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How AI Writing Intensity Shapes Students' Independent Academic Writing Ability: A Correlational Study

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ABSTRACT

Artificial Intelligence is widespread in various aspects of life, particularly in the field of education. The emergence of AI-based digital platforms such as ChatGPT, Grammarly, Google Gemini, and others has transformed the way students complete academic assignments, particularly academic writing. However, college students often become dependent on AI and less motivated when completing independent writing assignments due to AI's ability to generate high-quality essays. This study investigated the correlational relationship between the intensity of AI use in the writing process and students' independent academic writing ability. Employing a quantitative-correlational design, this study involved 32 English Education students from the 2023 intake at Universitas Tidar who had completed the essay writing course and were currently enrolled in the academic writing course. AI use intensity was measured using the Academic Writing Questionnaire (AI-AWQ), while independent writing ability was assessed using the Transparent Academic Writing Rubric (TAWR). The findings reveal that AI use intensity was significantly and positively correlated with independent academic writing ability (r=.454, p=.009). The higher the intensity of Artificial Intelligence utilization, the greater the learners' independence in writing ability. Normality assumptions are met (Shapiro-Wilk: p=.150 and p=.254), justifying the use of Pearson correlation. These findings suggest that students with higher AI use intensity do not necessarily demonstrate lower levels of independent writing ability; rather, AI can function as a scaffolding tool when applied reflectively.

Keywords: academic writing, artificial intelligence, correlational study, independency, intensity

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Introduction

The widespread use of AI tools such as ChatGPT and Grammarly in student writing is associated with the platforms' effect on students' independent learning, critical thinking, and academic integrity. Ravselj et al. (2025) conducted a large-scale comprehensive global study focusing on college students, which involved 28,218 students from 109 countries and showed that students frequently use ChatGPT for brainstorming, summarizing readings, and finding research articles. The students use ChatGPT to simplify complex information and summarize content, but it is less reliable for providing information. The students' concerns about ChatGPT encouraging cheating, plagiarism, and social isolation led them to agree that AI controls at all levels were necessary. This case will cause concern in the academic field, particularly regarding the validity of academic writing.

Academic writing is at the heart of our understanding of ideas critically, analytically, and systematically in writing. It demonstrates the ability to understand, critique, synthesize, and evaluate knowledge (Hyland, 2003). Writing is a complex cognitive process that includes planning, organizing ideas, drafting, and revising. The book "*Teaching L2 Composition: Purpose, Process, and Practice (3rd ed.)* by Dana Ferris and John Hedgcock, as reviewed by Estes (2016), emphasizes that academic writing skills develop through repeated practice accompanied by adequate feedback. Writing is an active and demanding skill that requires students to accumulate their thoughts and meanings within the brain and transfer them into a language before conveying them into a written form (Arochman et al., 2024).

The use of AI in academic writing tasks includes summarization, paraphrasing, and language support. AI helps students improve grammar, accuracy, and overall writing quality, facilitates the generation of ideas, and provides easy access to academic knowledge in various languages (Baldrich et al., 2025). Academic writing is a formal form of written communication in the fields of education and research. Hyland (2003) states that academic writing involves the ability to understand, critique, synthesize, and evaluate knowledge. Hyland identifies five dimensions of academic writing quality: (1) text organization and structure, (2) coherence and cohesion between sentences and paragraphs, (3) argumentation quality and critical analysis,

(4) academic vocabulary and lexical sophistication, and (5) grammatical accuracy and mechanical precision. These five dimensions serve as the primary framework for evaluating the quality of writing. Ferris and Hedgcock (2014) state that academic writing skills develop through repeated practice and structured feedback. The cognitive processes involved in writing consist of ideation, planning, drafting, monitoring, and revision, which are actively practiced by students. Anggraeni et al. (2025) revealed the challenges related to cognitive work on academic writing, such as different writing styles and voices, different ways of generating ideas, writing consistency, and content knowledge.

