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Gemini AI as a Writing Catalyst: Boosting Fluency, Coherence, and Confidence in EFL Composition

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ABSTRACT

Google now has its own AI, Gemini AI, which can be used in various sectors of the learning education, industry, medicine, science and can still be explored more. In this study investigates how Gemini AI will impact on students' learning of writing skills, effectiveness, advantages and disadvantages in language learning. The researchers used the quasi-experimental method for 60 students from the eleventh grade in senior high school 10 Palembang. The result of this study indicate that the use of Gemini AI can serve as an effective tool in improving students' writing skills, provided that its use is done judiciously and under the supervision of teachers. It is important to maintain a balance between the utilization of technology and the development of students' natural abilities. Teachers have a crucial role in guiding students not only to rely on AI, but also to develop their creativity and writing skills independently. We can concluded that the use of Gemini AI has a significant impact on the writing skills of eleventh grade students at SMAN 10 Palembang. Students who engaged in learning with the help of Gemini AI showed more significant improvement in writing skills compared to students who were not taught using Gemini AI. This improvement was seen in various aspects, including writing structure, language grammar, coherence, and vocabulary selection.

Introduction

The emergence of Artificial Intelligence (AI) has ushered in a transformative era across various fields, with education being a particularly promising area for AI application. In the field of language learning and teaching, AI-powered tools are increasingly being explored for their potential to enhance students' writing skills. This section provides a comprehensive review of the theories, concepts, and previous research relevant to the impact of AI, with a particular focus on the role of Gemini AI in improving writing skills, while also highlighting existing research and the rationale behind the current study.

Writing is a vital and intricate language skill that significantly contributes to academic, professional, and personal communication. In the current digital era, where information circulates rapidly, the skill to express thoughts clearly, logically, and effectively via writing has grown significantly essential. Nonetheless, students frequently encounter multiple obstacles in enhancing their writing abilities, including struggles with idea generation, constructing proper sentence structures, and perfecting suitable grammar and vocabulary (Kartika, 2024).

Understanding the impact of artificial intelligence (AI) on writing skills requires a foundation for discussion based on a relevant theoretical framework. Cognitive theories of learning, such as the writing process model proposed by Hayes and Flower (2019), emphasize the complex cognitive abilities involved in writing, including planning, transforming ideas into text, and revising. AI tools, by automating certain aspects such as grammar checking, brainstorming, and providing structural suggestions, have the potential to reduce the cognitive load on writers (Gayed et al., 2022). This allows students to allocate more cognitive resources to higher-order thinking skills such as content generation, critical analysis, and argumentation.

In addition, while some studies acknowledge concerns regarding over-reliance on AI and potential academic dishonesty, it is good that students can utilize AI wisely. The specific cultural and educational context of Indonesian students, including unique learning styles and challenges in English writing, also present research gaps that need to be addressed for effective Gemini implementation. Although there is a growing body of research on AI in writing education, several research gaps remain relevant, particularly regarding the complex impact of advanced AI models such as Gemini. While general AI writing tools have been studied, Gemini AI's unique features and capabilities, with its advanced context understanding and multimodal reasoning, require further investigation. Most existing research on the impact of AI on writing skills is short-term or cross-sectional (Nguyen et al., 2025). There is a significant lack of longitudinal studies assessing how the long-term and integrated use of Gemini AI affects students' long-term writing proficiency, critical thinking, and the development of their unique writing voice.

By analyzing the specific functions of Gemini AI and its application in a structured writing curriculum, this study aims to provide information about the potential benefits and impacts, as well as to provide educators with an overview of how to appropriately and effectively integrate Gemini AI applications into writing skills. The promise of Gemini AI in supporting education and enhancing writing skills is thrilling to investigate. With its capability to deliver immediate feedback, recommend grammar improvements, enhance vocabulary, or even aid in idea development, Gemini AI could be a groundbreaking support resource for learners. Incorporating AI into education may provide a more tailored and flexible learning experience, addressing certain constraints of conventional approaches (Rane et al., 2024).

