Students' Perceptions of Gemini AI Effectiveness in Academic Writing

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Abstract

This research investigates students' perceptions of the effectiveness of Gemini AI in English academic writing, addressing the gap in the literature on AI-powered writing tools for EFL students. A qualitative case study involving 26 English education students from a university in North Sumatra explored how Gemini AI impacts their academic writing. Data was collected through questionnaires, analysis of students' academic writing files, and semi-structured interviews. The findings highlight the significant impact of Gemini AI on students' academic writing, particularly in improving structure, coherence, and revision skills. The study also reveals challenges related to source attribution and plagiarism concerns. This study contributes valuable insights into the potential of AI-powered tools like Gemini to enhance EFL students' academic writing capabilities and provides practical implications for educators and developers.

Keywords: *AI chatbot, EFL students, natural language processing, large language model, writing assistant tools*

Introduction

Technology has become an essential element of modern education Bozkurt (2020), profoundly influencing today's youth's in-class and extracurricular learning experiences (Raja, 2018; Tabassum et al., 2024). Empirical evidence substantiates its effectiveness in enhancing student understanding of intricate concepts and promoting collaborative learning environments (Agrawal, 2022; Fithriani, 2023). Incorporating technology in higher education is now broadly acknowledged and thoroughly investigated (Strecker, 2018). Nonetheless, although technological advancements provide unparalleled education opportunities, they also introduce distinct challenges, especially in the domain of academic writing (Cunha, et al. 2020; Alenezi, et al. 2023).

A significant challenge, especially for English as a Foreign Language (EFL) students, is proficient academic writing (Nenotek et al., 2022). Academic writing, a complex intellectual undertaking, transcends mere linguistic proficiency or technical writing skills, demanding instead the intricate synthesis of a range of cognitive abilities, domain-specific knowledge, and discursive strategies (Teng et al., 2021; Wojciechowska & Karpiń´ska-Szaj, 2022). EFL learners must engage in a complex set of tasks, such as goal setting, problem-solving, and efficient memory management (Allen, 2017; Wennås Brante, 2024). The intrinsic complexity is exacerbated by the difficulties encountered by non-native English speakers, including challenges in articulating ideas clearly and succinctly, grammatical inaccuracies, and limited vocabulary. Aldabbus & Almansouri (2022) and Gupta et al. (2022) elucidate that the absence of tailored guidance for students' specific needs impedes the effective enhancement of their writing abilities.

The advent of Artificial Intelligence (AI) technology presents potential solutions to this challenge (Dwivedi, 2019). The integration of AI can be analyzed through the lens of Vygotsky's (1978) theory of mediated learning, which explains that humans use a variety of tools, both physical and psychological, to mediate interactions with the environment. Gemini AI is an AI chatbot that uses an advanced large language model (LLM) that can connect words and concepts, understand in-context clues, and conduct human-like dialogs (Wang & Zhao, 2023; Barrot, 2024). Gemini features advanced functionalities, including real-time updates, extensive generative abilities encompassing text generation, translation, coding, and addressing intricate inquiries, and the capacity to execute complex tasks efficiently (Carlà, et al., 2023; McIntosh et al., 2023).

Research on the application of AI to enhance EFL students' academic writing proficiency has proliferated in recent years. Prior studies have investigated the application of Gemini AI in evaluating research content Ul haq Akhoon, et al., (2024), writing quality evaluation and plagiarism checking Kotmungkun (2024), evaluating the quality of AI feedback Almegren (2024), and Gemini as a Writing assistant Tool (Ananda, 2024). However, research that specifically examines the effectiveness of Gemini AI in improving students' academic writing skills is limited. There is a lack of previous studies that directly evaluate how EFL students utilize Gemini AI in the academic writing process, as well as how Gemini AI promotes the development of writing skills and there are still few studies that explore the strategies students use in adapting the use of AI to overcome specific challenges in their academic writing.