Vygotsky's (1978) sociocultural theory introduces the concept of the Zone of Proximal Development (ZPD), defined as the gap between what a learner can do independently and what they can achieve with guidance from a more capable other. The central idea of this theory is the notion of scaffolding, or temporary support that is gradually withdrawn as the learner internalizes the skill, eventually enabling independent performance. Within writing pedagogy, scaffolding has traditionally been provided by teachers, peers, or structured feedback (Ferris & Hedgcock, 2014).

The emergence of generative AI introduces a new potential scaffolding agent. AI may function as the more knowledgeable other within the learners' ZPD in completing writing tasks. Students who used AI through active prompting and reflective engagement, actively evaluating and revising AI output, retained stronger independent writing performance (Jin et al., 2025; Tseng & Warschauer, 2023). However, if AI support becomes more substitutive rather than developmental, the ZPD framework predicts erosion rather than development of independent competence. The distinction between AI as a support for development scaffold and a substitutive crutch depends heavily on the type and manner of AI use through the four-level AI use intensity framework (Rende & Lahope, 2025). AI functions as temporary scaffolding that is internalized to enhance independent writing rather than replacing students' ability.

Based on this framework, this study argues that AI tools serve as reflective and temporary scaffolding to enhance students' writing ability, consistent with Vygotsky's Zone

of Proximal Development. Drawing on Vygotsky's (1978) ZPD, if students use AI reflectively as a temporary scaffold, higher AI use intensity should be accompanied by stronger independent writing ability. If AI use were predominantly substitutive, higher intensity would instead be associated with weaker independent writing ability. Accordingly, this study tests the following hypotheses:

H_0: There is no significant correlation between AI use intensity and students' independent academic writing ability.

H_1: There is a significant positive correlation between AI use intensity and students' independent academic writing ability.

Many studies on AI usage are concerned with its advantages on learning outcomes in language learning. The previous research on AI usage lacks clarity regarding the influence of AI and how it correlates with certain skills in English. AI allowed the students to practice writing in a dynamic, low-pressure environment, engaging reflectively with direct suggestions, feedback, and evaluation (Andika et al., 2025; Tseng and Warschauer, 2023). Lodge et al (2023) in Assessment Reform for the Age of Artificial Intelligence for Australian Education stated that generative AI provides students' and teachers' productivity but threatens academic integrity. This implies an urgent need to provide guidance on AI use so that it does not threaten students' independent writing ability.

In the context of academic writing, Anggytha et al. (2024) conducted a study regarding the use of AI (Perplexity AI) and found that AI has limited ability to generate relevant, original, and creative ideas, even though it helps in the process of brainstorming. AI-generated writing might be less context-specific, more general, and less tailored to a specific context, while human writing might be more contextually aware and more audience-responsive. Furthermore, AI chatbots may not provide appropriate citations or references and are incapable of producing original work. The work that has been written by AI is likely to be similar to existing sources. Academic writing is expected to cite the references of other work accurately. There is an urgent need to develop policies that use AI ethically and responsibly to safeguard academic integrity (Cotton et al, 2023).

Much uncertainty still exists about the relationship between the AI use intensity and students' writing independency. Previously published studies on the effect of AI are not consistent. This paper examines the relationship between AI use intensity and students' independent academic writing ability. This study addresses this gap by using actual exam scripts and controlled in-class writing tasks as the measure of authentic independent writing ability. Previous studies of AI use have not dealt with academic writing ability. Although some research has been carried out on AI use, there is still very little scientific understanding of operationalizing writing-specific AI use intensity across four dimensions simultaneously: frequency, duration, functional type (brainstorming vs. full drafting), and degree of dependency (Yang et al., 2025).

Most Indonesian universities have no formal evidence-based policy governing AI use in academic writing. The ease of use of AI tools led to "cognitive offloading", a condition where students who use AI extensively show significant reductions in their capacity for analytical reasoning and decreased study motivation in academic culture and language dynamics (Ninghardjanti et al,2025; Shi et al, 2025). This study is conducted to answer the following research questions:

RQ1: What is the level of AI use intensity among students in the class of 2023?

RQ2: What is the level of students' independent academic writing ability?

RQ3: Is there a significant correlation between AI use intensity and students' independent academic writing ability?

