well above the recommended 0.70 cutoff, with Digital Literacy showing particularly high internal consistency (α = 0.956). Furthermore, the Average Variance Extracted (AVE) values range from 0.779 to 0.851, which are all superior to the 0.50 threshold, indicating that the constructs are able to explain more than 50% of the variance in their respective indicators.

To ensure that the constructs are empirically distinct from one another, discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio. Table 3 illustrates the correlation ratios between the variables.

Table 3. Discriminant Validity Analysis (HTMT)

Relationship	HTMT Ratio
AI Utilization <-> Digital Literacy	0.133
Writing Proficiency <-> Digital Literacy	0.841
Writing Proficiency <-> AI Utilization	0.592

The results in Table 3 confirm that discriminant validity has been achieved for all constructs. The HTMT ratios for all pairs of variables are below the conservative threshold of 0.85 (and significantly below 0.90). The highest ratio observed is between Writing Proficiency and Digital Literacy (0.841), which is still within acceptable limits, thereby proving that the variables of Digital Literacy, AI Utilization, and Writing Proficiency are measuring distinct concepts in this study.

Structural Model Evaluation (Inner Model)

With the measurement model validated, the structural model was examined to determine the predictive power of the independent variables.

Table 4 presents the R-Square value for the dependent variable.

Table 4. Variance Explained (R^2)

Dependent Variable	R-Square	Adjusted R-Square
English Writing Proficiency (Y)	0.833	0.826

Table 4 indicates a substantial predictive accuracy for the structural model. The R-Square value of 0.833 signifies that 83.3% of the variability in students' English Writing Proficiency can be simultaneously explained by the variations in their Digital Literacy and AI Utilization. This high percentage suggests that the model is robust and that the selected independent variables are primary drivers of writing competence in the context of Indonesian higher education.

Finally, the proposed hypotheses were tested by analyzing the path coefficients, t-statistics, and p-values. Table 5 details the direct effects of the independent variables on the dependent variable.

Table 5. Hypothesis Testing Results

Hypothesis Path	Beta (β)	T-Statistic	P-Value	Conclusion
H1: Digital Literacy -> Writing Proficiency	0.736	14.281	0	Accepted
H2: AI Utilization -> Writing Proficiency	0.457	7.249	0	Accepted

The hypothesis testing results in Table 5 provide strong statistical support for both proposed relationships. Digital Literacy exhibits a powerful positive influence on Writing Proficiency (β = 0.736), which is statistically significant given the T-statistic of 14.281 (well above 1.96) and a P-value of 0.000. Similarly, AI Utilization positively impacts Writing Proficiency (β = 0.457), also achieving statistical significance (T = 7.249, P = 0.000). Thus, both Digital Literacy and AI Utilization are confirmed as significant predictors of improved English writing skills.

Discussion

The Influence of Digital Literacy on English Writing Proficiency

The statistical analysis has confirmed that digital literacy significantly and positively influences the English writing proficiency of undergraduate students in Indonesia. This finding aligns with the theoretical premise that in the modern educational landscape, the ability to write academically is inextricably linked to the ability to navigate digital environments. Specifically, the indicators of digital literacy—such as the capability to access information, evaluate source credibility, and adhere to digital ethics—serve as the foundational cognitive scaffolding for high-quality writing. When students possess a high level of competence in evaluating the credibility of digital sources, they are better equipped to filter out misinformation and select high-quality references. This directly enhances the "clarity of ideas" and "coherence" in their writing, as their arguments are built upon reliable data rather than fragmented or erroneous internet content. Furthermore, the indicator of digital ethics, particularly the awareness of plagiarism and copyright, plays a critical role in academic integrity. Students with high digital literacy do not merely copy and paste; they understand how to synthesize information ethically, which improves the originality and logical flow of their essays. Previous research supports this, noting that digital literacy is a strong predictor of proficiency because it encompasses the critical thinking skills required to structure arguments and evaluate content rigor, which are essential for academic writing success (Zhang, 2025; Indah et al., 2022).