Gemini can assist students in improving their academic writing skills. Featuring a writing editor, idea generator, and study guide, among other functionalities. The app is easily accessible, requiring only a stable internet connection. This accessibility allows access at any time and from any location. This study aims to investigate Challenges to academic writing students' perceptions, the potential of Google Gemini AI to enhance EFL students' writing skills, and strategies for using Gemini AI thereby improving their academic performance and overall language proficiency. The research questions of the study include:

1. What are EFL students' challenges in academic writing?
2. How do EFL students perceive the effectiveness of Gemini AI in supporting their academic writing?
3. What are the Students' Strategies and Adaptations in Using Gemini AI?

Method

This research employed a qualitative case study methodology, as articulated by Baxter and Jack (2008), to investigate students' perceptions of Gemini AI impact on academic writing. This study involved 26 English education students from the University of North Sumatera, students who completed a questionnaire, and five who were chosen to examine further how Gemini AI enhances the structure and coherence of their academic writing. The purposive sampling method (Campbell et al., 2020) was employed to select students who fulfilled the criteria, specifically those who have participated in writing classes. Details of participant characteristics are presented in Table 1 below:

Table: 1 Demographic Participants

Participants	Gender	Age	Semester	Gemini's experience in academic writing	Writing Experience
Participant 1 (P1)	Female	22	5th Semester	Very often	2 Years
Participant 2 (P2)	Female	22	7th Semester	Often	3 Years
Participant 3 (P3)	Female	20	7th Semester	Often	2 Years
Participant 4 (P4)	Male	20	5th Semester	Often	2 Years
Participant 5 (P5)	Female	21	7th Semester	Very Often	2 Years

Based on this table, it shows that all participants had experience using Gemini AI in academic writing. This makes it easier for researchers to explore the perceptions of students with similar levels of experience towards Gemini AI.

This research used three data collection instruments: a closed-ended questionnaire, academic writing samples, and open-ended interviews. This questionnaire consisted of 5 questions using a Likert scale from "strongly disagree" to "strongly agree" to examine students' perceptions regarding various facets of academic writing, including their confidence levels, challenges faced, and time invested in producing an academic paper. This study involves the collection of academic writing samples from students. These samples serve as supporting data for this research. Interviews were subsequently conducted to explore students' perspectives and experiences with Gemini AI for academic writing. The interviews, executed through mobile phones and documented for subsequent analysis, lasted around 20–30 minutes and were conducted in the Indonesian language, because it is more flexible, reduces social bias, and can still produce high-quality data as supported by previous research (Fielding, et al., 2017; Weller 2015).

This study utilized both quantitative and qualitative methods for data analysis. The data from the closed-ended questionnaire were quantitatively analyzed through frequency counts to discern patterns and trends in participant perceptions. The interview data gathered underwent thematic analysis. Thematic analysis, as articulated by Johnny Saldaña (2016), in The Coding Manual for Qualitative Researchers is a widely employed method for analyzing qualitative data. The thematic analysis process is from initial coding, categorization, theme identification, reflection, interpretation, and organization. This research employed triangulation and member-checking techniques to augment the credibility of the results. Triangulation, which involves integrating various information sources from the field to validate evidence, was used to reduce bias that could result from relying on a singular method or data source (Stahl & King, 2020).

Results and Discussion
Result

This study seeks to understand how students perceive the effectiveness of Gemini AI in English academic writing. The data collected from questionnaires and interviews was analyzed, resulting in three main themes that will be discussed one by one. These three themes will provide a comprehensive overview of students' perceptions regarding the use of Gemini in the context of academic writing.

Challenges Faced by EFL Students in Academic Writing

After the analysis data, the closed-ended questions section of the questionnaire was used to obtain students' demographic data related to perspectives towards academic writing, with more emphasis on their experience in academic writing. The data analysis results show that students still find it difficult to academic writing on average.