Although some research has been carried out on the relation between AI use intensity and critical thinking, much uncertainty still exists about the relation between AI use intensity and independent writing ability. This study focuses on the relationship between AI use intensity and independent writing through reflective, evaluative, and strategic cognitive processes. It is hoped that this study will contribute to a deeper understanding of the importance of AI use policy in an educational context. Therefore, the findings may make an important contribution to the field of digital education to improve independent academic writing ability.

Methods

The present study employed a quantitative-correlational research design to measure the degree of association or relationship between two or more variables or sets of scores (Creswell, 2015). This research aimed to measure the correlation between the intensity of AI use and students' independent academic writing ability. A correlational research design was adopted to examine whether there is a systematic relationship between the intensity of AI use in the writing process and students' ability to write academic writing independently, without manipulating variables, but rather observing the natural relationship that already exists in the field. This study did not use an experimental design because it required researchers to manipulate independent variables. Instead, it aimed to examine relationships that occur naturally in a real-world educational setting.

The population of this study consists of 2023-intake English Education students at Universitas Tidar who have completed the essay writing course and are currently taking the academic writing course, which includes components of essay or academic report writing. This research was conducted in accordance with ethical guidelines for research involving human subjects. Approval for the use of student data was obtained from both the course instructor and the participating students. All data were handled and used solely for academic research purposes. The research sample was selected using purposive sampling based on the following criteria: (1) 2023-intake English Education students at Universitas Tidar, (2) have taken the essay writing course, (3) currently taking the academic writing course, (4) have active access to at least one primary AI platform, (5) have experience in writing essays or academic assignments, and (6) are enrolled in midterm or final exams based on written work. A total of 32 students met all the eligibility criteria and were included in the study (N=32), representing the target population rather than a sample.

This study uses the intensity of AI use as the independent variable, measuring how often students use AI in the writing process: planning, drafting, revising, editing, and proofreading. Students' independent academic writing ability serves as the dependent variable, measuring their ability to produce academic writing without the aid of AI. The writing

assessment was conducted under proctored in-class conditions, with students supervised by the lecturer, and it was strictly forbidden to use mobile phones, access online resources, or discuss. The researcher adopted the AI Academic Writing Questionnaire (AI-AWQ) by Khojasteh et al. (2025) to assess the intensity of AI use in the context of independent academic writing by students. The AI-AWQ consists of 30 items on a 5-point Likert Scale (Always = 5, Often = 4, Sometimes = 3, Rarely = 2, Never = 1) organized into the following categories: (1) Perceived Effectiveness of AI that demonstrates students' perceptions of AI's practical use and its effectiveness in supporting their academic writing tasks (items 11, 12, 14, 16, 17, 22, and 29), (2) Ethical and Authenticity Concerns that reflect students' strong awareness of ethical of AI use in academic writing related to academic integrity and accountability (items 24, 25, 26, 27, 28, 30), (3) AI-Supported Writing Process that reflects the growing role of AI in supporting writing activities (items 1, 2, 3, 4, 5, 6, 7, and 9), (4) AI Feedback and Writing Enhancement which reflects the growing interaction between students and AI tools to provide feedback for improvement (items 8, 10, 13, and 15), and (5) Affective and Motivational Impact which reflects students' emotional and motivational toward AI use in academic writing (items 18, 19, 20, 21, and 23). It is important to clarify that AI-AWQ yields a multidimensional composite score rather than a simple frequency count of AI tool usage. The instrument captures multiple dimensions of AI engagement, including frequency, functional purposes, and cognitive strategies, to provide a more comprehensive assessment of AI use intensity in academic writing contexts.