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The main research problem revolves around how to effectively utilize Gemini's AI to improve students' English writing skills in a tangible way, especially in contexts such as English as a foreign language. While there are many studies exploring the general impact of AI on writing proficiency, there are still some gaps. According to Baskara (2025) current research often focuses on general AI tools (e.g., ChatGPT) or specific aspects such as grammar and vocabulary improvement, with little emphasis on the nuanced and diverse nature of writing. There is a notable gap in understanding how students interact with and understand multimodal AIs such as Gemini for various writing tasks, beyond basic correction. Specifically, this research will delve deeper into how Gemini AI can foster writing skills, such as critical thinking, argumentation development, effective usage, and creative expression, rather than just surface-level accuracy.

Many studies have investigated the usefulness of artificial intelligence (AI)-based writing tools in improving various aspects of student writing. Tools such as Grammarly, QuillBot, and other GPT-based applications have demonstrated their effectiveness in improving surface-level features such as grammar, spelling, and syntax (Alharbi, 2023; Chun, 2020 & Zawacki-Richter et al., 2019). Although the potential of artificial intelligence (AI) in improving academic writing processes and overall teaching quality has been widely recognized (Kartika, 2024; Mulyanah et al., 2024 & Rane, 2024), research also highlights the importance of addressing related challenges and ethical considerations. Understanding the cognitive processes of writing (Hayes & Flower, 2019) remains crucial in the AI era. Additionally, robust research methodologies, such as those outlined by Creswell (2012), for educational research design or (Etikan & Balla, 2017), for sample size determination are essential for validly evaluating the impact of AI. Effective and responsible integration of AI in higher education requires a comprehensive understanding of its various aspects.

Based on the identification of problems and gaps that have been described, this study aims to investigate the impact of integrating Gemini AI on the enhancement of English writing skills in eleventh graders students in SMAN 10 Palembang, concentrating on both lower-order (grammar, vocabulary, mechanics) and higher-order (coherence, cohesion, critical thinking, argumentation) writing capabilities. The potential of Gemini AI demands action to fully utilize its impact in education. This requires responsible and appropriate application of AI, and an understanding of its impact. Educational institutions and teachers strongly encourage students to apply Gemini AI and provide appropriate guidance and real-life examples, which can support the integration of AI into the classroom. (Perera & Lankathilaka 2023).

This study aims to provide essential contributions to English language teaching, educational technology, and artificial intelligence in education. In theory, this study will enhance comprehension of how multimodal AI models like Gemini affect the intricate cognitive processes associated with writing. The results will provide specific teaching suggestions for English teachers in Indonesia and comparable EFL settings on effectively incorporating Gemini AI into their writing programs. This involves creating effective

strategies for writing equations, essays, giving feedback, and promoting critical literacy in students. Furthermore, this study can guide the creation of more suitable and efficient AI tools for language acquisition. This study seeks to enable students and teachers to utilize the capabilities of advanced AI for a more engaging, tailored, and effective development of English writing skills. (Kartika, 2024).

Method

The quasi-experimental design of this study consisted of two experimental groups and a control group - both of which were tested before and after to assess changes in writing proficiency (Creswell, 2012). The experimental group used Google Gemini, an AI chatbot, to assist with their writing tasks. While the control group received traditional writing instruction, which included classroom learning, assignments, and peer feedback. The study compared the writing performance of both groups before and after the intervention to evaluate the effectiveness of Gemini AI support in improving writing skills. Since the study was conducted in a natural classroom setting, the researchers divided into two groups, the experimental and the control, which were 30 students each. This way the researchers were know what the writing skills of the two groups are like. The quasi-experimental design allows for a practical investigation of the impact of using Gemini AI in the context of English language education.

According to Fraenkel and Wallen (2023, p. 93), "population refers to the group that is the focus of the research, namely the group whose research results the author wishes to generalize. “The population in this study was the eleventh-grade students of SMAN 10 Palembang for the 2024/2025 academic year. The total population was 60 students. A sample is a group of participants selected from the entire population. This sample was the focus of research interest for the researchers in Bordens et al.'s (2011, p. 163) study. In this research, the research used random sampling. The participants of this study were 60 eleventh-grade students, namely grades A and B at SMAN 10 Palembang.