Table 1. Students' Perceptions in Academic Writing

No.	Statements	Frequency				
		SD	D	N	A	SA
1	I felt confident enough to write academic writing		11.5%	50%	38.5%	
2	I find it difficult to structure good academic writing	3.8%	19.2%	34.6%	34.6%	7.7%
3	I often make grammar and spelling mistakes in academic writing		15.4%	30.8%	38.5%	15.4%
4	I find it difficult to develop ideas and arguments in academic writing	7.7%	26.9%	19.2%	34.6%	11.5%
5	I need a long time to finish an academic writing		11.5%	34.6%	50%	3.8%

SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree

This questionnaire revealed students' views on academic writing and the barriers they face. Confidence in academic writing remains a challenge, with 50% of students disagreeing and 11.5% strongly disagreeing that they feel confident, while 38.5% chose neutral. This shows that most students still feel burdened with academic writing. In addition, 42.3% of students had difficulty in structuring academic writing well (34.6% agreed and 7.7% strongly agreed), while 34.6% chose neutral, indicating that understanding of the structure of writing is still varied.

Grammar and spelling mistakes are also a concern, with 15.4% of students strongly agreeing that they often make mistakes, 30.8% agreeing, and 38.5% choosing neutral, indicating that this issue needs further attention. Difficulties in developing ideas and arguments were recognized by 46.1% of students (34.6% agreed and 11.5% strongly agreed). In addition, efficiency in completing academic writing also varied, with 50% of students choosing neutral, indicating that the duration of writing completion still varies between individuals. These results emphasize the need for more attention to developing students' academic writing skills. After examining the structural challenges students face in academic writing,

the next theme explores how Gemini AI assists in improving coherence and organization.

The Role of Gemini AI in Academic Writing Improvement

Results from questionnaires, and semi-structured interviews indicate that Gemini AI assists EFL students in enhancing the structure and coherence of their academic writing. This process enables participants to obtain feedback from Gemini AI concerning enhancements in structure and coherence. By offering an objective and comprehensive analysis of academic writing, Gemini can pinpoint errors and areas for enhancement, facilitating targeted modifications that improve its effectiveness as a writing assistance tool for academic purposes.

Enhancing Academic Writing Organization with Gemini AI

Gemini AI offers systematic assistance in academic writing, improving its structure and coherence. Students perceived an improvement in writing organization after using this Gemini AI. One student stated, "The analysis of their writing using Gemini AI showed that most students experienced an improvement in their writing structure. Transitions between paragraphs became clearer and ideas were better organized." A participant shared their experience of using Gemini AI to write academic writing.

The participant felt their writing was rushed and lacked smooth transitions between paragraphs. They perceived a sense of abruptness in the flow of ideas, making the overall piece feel disjointed and less cohesive. The writing lacked the polish and structure they desired.

> *Previously, my articles seemed rushed and inappropriate, jumping around every paragraph. With Gemini AI, I see a very significant and crucial change in my articles that feel more natural, more like a research report rather than an article that contains only the same sentences repeated." (P1, Interview, 2025)*

Students reported significant improvements in the quality of their writing after using Gemini AI. They observed that the flow of writing became more natural, resembling the structure of a good research report. Transitions between paragraphs became smoother, making the narrative more logical and coherent. In addition, Gemini AI helped clarify ideas and improved the overall cohesiveness of the writing. This positive experience shows that Gemini AI has the potential to be an effective tool in improving the quality of academic writing, especially in terms of structure and coherence.

Participants had difficulty making smooth transitions between paragraphs, resulting in disjointed and less cohesive writing. This hindered reader comprehension and reduced the clarity of the message. They realized this weakness and worked to improve the fluency and coherence of their writing.

> *"I previously struggled to create smooth transitions between paragraphs, but after using Gemini, my writing flows much better." (P2, Interview, 2025)*

Students reported a significant change in the flow of their writing. Transitions between paragraphs became smoother and more natural, making writing easier to read and understand. The participants felt that Gemini has helped them overcome difficulties in creating cohesive transitions so that ideas can be conveyed more effectively.