Adapted from Rende and Lahope (2025) AI use intensity in writing can be classified into four levels as follows:

Table 1

AI Use Intensity

Description	Category	Range	Level
AI used only for basic spell-checking or grammar correction	Low	0-25	1
AI used for sentence suggestions and initial brainstorming	Medium	26-50	2
AI used to generate full paragraphs that are subsequently modified by the student	High	51-75	3

AI used to generate full paragraphs that are subsequently modified by the student	Very High	76-100	4
Score = (sum of all item scores / 150) × 100			

The data used for independent writing ability consists of students' graded assignments, including midterm and final exams from the academic writing or essay writing course. These assessments utilized the Transparent Academic Writing Rubric (TAWR) developed by Razı (2015) to evaluate students' written work. The rubric comprises five key dimensions, with a total raw score of 52 points derived from 13 distinct aspects, each graded on a scale from 0 (very poor) to 4 (excellent). The significant portion is 30% for citation (examines the accuracy of paraphrases and quotations, correct adherence to in-text citation rules, the quality and completeness of the references list, and overall originality). The remaining weight is 20% for Introduction (its relevance and structural clarity), 20% for Academic Writing (assessing the variety and precision of formal language), 20% for Presentation (evaluates the cohesion, unity, and strength of argumentation and conclusion), and 10% for Mechanics (covers basic writing conventions and word choice). The final grade categories are 81-100 (Very High), 61-80 (High), 41-60 (Moderate), 21-40 (Low), and 0-20 (Very Low).

The writing samples were assessed by the researcher for grading purposes. The independent writing assignment was evaluated by two raters: the researcher and AI (Claude AI). Both raters evaluated 32 writing samples using the TAWR rubric with the same evaluation criteria.

Table 2

Reliability Statistics

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.150	.134	1.082	.279
N of Valid Cases		32			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

The researchers used Cohen's Kappa coefficient in SPSS to test the level of reliability between the researcher and the AI evaluations. Kappa value of .150 (p=.279) indicates a very low level of agreement (slight agreement). This low level of agreement suggests that the AI and the researcher tend to provide different evaluations and assessments of the same writing samples. Given this low level of inter-rater agreement, the researcher's scores were designated as the primary and official scores used in all subsequent statistical analyses, including the normality, linearity, and Pearson correlation tests reported in this study.

Descriptive statistics are used to provide an overview of the distribution of scores for each variable, namely AI-AWQ scores and students' independent academic writing scores. Prior to the Pearson correlation test, the researcher conducted a normality test using the Shapiro-Wilk test to ensure that the variables are normally distributed. To ensure that the relationship between AI intensity and independent writing ability is linear, a linearity test was conducted using ANOVA. Pearson's correlation test was used to measure the strength and direction of the linear relationship between AI usage intensity and independent academic writing ability.

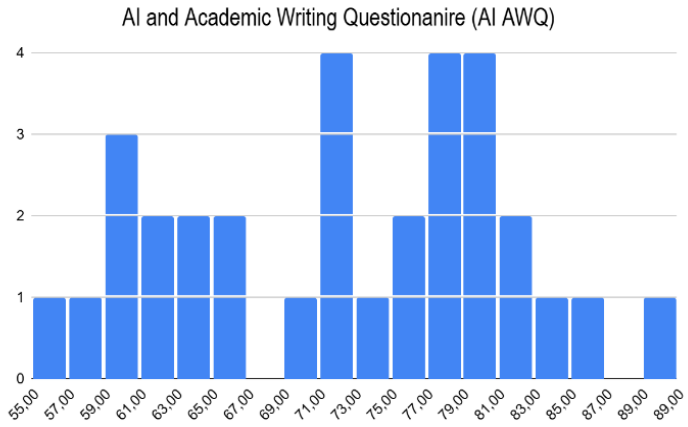
Result and Discussion

The results of the AI Academic Writing Questionnaire (AI-AWQ) and the independent writing scores using the Transparent Academic Writing Rubric (TAWR) indicate a relationship between the frequency of AI use and students' independent writing skills. This section presents these findings, organized into five sections: AI AWQ results, independent writing

results assessed by the Transparent Academic Writing Rubric (TAWR), normality test, linearity test, and correlation test.