The experimental group (Group A) consisted of 30 students who would use Google Gemini as part of their writing practice. The control group (Group B), which also consisted of 30 students, would receive traditional writing instruction without the aid of AI tools. The sample criteria were eleventh-grade students who had used Gemini AI in their writing learning process, or at least had a basic understanding of Gemini AI and its use in a writing context. According to Kartika (2024), the main instrument used to measure writing ability in this study is a standardized writing test. The test is designed to assess various aspects of writing, including grammar, vocabulary, coherence, task accomplishment, and overall writing fluency. The writing test consists of two parts: a question-based essay and a short answer writing task. Both parts were intended to evaluate students' ability to organize and express ideas clearly, use appropriate language, and follow the conventions of academic writing. At the beginning of the study, both the experimental and control groups completed a pre-test to assess their initial writing ability.

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This pre-test was designed to measure the participants' initial proficiency in writing, and included essays on general topics related to academic writing. For example, one of the essay questions was “The Importance of Education in Modern Society.” In addition, the pre-test contains a short-answer writing task that aims to evaluate students' ability to express ideas clearly in written form. results from the pre-test provided a baseline measure of writing skills for both groups, ensuring that any improvement observed later could be attributed to the intervention. After the intervention period, the participants completed a post-test under the same conditions. The post-test mirrored the format of the pre-test, thus allowing for a consistent comparison of writing performance over the course of the study. The essay questions and short answer tasks on the post-test were similar in content and structure to the pre-test. This consistency ensured that any changes in writing proficiency could be directly attributed to the intervention. Both the pre-test and post-test were scored using a rubric that assessed grammar, vocabulary, structure, and overall task fulfilment.

The data collection procedure consisted of three phases, The research began with a pre-test phase where both experimental and control groups completed a pre-test writing task, establishing a baseline for their grammar, vocabulary, coherence, and task achievement. Critically, the experimental group was introduced to Google Gemini, while the control group maintained traditional writing instruction. The core of the study lay in the one-week phase. During this period, the experimental group consistently utilized Google Gemini AI for their daily writing assignments, leveraging its immediate feedback on grammar, vocabulary, sentence structure, and coherence for revision and improvement. In contrast, the control group continued with conventional methods like teacher lectures and peer feedback (Kartika, 2024). Both groups had instructor access, but only the experimental group benefited from AI support. Finally, the post test phase saw both groups complete a post-test mirroring the pre-test, with the same scoring rubric applied to assess improvements in writing proficiency.

For data analysis, normality, homogeneity, paired sample t-test and independent tests was conducted to determine whether there was a statistically significant improvement in the writing proficiency of the experimental group after eight weeks of the Gemini AI-based writing intervention. The statistical analyses would reveal whether the use of Gemini AI led to a measurable and significant enhancement in the eleventh graders' English writing skills (Miles et al., 2019).

Results and Discussion

The results and discussion are adjusted to the research approach. If the quantitative research approach consists of descriptive statistics, the results of the assumption test and the results of hypothesis testing are then analyzed critically. If the qualitative approach is in the form of themes from the results of the qualitative analysis carried out.

Results

Result of Normality.

This section provides an overview of the results of the normality tests of students' writing skills, as outlined can be seen in table 1 and table 2.

Normality of the Impact Using Gemini AI to Improve Writing Skill

The results of the normality analysis conducted with the Kolmogorov-Smirnov test showed that the significant p values for the pre-test and post-test scores in the control group and the experimental group were above the stipulated cut-off level of 0.05. Thus, it can be concluded that the data follows a normal distribution. This information is presented in :

Table 1
Normality Pre-Test and Post-Test Experimental Class
One-Sample Kolmogorov-Smirnov Test

		pretest_eksperimen	postest_eksperimen
N		30	30
Normal Parameters[a,b]	Mean	65.6667	82.6000
	Std. Deviation	7.86671	9.37201
Most Extreme Differences	Absolute	.064	.085
	Positive	.064	.059
	Negative	-.058	-.085
Test Statistic		.064	.085
Asymp. Sig. (2-tailed)		.200[c,d]	.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Data normality analysis of One Sample Kolmogorov-Smirnov Test for pre-test and post-test scores in the experimental class (N=30).