Enhancing coherence and logical flow with Gemini AI

The experience of using Gemini AI helps students understand the relationship between ideas in paragraphs. The revision feature not only improves sentence quality but also clarifies the flow of thought. The various correction options and AI's ability to identify errors make the revision process easier and more efficient. This allows students to focus more on the substance of their writing.

The participants found it difficult to determine which parts of their writing need improvement. They are not sure which areas need revision or how to improve them effectively. This process can feel confusing and time-consuming, as the writer has to go through the entire piece of writing to look for potential errors or flaws.

> *"Upon enquiring about the section requiring correction, Gemini AI presented three alternative revisions for my selection." (P1, Interview, 2025)*

Participants explain that after using Gemini, the writing improvement process became more focused and efficient. When the participant asks about which part needs correction, Gemini AI provides three different revision alternatives to choose from. This is very helpful for them because they can directly see several potential revision options and choose the one that best suits their preferences. With these alternatives, writers no longer have to struggle to find and determine the areas that need to be corrected, thus saving the time and effort needed for the revision process. This finding shows that Gemini AI doesn't just function as an automatic correction tool, but also as an assistant that helps writers in their creative process. This allows writers to make better decisions about their writing and ultimately can make the writing better.

Enhancing Revision Skills with Gemini AI

Before using Gemini AI, students experienced difficulties in revising their academic writing. The main challenges included uncertainty in determining the sections that needed to be improved, difficulty in identifying grammatical errors, and limitations in choosing more academic words. After using Gemini AI, they found it more helpful as the AI provided specific feedback on the sections that needed revision.

> *I was often confused about where to start revising. I knew my writing was not good enough, but I didn't know which parts to improve. After using Gemini AI, I received very detailed suggestions about grammar and sentence structure, so I could immediately make improvements." (P3, Interview, 2025)*

Students also appreciate the feature that not only points out errors but also provides several repair options, so they have the flexibility to determine the best revision.

> *"When I asked the AI to check the parts that needed improvement, it not only showed me my mistakes but also gave me several revision options. I could choose which one best suited my writing style." (P4, Interview, 2025)*

Nonetheless, some students realize that manual revision is still necessary for their writing to meet academic standards. Participants found the feedback from Gemini AI very helpful. When they asked for an analysis of areas that needed improvement, the Gemini AI identified their mistakes and provided some revision options. This feature is invaluable, as it allows writers to see concrete examples of how their writing can be improved. In addition, students feel that AI helps them understand the mistakes they often make in writing. By looking at the correction patterns provided by the AI, they realize which aspects of their writing need more attention.

However, although the Gemini AI provides very helpful suggestions, some students also realize that they still need to make manual revisions to ensure their writing meets the expected academic standards. One student revealed that although Gemini AI provides good suggestions, sometimes they still need to adjust the language to be more academic.

> *"I can't directly use all the suggestions from the Gemini. Sometimes I have to adjust it myself to make the language more academic and by my writing style." (P5, Interview, 2025)*

Participants realized that while Gemini AI suggestions are helpful, they are not always suitable for all needs. She found that some Gemini AI outputs required adjustments to align with the specific demands of academic writing and to maintain their writing style. Participants understand that Gemini AI serves as a valuable tool for generating ideas and identifying areas for improvement, but the final product still requires their own critical thinking and editing skills. Thus, although AI acts as an effective tool, students must remain active in the revision process and use Gemini AI as a companion, not as a substitute for their critical thinking."

Gemini AI Role in Idea Generation and Expansion

In academic writing, many students experience writer's block and difficulty developing ideas. This makes writing feel limited and lacking in depth. Gemini AI's brainstorming feature helps by providing various suggestions based on the text that has been written so that students can identify parts that need to be developed or improved.

Participants also often experience idea block, a condition where they struggle to develop ideas or continue writing. When experiencing idea block, they feel stuck and don't know how to continue or develop their writing. This condition certainly hinders the writing process and makes writers feel frustrated. They need a way to overcome the idea block and get new inspiration to continue writing.