Figure 1

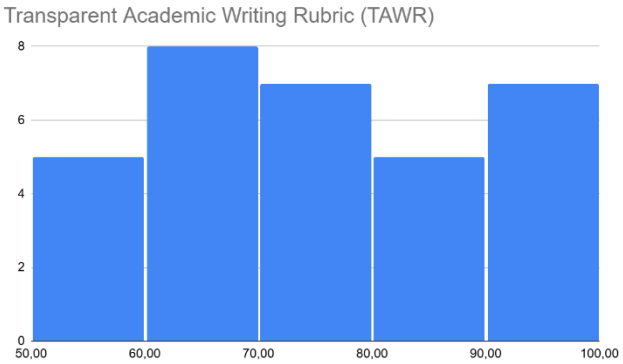
AI Academic Writing Questionnaire (AI-AWQ) Results



As shown in Figure 1, the distribution of AI-AWQ scores among the 32 participants reveals that the use of AI in the writing process is already widespread and intensive across the students. 18 students (56.2%) obtained scores within the 51-75 (High). This indicates that these students use AI to generate full paragraphs that are subsequently modified. Meanwhile, 14 students (43.8%) obtained scores within the 76-100 (Very High). This indicates that these students use AI to generate full paragraphs that are subsequently modified by the student. None of the students scored within the Low (0-25) or Medium (26-50) categories. This means that not a single student in class used AI only for basic spell-checking and grammar correction or sentence suggestions and initial brainstorming. This distribution indicates that the majority of students have already integrated AI tools regularly and substantially into their academic writing process.

Figure 2

Independent Writing Results Assessed with TAWR



As can be seen from Figure 2 above, the students' independent academic writing scores were obtained using the Transparent Academic Writing Rubric (TAWR). What stands out in the table is the wide range of strong levels of independent writing performance. 20 students (62.5%) obtained scores in the 61-80 (High). Meanwhile, 12 students (37.5%) obtained scores in 81-100 (Very High). None of the students were in the Moderate, Low, or Very Low categories. What is interesting about the data in this table is that the students produced academic writing across the five TAWR dimensions of introduction, citation, academic language use, idea presentation, and mechanics. The students in this sample who reported high AI use intensity were nevertheless capable of producing high-quality independent academic writing.

Table 3

Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Academic writing	.081	32	.200*	.951	32	.150
AI AWQ	.124	32	.200*	.959	32	.254

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

After the data were normalized using Shapiro-Wilk, a linearity test was conducted using an ANOVA table.

Prior to hypothesis testing, the normality of both variables was examined using the Shapiro-Wilk test, as the sample of this study (N=32) falls within the range for which this test is considered appropriate. As presented in Table 3 above, the data were normally distributed for both the academic writing score (W = .951, df = 32, p = .150) and the AI-AWQ score (W = .959, df = 32, p = .254). Since both significance values exceeded the threshold of .05, both p > 0.05, so that the parametric assumptions for the Pearson correlation test are met. These outcomes allowed the analysis to proceed to the linearity test and subsequently to the correlation test without the need for non-parametric alternatives.

Once the samples were normalized, it was necessary to test the linearity of the variable. This linearity test was conducted to test the linearity of the relationship between the two variables.

Table 4

Linearity Test

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
nilai academic writing * skor AI AWQ	Between Groups	(Combined)	1484.930	21	70.711	.825	.661
		Linearity	482.270	1	482.270	5.627	.039
		Deviation from Linearity	1002.659	20	50.133	.585	.852
	Within Groups		857.000	10	85.700		
	Total		2341.930	31			

As presented in Table 4, the linearity test shows an F-value of 5.627 with a significance level of 0.039. Since this value is < 0.05, there is a significant linear relationship between the two variables. The deviation from linearity test yielded an F-value of 0.585 with a significance level of 0.852. Since this value is > 0.05, there is no significant deviation from linearity. Therefore, the relationship between academic writing scores and AI AWQ scores is linear because the significance value for deviation from linearity is 0.852 > 0.05, thus fulfilling the assumptions of linearity. With both the normality and linearity assumptions fulfilled, the data were considered appropriate for proceeding to the Pearson correlation analysis.

A Pearson correlation analysis was conducted in order to determine the strength and direction of the relationship between the intensity of AI use and students' independent academic writing ability.