Pre-Test Experimental Class:

Based on the results of the Kolmogorov-Smirnov normality test on the experimental class pre-test, the average value recorded was 65.66 with a standard deviation of 7.866. The most significant differences between the observed and expected cumulative distributions are as follows: absolute difference of 0.064, positive difference of 0.064, and negative difference of -0.058. The test statistic value obtained is 0.064, with an asymptotic (two-tailed) significance value of 0.200, which indicates that the data follows a normal distribution ($p > 0.05$). Based on the results of the Kolmogorov-Smirnov normality test on the experimental class pre-test, it can be concluded that the data is normally distributed. This is indicated by the test statistic value of 0.064 with a significant (p-value) of 0.200 which is greater than the significance level of 0.05.

Post-Test Experimental Class:

Based on the results of the Kolmogorov-Smirnov normality test on the experimental class post-test, the average value recorded was 82.66 with a standard deviation of 9.372. The most significant differences between the observed and expected cumulative distributions are as follows: absolute difference of 0.085, positive difference of 0.059, and negative difference of -0.058. The test statistic value obtained is 0.085, with an asymptotic (two-tailed) significance value of 0.200, which indicates that the data follows a normal distribution ($p > 0.05$).

The results of the analysis can be concluded that the data for the pre-test and post-test in the experimental class were normally distributed, as indicated by the significance value being greater than 0.05 after applying the Lilliefors significance correction. Data normality evaluation was conducted by applying the One-Sample Kolmogorov-Smirnov Test on the pre-test and post-test scores in the control class (N=30).

Pre-Test Control Class:

Based on the results of the Kolmogorov-Smirnov normality test on the pre-test of the control class, the average score recorded was 48.06 with a standard deviation of 9.627. The most significant differences between the observed and expected cumulative distributions are as follows: absolute difference of 0.092, positive difference of 0.092, and negative difference of -0.082. The test statistic value obtained is 0.092, with an asymptotic (two-tailed) significance value of 0.200, which indicates that the data follows a normal distribution ($p > 0.05$).

Post-Test Control Class:

Based on the results of the Kolmogorov-Smirnov normality test on the control class post-test, the average value recorded was 67.63 with a standard deviation of 7.805. The most significant differences between the observed and expected cumulative distributions are as follows: absolute difference of 0.069, positive difference of 0.059, and negative difference of -0.061. The test statistic value obtained was 0.069, with an asymptotic (two-tailed) significance value of 0.200, indicating that the data followed a normal distribution ($p > 0.05$).

The findings showed that the pre-test and post-test data in the control class followed a normal distribution, as evidenced by the significance value that was greater than 0.05 after the application of the Lilliefors significance correction.

Table 2
Normality Pre-Test and Post-Test Control Class

One-Sample Kolmogorov-Smirnov Test

		pretest_control	postest_control
N		30	30
Normal Parameters[a,b]	Mean	48.0667	67.6333

	Std. Deviation	9.62731	7.80576
Most Extreme Differences	Absolute	.092	.069
	Positive	.092	.069
	Negative	-.082	-.061
Test Statistic		.092	.069
Asymp. Sig. (2-tailed)		.200[c,d]	.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Result of Homogeneity Test

This section provides an overview of the results of the homogeneity tests of students' writing skills, as outlined can be seen in table 3.

Table 3
Homogeneity of Variances

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Pretest	2.409	1	58	.126
Postest	1.403	1	58	.241

The results of the homogeneity test showed that the students' writing ability in the pre-test and post-test groups were homogeneous, because the p value obtained was greater than 0.05. This indicates that there was a significant difference in writing ability between the two groups at the 0.05 level of significance.