> *"When I experienced idea block, I entered my writing into Gemini AI and the AI provided several suggestions for development. From there, I knew which parts needed to be clarified or added." (P4, Interview, 2025)*

From experience, she found a solution to overcome the idea block. When she had trouble developing ideas, she fed their writing into Gemini AI. The Gemini AI then gives some suggestions for developing the writing. From these suggestions, the writer knows which parts need to be clarified or added. Gemini AI helps writers to get a new perspective and find good ideas to continue their writing. In addition to providing suggestions on how to expand arguments, some students also feel that Gemini AI helps them see perspectives they had not previously considered. This makes their writing richer and more varied.

The participants felt that their writing was sometimes too narrow in scope, focusing only on one point of view. They realize that this can make their writing less rich and less in-depth. The participants want to broaden their perspectives and present more diverse ideas in their writing but are finding it difficult to do so. They need help seeing topics from different angles.

"Sometimes I feel my writing is too narrow in scope, only focusing on one point of view. After using Gemini AI, I received recommendations for ideas that allowed me to see the topic from another perspective." (P3, Interview, 2025)

Students experience after using Gemini AI was receiving recommended ideas that allowed them to see topics from another perspective. Gemini AI helped them break out of their narrow focus and consider different points of view. This resulted in more comprehensive and in-depth writing. The participants felt that Gemini AI helped them enrich their writing with new ideas and diverse perspectives, resulting in higher-quality work.

However, although the Gemini AI can provide inspiration and additional ideas, students realize that they still must select the suggestions provided. Not all ideas generated by Gemini AI are appropriate to the context of their research, so they must think critically in choosing and adapting the input from the AI. From these interview results, it can be concluded that Gemini AI acts as an effective tool in overcoming writer's block and enriching the content of students' academic writing. Although Gemini AI cannot completely replace the human critical thinking process; students still must adjust and evaluate the ideas generated to be relevant to their academic writing.

Student Strategies and Adaptations in Using AI

In using the Gemini AI application, students have developed various strategies to utilize it ethically and effectively in academic writing. Based on interviews, it can be concluded that they understand that Gemini AI is not a tool that can completely replace their writing skills. Instead, they see Gemini AI as a supporting technology that helps in developing ideas, improving writing structure, and enhancing. overall academic quality. By implementing the right strategies, students can benefit from Gemini AI without losing originality and academic integrity in their writing.

Ethical and Responsible AI Use in Academic Writing

Students understand the importance of using Gemini AI responsibly to maintain academic honesty and avoid plagiarism. They used the AI as a tool to help them find ideas and structure their writing, not to generate text directly. One interviewee stated:

> *"I use Gemini AI to guide me, not to ask AI to write paragraphs in full. I use it only to give ideas, but students still have to reread and rephrase so they don't get caught by plagiarism detection in Turnitin." (P3, Interview, 2025)*

The student has a good understanding of how to use Gemini AI responsibly in the learning process. The student avoids plagiarism by not submitting writing that is entirely generated by Gemini AI. Instead, they use Gemini as a source of ideas and references and then formulate and write their own opinions. This shows that the student has an awareness of the importance of academic integrity and the development of critical thinking skills. Such wise use of Gemini AI can be an effective strategy to improve the quality of learning and prepare students to face challenges in the digital era.

Students also realized that AI often did not list clear sources, so they had to verify the information before using it. One participant raised concerns regarding the accuracy of the sources provided by AI:

> *"I'm worried that the sources provided are not accurate, incorrect, or even non-existent." (P2, Interview, 2025)*

From the participants, we can see how the students used Gemini AI as a clever learning tool. The students used Gemini to enrich their understanding of concepts and to find ideas. This process was then processed and rewritten in their own words, showing that the student values originality and academic integrity. This is proof that the appropriate use of AI can be a driving force in learning. Gemini AI is no longer an answering machine but has become a collaborative partner that helps students think more critically, creatively, and independently. As such, students are not only prepared to face academic challenges but also have a strong foundation to thrive in the dynamic digital era.