Table 5

Pearson Correlation

Correlations			
		AI AWQ	Academic writing
AI AWQ	Pearson Correlation	1	.454**
	Sig. (2-tailed)		.009
	N	32	32
Academic writing	Pearson Correlation	.454**	1
	Sig. (2-tailed)	.009	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

The results of the correlation analysis are shown in Table 5. A positive correlation was found between AI use intensity and students' independent writing. As can be seen from the table above, a correlation coefficient of r = +0.454 (p=.009) indicates that the higher the intensity of AI use, the higher their independent writing ability. Students who reported higher AI use intensity in this sample tended to be stronger in their independent academic writing performance. The correlation between AI use intensity and students' independent academic writing ability is interesting because AI functions as a scaffolding tool to support their writing rather than substituting for their competence development. Together, these results provide important insight that there is a correlation between AI use intensity and students' independent writing ability.

This study explores the correlation between AI intensity use and students' independent academic writing ability in Universitas Tidar. The findings show the intensity of AI use and students' independent writing ability, especially in academic writing. Key findings indicate that students' regularly use AI to support their writing. Students with higher AI AWQ scores have higher independent writing scores.

The first questions in this study sought to examine the frequency of AI use among English students in the class of 2023. The students' questionnaire scores, as shown in Figure 1, revealed that most students have integrated AI into their writing process, including ideation, planning, drafting, monitoring, and revision. Eighteen students (56.2%) scored in the 51-75 range (High), which means that students use AI to generate full paragraphs that are subsequently modified by the students. While 14 students (43.8%) scored in the 76-100 range (Very High), which means that students use AI to write the text with minimal student intervention. This finding is in line with Wulyani et al. (2024), where AI is becoming increasingly integrated into EFL students' writing to refine their capabilities over time by navigating and utilizing it with minimal effort. It suggests that AI increases convenience, knowledge, and speed of task completion.

The second question in this study sought to determine the quality of students' independent writing without generative AI use. The students' independent writing ability, as shown in Figure 2, indicates that students get high scores even when the frequency of AI use is high. 20 students (62.5%) fell into the High category (61-80) and 12 students (37.5%) into the Very High category (81-100). Furthermore, Al Amin and Mahjabeen (2025) found that the utilization of AI tools is a complementary resource rather than a replacement for traditional learning. Although AI-generated texts can be helpful with vocabulary and linguistic correctness, AI has not been able to provide full, correct, on-demand feedback, but it is necessary to develop language learning in writing practice. A broadly similar point has also recently been made by Deep and Chen (2025), who found that AI can promote self-directed learning and development by providing personalized tutoring to help improve writing fluency.

The third question of this study sought to examine the correlation between AI use intensity and independent writing ability. The correlation test using Pearson correlation shows the coefficient r= .454 (p=.009) indicates that there is a statistically significant positive correlation between the intensity of AI use and students' independent academic writing ability. Perhaps the most compelling finding is that these results challenge the commonly

held assumption that greater AI use necessarily diminishes independent writing competence. Consistent with the literature, this research found that students with a high frequency of AI also tend to have better performance in independent writing. This view is supported by Mahapatra (2024), who wrote that there is a significant positive impact of ChatGPT on students' academic writing skills. This is consistent with the data obtained by Wang (2026) that instructor-mediated AI can significantly improve students' academic writing when utilized in human instruction rather than in place of it.

These results are in line with Tseng & Warschauer's (2023) findings, which showed that AI-assisted writing can improve writing quality through active prompting and engage reflectively, actively evaluating, giving feedback, and revising AI output, resulting in stronger independent writing performance. The moderate correlation (r = .454) aligns with Rende & Lahope (2025) classification suggesting that students may be operating predominantly at the High (56.2%) or Very High (43.3%) intensity levels, where AI supplements rather than supplants student cognition. Students who use AI tools for brainstorming, grammar checking, and sentence-level feedback may develop greater metacognitive awareness of writing conventions, which translates into stronger independent performance.