Moreover, the influence of digital literacy extends beyond simple information retrieval to the sophisticated integration of technology for learning purposes. In the context of Indonesian higher education, where the digital divide and infrastructural barriers often persist, students who have mastered the ability to use digital technology for learning (an indicator of this variable) show a marked advantage in overcoming resource constraints (Bachtiar, 2025; Fatonah, 2025). These students utilize digital platforms not just to find facts, but to collaborate, seek feedback, and refine their linguistic output, which directly correlates with improvements in "vocabulary use" and "grammar accuracy." The ability to integrate

digital information into academic tasks allows students to produce multimodal and cognitively complex texts that meet international standards of proficiency. However, scholars warn that without this foundational literacy, the mere access to digital tools does not translate to skill acquisition; rather, it is the *competence* in using these tools that drives performance. This suggests that the "digital divide" is shifting from a divide of access to a divide of usage capability, where students with lower digital literacy fail to leverage available resources to improve their writing coherence and cohesion (Nabhan & Habók, 2025; Roh et al., 2025). Therefore, digital literacy acts as a gatekeeper variable that determines whether a student can effectively transform digital inputs into proficient written outputs.

The Influence of Artificial Intelligence Utilization on English Writing Proficiency

The results also demonstrate that the utilization of Artificial Intelligence (AI) has a significant positive influence on English writing proficiency, a finding that reflects the transformative role of generative AI in current pedagogical practices. This influence is primarily driven by the "frequency of use" and the "types of AI used," such as grammar checkers (e.g., Grammarly) and generative text tools (e.g., ChatGPT). Students who frequently utilize these tools for specific writing tasks experience immediate and tangible improvements in the "grammar accuracy" and "vocabulary use" indicators of writing proficiency. This is because AI tools provide real-time, corrective feedback that acts as a personalized tutor, allowing students to identify and correct morpho-syntactic errors that they might otherwise miss (Jamshed et al., 2024; Deep & Chen, 2025). The "perceived usefulness" and "ease of use" indicators further amplify this effect; when students perceive AI as an accessible and beneficial support system, they are more motivated to engage in the iterative revision processes necessary for high-quality writing. This reduction in the cognitive load required for surface-level mechanical corrections allows students to reallocate their mental resources toward higher-order writing skills, such as improving the "clarity of ideas" and maintaining "coherence and cohesion" throughout their text (Corbita & Al Ghafri, 2025; Mekheimer, 2025).

However, the mechanism by which AI influences proficiency is complex and requires a nuanced interpretation regarding the "type of usage." While the tools significantly boost lexical sophistication and grammatical precision, there is a valid concern regarding the "clarity of ideas" if students become over-reliant on the technology. If the utilization is passive—where students simply accept AI-generated text without critique—there is a risk of producing grammatically perfect but intellectually shallow content, potentially diminishing their independent creative capabilities (Budiyono et al., 2025; Amoush & Alhosban, 2025). The findings suggest that the positive influence is most robust when AI is used as a collaborative partner rather than a replacement for human thought. In the Indonesian context, where English is a foreign language, AI tools serve as a critical bridge that reduces writing anxiety and increases confidence (Rafida et al., 2024; Syafei & Nuraeningsih, 2025). The immediate feedback loop provided by AI fosters a sense of self-efficacy, encouraging students to experiment with more complex sentence structures and diverse vocabulary. Nevertheless, ensuring that this utilization leads to genuine proficiency requires that students maintain ethical standards and academic integrity, avoiding the pitfalls of plagiarism that can arise from unchecked AI usage (Yusra & Hanifa, 2025; Amini et al., 2025). Thus, AI utilization improves writing proficiency by acting as a powerful scaffold that enhances technical accuracy and confidence, provided it is balanced with independent cognitive engagement.

E. Conclusion

Based on the empirical findings of this study, it can be concluded that digital literacy exercises a significant and dominant positive influence on English writing proficiency, confirming that the cognitive capability to evaluate and integrate digital information is a fundamental prerequisite for producing high-quality academic text. Furthermore, the utilization of Artificial Intelligence significantly and positively impacts writing proficiency, indicating that students who frequently and effectively employ AI tools for feedback and refinement demonstrate superior grammatical and lexical competence. Simultaneously, digital

literacy and AI utilization act as powerful predictors that collectively explain a substantial portion of the variance in writing outcomes, suggesting that the synergy between human digital competence and technological assistance is currently the most critical factor in educational success. Consequently, future research is advised to expand upon these findings by conducting longitudinal studies to determine the long-term sustainability of these skill improvements and to explore how varying levels of ethical AI literacy specifically moderate the potential trade-offs between AI-assisted fluency and independent student creativity.

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