In addition, they emphasize the importance of understanding concepts before relying on AI in learning. Students should not just accept information from AI at face value but ensure that the resulting texts are relevant and in line with academic standards. A participant reported:

> *"Don't just copy text from Gemini AI because it could be wrong or too complex. We have to understand it before using it." (P1, Interview, 2025)*

This information tells and describes a student's wise attitude in using AI. Instead of just "swallowing" information from Gemini, this student emphasizes the need for deep understanding. He realizes that AI can make mistakes or provide information that is too complex. Therefore, understanding concepts is the key to using AI assistance. This attitude reflects a good understanding of how technology should function as a tool, not a substitute for human understanding.

Enhancing writing skills through AI assistance

In addition to helping maintain academic honesty, students also feel the benefits of Gemini AI in improving the quality of their writing. AI helps them in several important aspects, such as arranging the structure of writing to be more coherent, providing new ideas, and assisting in the revision of writing. One of the main benefits that students feel is how AI helps them in arranging the structure and flow of writing. Some students admit that before using AI, their writing often felt incoherent and difficult to understand. However, with the help of AI, they can produce writing that is more systematic and by academic standards. One interviewee explained:

> *"Before using Gemini AI, I felt that my writing was not coherent and seemed to 'jump' between paragraphs. However, after using it as a guide, I saw a significant change in the structure of my writing. My article feels more natural, more like a research report than just a collection of repeated sentences." (P4, Interview, 2025)*

This conversation shows how Gemini AI helped improve the quality of students' writing. Initially, they struggled to organize their writing coherently, but after using AI, their writing became more structured and flowed naturally. Gemini AI acts as a tool, not a substitute, guiding students in building logical arguments, making smooth transitions, and producing more professional writing.

In this interview, a participant explained the comparison between Gemini ai and GPT in the context of academic writing. He highlighted the weaknesses of each AI based on his experience in using both technologies.

> *"For now, in 2025, it is still GPT when it comes to the quality of grammar writing. But when it comes to information, Gemini is more updated because it is directly from Google." (P3, Interview, 2025)*

From this statement, participants prefer to use GPT for academic writing purposes because of its advantages in grammar. However, he also admitted that Gemini AI is superior in terms of information updates because it is directly connected to data from Google. This shows that AI users in academia often have to adjust their choice of tools based on specific needs, such as the accuracy of information or the quality of language in their writing.

This approach reflects the principle of active learning, where technology is used to enhance students' understanding and skills, not to replace their critical thinking. By implementing the right strategies, students can utilize AI to improve

the quality of their writing without losing originality and academic integrity. They remain active in the writing process, starting from understanding the material, and structuring ideas, to revising to ensure their writing remains academic writing. Thus, AI is not only a tool that simplifies the writing process but also becomes a means for students to learn and improve their skills in critical thinking and composing better academic writing.

Discussion

This study confirmed that EFL students still face various challenges in academic writing, especially in structuring their writing, developing ideas, and avoiding grammatical and spelling errors (Alharbi, 2019). These results are in line with Chen's (2022) research, which states that EFL students often have difficulties in understanding appropriate linguistic structures, so their writing often feels disjointed and difficult to understand. In addition, limited time and resources in academic learning are also an obstacle, as students do not always get enough feedback from lecturers or peers, which ultimately hinders the development of their writing skills (Pérez-Juárez et al., 2023).

These challenges are further compounded by distractions in the digital age, which can reduce students' focus during the writing process (Dontre, 2020). In this study, students reported that the use of Gemini AI helped them to develop more structured and coherent writing, especially in terms of idea organization, writing structure improvement, and grammar correction (Utami, 2023). These results support previous findings showing that AI-based technologies can provide faster, and objective feedback compared to conventional methods, thus helping students overcome various difficulties in academic writing (Xu, 2019; Zhang & Cai, 2019). In addition, the use of AI in language learning is also known to increase students' motivation and provide access to additional resources that can help them improve their writing.