The findings revealed a statistically significant positive correlation between AI use intensity and independent academic writing ability (r=.454, p=.009). These results further support the ideas of Vygotsky's (1978) Zone of Proximal Development framework. Furthermore, these findings support the idea of Al Hamdani and Yousif (2025) that AI tools are able to dynamically assess the current level of a student and adjust content difficulty in real time. So, teaching precisely aligns with their cognitive zone. AI uses data analysis and machine learning to supply personalized feedback and problem sets to learners to help bridge the gap between current knowledge and potential mastery. It functions as a cognitive and motivational facilitator within the ZPD. The emergence of generative AI introduces a new potential scaffolding agent. AI may function as the more knowledgeable other within the learners' ZPD in completing writing tasks. AI serves as a scaffolding tool to support tasks marginally beyond the learner's current ability without replacing cognitive engagement. It

may facilitate the development of writing competencies. This interpretation aligns with Jin et al. (2025), who found that students using passive chat bots requiring active prompting retained stronger independent writing performance. Furthermore, Rahman et al. (2026) stated that AI tools operate as an adaptive and responsive scaffolding to assist learners in overcoming difficulties and facilitating self-regulated learning.

These findings may be somewhat limited by the small sample (N=32). However, with a small sample size, caution must be applied, as the findings might not represent all college students. It should be acknowledged that the low agreement between the two inter-rater (Cohen's Kappa+.150) indicates that AI-

based scoring does not yet substitute reliably for expert human assessment of academic writing quality. This study employed a cross-sectional, correlational design. A positive correlation between AI use intensity and writing ability is consistent with the theoretical proposition that AI may serve as a scaffolding tool within the ZPD. It could be argued that the positive results were due to students' cognitive level and background knowledge. This study relied on a composite AI use intensity score rather than disaggregating by functional type, which, as the ZPD framework suggests, may produce divergent effects on independent development. These findings remain that students with stronger writing ability are simply more capable of using AI tools effectively rather than AI use causing improved independent writing. It is plausible that AI-based writing tools may function as digital scaffolds within the ZPD, potentially supporting the development of independent writing ability.

The present results are important in at least two major respects. The absence of a formal AI use policy in education may have led students to develop informal self-regulatory strategies for AI use that preserved their independent competence. AI literacy education and transparent guidelines are effectively needed in the Indonesian context, especially in higher education (Shi et al., 2025; Cotton et al., 2023). Gerlich (2025) and Tian and Zhang (2025) showed that there is a negative association between AI reliance and critical thinking that may reflect populations with higher AI dependency rates. These findings suggest that the future research should disaggregate AI use intensity by functional type (e.g. generative, evaluative,

editing, brainstorming) as suggested by ZPD. This would allow researchers to examine which specific types of AI support promote or hinder independent writing development and produce differential outcomes. In future investigations, it might be possible to use a more diverse sample of college students across multiple institutions to enhance the statistical power and generalizability of the findings.

Conclusion

This study set out to examine the correlational relationship between AI writing use intensity and students' independent academic writing ability in college students. The most obvious finding to emerge from this study is that there is a statistically significant positive correlation between AI use intensity and students' independent writing ability. Pearson correlation test found ($r = .454$, $p = .009$), indicating that higher AI use intensity is associated with higher independent academic writing ability. In the absence of a formal AI use policy in Indonesian education, students may have developed informal self-regulatory strategies for AI use that preserved their independent competence. AI literacy education and transparent guidelines are effectively needed in the Indonesian context, especially in higher education. These findings suggest that AI tools may support the development of writing competencies when used reflectively and within a scaffolding framework consistent with Vygotsky's ZPD. Based on the constraints of the single-cohort, N=32 study, future research should extend this investigation to larger and more diverse samples, incorporate qualitative methods to explore students' AI use practices in depth, and longitudinally track the long-term effect of varied AI use intensities on writing development. The consistently high level of AI use intensity in this cohort suggests that institutions could pilot policies that guide how AI is used, rather than whether it is used, and complement them with controlled assessments that capture students' independent writing. Indonesian higher education institutions are encouraged to develop evidence-based AI use policies that distinguish between assistive and substitutive AI use patterns, promote AI literacy, and integrate controlled AI-free assessments to monitor the development of authentic independent academic writing ability.

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