Pre-Test:

Based on the results of the homogeneity of variance test using the Levene statistic for the pre-test, the Levene statistic value is 2.049 with degrees of freedom (df = 1, df2 = 58), and a significance value (p-value) of 0.126. Thus, it can be concluded that the variance of the pre-test scores in the tested groups is homogeneous ($p > 0.05$).

Post-Test:

Based on the results of the homogeneity of variance test using the Levene statistic for the post-test, the Levene statistic value is 1.403 with degrees of freedom (df = 1, df2 = 58), and a significance value (p-value) of 0.241. Thus, it can be concluded that the variance of the post-test scores in the tested groups is homogeneous ($p > 0.05$)

Thus, the results of this analysis indicate that the pre-test and post-test scores assume homogeneity of variance is met.

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Result of Paired Sample t-Test

The results of the paired sample t-test can be seen in table 4 below ;

Table 4
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest_Exp - Postest_Exp	-16.933	2.840	.518	-17.994	-15.873	-32.660	29	.000

Pair 1: Pre-test vs. Post-test

Based on the results of the paired sample t-test conducted for the comparison between the pre-test and post-test in the experimental class, the average score difference is -16.933 with a standard deviation of 2.480 and a standard error of 0.518. The 95% confidence interval for this difference ranges from -17.994 to -15.873. The t-value obtained was -32.660 with degrees of freedom (df) =29, and a two-sided significance value (p-0.000). Since the p value is <0.05, it can be concluded that there is a significant difference between the pre-test and post-test scores.

This finding indicates the impact of the effectiveness of the applied Gemini AI in improving students' writing ability.

Result of Independent Sample Test

The researcher conducted testing by utilizing the results of statistical analysis and research findings to formulate and carry out hypothesis testing, which was adjusted to the formulation of research questions. The focus of the test was to find out whether there was a significant difference in writing skills between students who received English learning using Gemini AI and students who did not, at SMAN 10 Palembang.

The hypotheses tested were as follows:

- Ho (Null hypothesis): There is no significant difference in writing skill between students who were taught using Gemini AI and those who were not.
- Ha (Alternative hypothesis): There is a significant difference in writing skills between students who are taught using Gemini AI and those who are not at SMAN 10 Palembang

The testing criteria were set as follows:

- If the p-output value < 0.05, then Ha 1 is accepted, and Ho1 is rejected.

- Conversely, if p - output > 0.05, then Ha1 is rejected and Ho 1 is accepted.

Referring to the initial research question, the researcher evaluated whether there was a significant difference in the writing skills of grade XI students between the group taught using Gemini AI and the group not using Gemini AI at SMAN 10 Palembang. The results of the analysis showed a significant difference with a p value of 0.000 which is below the significance threshold of 0.05. Thus, the alternative hypothesis was accepted indicating that there was a significant difference in writing ability between the two groups. Further information regarding the results of the independent samples t-test is presented in table 5.

Table 5
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pretest	Equal variances assumed	2.409	.126	-7.754	58	.000	-17.600	2.270	-22.144	-13.056
	Equal variances not assumed			-7.754	55.785	.000	-17.600	2.270	-22.147	-13.053
Postest	Equal variances assumed	1.403	.241	-6.721	58	.000	-14.967	2.227	-19.424	-10.509
	Equal variances not assumed			-6.721	56.163	.000	-14.967	2.227	-19.427	-10.506

Independent sample t-test was used to compare the pre-test and post-test scores between two groups, while Levene's Test was applied to check for equality of variances.

Pre-Test:

Levene's Test for Equality of Variances showed an F value of 2.409 with a significance value of 0.126 ($p > 0.05$), the variances of the two groups were equal. Furthermore, in the t-test for Equality of Means, assuming equal variance, a t-value of -7.754 was obtained with a degree of freedom (df) of 58 and a two-sided significance value of 0.000 ($p < 0.05$). When equal variances are not assumed, the t value obtained is -7.754 with a degree of freedom of 55.785, and a Sig. (2-tailed) value of 0.000. ($p < 0.05$) which means there is a significant difference in the pre-test score between the two groups.