This finding is also consistent with the view that technology in education can increase student engagement and create a more interactive and adaptive learning environment. With AI such as Gemini, students find it more helpful in the revision process as it can provide alternative corrections and help them identify errors that they may have missed. However, although AI offers various conveniences, students still realize that its use has limitations. One of the main obstacles they face is that AI often does not include clear sources in the information provided, so they still need to verify the accuracy of the data used in their academic writing.

This is also supported by previous research, which shows that AI in educational contexts still has limitations in presenting information that can be verified academically (Song & Song, 2023). Students in this study also showed a high awareness of the importance of using AI ethically and responsibly (Klimova, 2023; Rusandi, 2023). They do not just use AI to automatically generate writing, but rather as a tool for brainstorming ideas, structuring writing, and editing. This

awareness is important in an academic context, as uncontrolled use of AI can increase the risk of plagiarism and decrease students' critical thinking skills (Cong-Lem, 2024; Hutson, 2024).

To ensure that their writing remains original and complies with academic standards, students apply various strategies, such as rereading and paraphrasing AI output before using it in their writing (Krajka, 2024). This awareness shows that students understand the importance of digital literacy in utilizing AI technology. They also realize that AI should be used as a supporting tool, not as a substitute for their writing skills. With the right strategies, students can optimize the benefits of AI in academic writing without compromising their academic authenticity and integrity (Perkins, 2023).

The findings of this study can also be explained through the ADDIE (Analyze, Develop, Implement, Evaluate) model and TPACK (Technological Pedagogical Content Knowledge) framework. In the ADDIE model, the use of AI in academic writing learning mainly plays a role in the Implementation and Evaluation stages, where students directly experience the integration of AI in the writing process and evaluate its effectiveness on the quality of their writing (Aldoobie, 2015). Meanwhile, within the TPACK framework, this study shows that the successful implementation of AI in academic writing depends on technological knowledge (ability to use AI), pedagogical knowledge (writing learning strategies), and content knowledge (academic concepts that students write about) (Koehler & Mishra, 2008).

Therefore, effective AI integration should consider the balance of these three elements so that students can gain maximum benefit from the technology without compromising their conceptual understanding of academic writing. The results of this study have important implications for teachers, students, and educational institutions. For teachers, the findings show that AI can be used as a tool in providing feedback on students' writing, but it still requires guidance so that students can use AI critically. For students, AI can be a helpful tool in revising their writing, but it should be used with appropriate strategies so as not to degrade their critical thinking skills.

Meanwhile, educational institutions need to consider how AI can be integrated into the curriculum without reducing the reflection and analysis aspects of academic writing learning. For future research, a long-term study should be conducted to evaluate whether the positive impact of AI on students' writing skills can be sustained over a longer period. In addition, comparative research between different types of AI writing tools can also provide further insight into the effectiveness of each technology in supporting academic writing learning.

Conclusion

This study aimed to examine students' perceptions of the effectiveness of Gemini AI in improving their English academic writing skills. The findings suggest that Gemini AI significantly aids students in organizing their ideas, enhancing structural coherence, and refining grammatical accuracy. Students acknowledged that AI-assisted feedback contributed to more polished and coherent writing. However, concerns regarding source attribution and potential plagiarism remain challenges that require attention. Despite these limitations, students demonstrated a high level of awareness in utilizing AI ethically and effectively, treating it as a supplementary tool rather than a replacement for their writing skills. These findings underscore the potential of AI-powered tools in EFL academic writing while emphasizing the necessity of critical engagement and human oversight.

This study contributes valuable insights into the role of AI in language learning and provides implications for educators, curriculum developers, and AI developers. The integration of AI into academic writing instruction must be carefully structured to ensure it enhances, rather than diminishes, students' critical thinking and originality. Future research could explore the long-term impact of AI-assisted writing on students' academic progress and investigate its effectiveness across diverse educational contexts. Additionally, further studies could focus on developing AI models that provide more verifiable sources and personalized feedback to support students' learning needs. Ensuring ethical AI use and fostering digital literacy among students will be crucial in maximizing the benefits of AI in academic writing instruction.

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