Post-Test

Levene's test for Equality of Variances showed an F value of 1.403 with a significance value of 0.241 ($p > 0.05$), the variances of the two groups were equal. Furthermore, in the t test for Equality of Averages, assuming equal variance, a t value of -6.721 was obtained with a degree of freedom (df) of 58 and a two-tailed significance value

of 0.000 ($p < 0.05$). When equal variances are not assumed, the t value obtained is -7.754 with a degree of freedom of 56,163, and a Sig. (2-tailed) of 0.000. ($p < 0.05$) In both analyses, the results indicated that there was a statistically significant difference in the pre-test scores between the two groups.

Overall, the data indicated that significant differences were already apparent in the pre-test scores and continued to be even more pronounced in the post-test scores.

Discussion

The main objective of this study was to evaluate whether there was a significant difference in the writing ability of eleventh graders students between those who were taught using Gemini AI and those who were not, at SMAN 10 Palembang. The results of the analysis showed that the p value for the writing ability of students who were taught with Gemini AI and those who were not at SMAN 10 Palembang was 0.000, which is below the significance threshold of 0.05. This indicates that there is a significant difference in writing ability between those who were taught with Gemini AI and those who were not, at SMAN 10 Palembang. This indicates that there is a significant difference in students' writing ability. Therefore, the hypothesis was accepted, indicating a substantial difference in writing skills between students who were taught with Gemini AI and those who were not, at SMAN 10 Palembang.

The results of the statistical analysis using independent sample t-test showed that students in the experimental class who were taught with Gemini AI for writing skills, achieved higher writing scores than students in the control class who were not taught using Gemini AI. This indicates a significant difference between the experimental group and the control group in the post-test results. Specifically, the average writing skill score of students using Gemini AI in the experimental class was 82.60, while that of the control class was 67.63. The researchers noted significant benefits after the implementation of Gemini AI in improving students' writing skills. The factors contributing to the success of this approach have been carefully considered by the researchers.

The results clearly showed that the use of Gemini AI in writing instruction was more effective in improving writing skills compared to students who were not taught using Gemini AI. According to Kartika, (2024) where the experimental group showed significant improvements in grammar, vocabulary, coherence, and overall fluency. The study said that AI tools such as Google Gemini AI can be very useful in improving students' writing skills. By providing customized and immediate feedback, these tools help students overcome basic problems in writing and improve their ability to complete assignments. However, the results of this discussion are also in line with findings from studies by Ananda (2024) and Rane (2024), which highlight that overuse of AI can result in dependency and decreased critical thinking skills among students. While Gemini AI offers various benefits, such as increased vocabulary and improved sentence structure, there is a risk of decreased ability to read, self-analyse, and develop ideas independent of technology.

Therefore, the results of this study indicate that the use of Gemini AI can serve as an effective tool in improving students' writing skills, provided that its use is done judiciously and under the supervision of teachers. It is important to maintain a balance between the utilization of technology and the development of students' natural abilities. Teachers have a crucial role in guiding students not only to rely on AI, but also to develop their creativity and writing skills independently.

Thus, educational institutions need to provide clear training and guidelines on the use of AI in the classroom, and design learning strategies that integrate AI responsibly. This aims to ensure that learning objectives are not only achieved in terms of outcomes, but also support students' cognitive growth and digital literacy.

Conclusion

Based on the research objectives, it can be concluded that the use of Gemini AI has a significant impact on the writing skills of tenth grade students at SMAN 10 Palembang. Students who engaged in learning with the help of Gemini AI showed more significant improvement in writing skills compared to students who were not taught using Gemini AI. This improvement was seen in various aspects, including writing structure, language grammar, coherence, and vocabulary selection.

It is recommended that Gemini AI be integrated into the English learning process to improve students' writing skills. Teachers are encouraged to utilize this technology in a sustainable manner with a planned approach, as well as provide the necessary guidance so that students can use the AI in an effective and responsible manner.

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