

Exploring Long-Term Impact of AI Writing Tools on Independent Writing Skills: A Case Study of Indonesian Language Education Students

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Abstract—This study explores the long-term effects of sustained use of Artificial Intelligence (AI) writing tools on the writing skills of Masters students majoring in Indonesian Language Education. A qualitative case study approach was employed, involving 15 participants selected through convenience sampling. Semi-structured interviews served as the primary data collection instrument, allowing for an in-depth examination of students' experiences with AI tools. The findings revealed that reliance on AI writing tools significantly reduced cognitive effort and creativity, overshadowed personal writing styles, and led to a decline in confidence and skill retention. These results suggest that, while AI tools enhance efficiency and technical accuracy, over-reliance on them may hinder the development of critical thinking, creativity, and independent writing skills. Implications highlight the need for educators to strike a balance between leveraging AI for productivity and fostering students' active learning. Limitations of the study include the small sample size, potential self-reporting biases, and a lack of consideration for individual differences in writing proficiency. Future research should expand the sample and utilize objective measures of writing ability to further explore AI's impact on writing development.

Keywords—Artificial Intelligence (AI)-assisted writing, independent writing skills, Indonesian language education, cognitive engagement, creativity and personal style

I. INTRODUCTION

In recent years, Artificial Intelligence (AI) has made significant advancements, particularly in the field of language learning and writing. AI-assisted writing tools, such as Grammarly, ChatGPT, Jasper, Jenni, Gemini, Copy AI and other generative language models, are increasingly integrated into the academic environment to aid in composition, grammar correction, and content generation [1–4]. These technologies are often celebrated for their ability to enhance productivity, reduce writing anxiety, and help students communicate more effectively in their second language [5–7]. However, as these tools become more prevalent, concerns regarding their impact on students' long-term development of independent writing skills have emerged. Scholars in education and technology have debated whether the reliance on AI tools helps or hinders students in mastering the art of writing without assistance [8–10].

There has been a plethora of research delving into the

efficacy of AI tools in the academic field. For instance, a study conducted by Wang found that AI-assisted tools significantly improved students' grammar and syntax accuracy, leading to higher quality writing outputs in the short term [11]. Similarly, Marzuki *et al.* investigated the impact of AI tools on students' writing skills, specifically focusing on their ability to structure coherent arguments [2]. They found that students using AI tools showed noticeable improvements in organizing their thoughts and developing logical flow in their writing. In a similar vein, Hooda *et al.* explored the effectiveness of AI tools in assisting teachers with providing feedback [12]. Their research indicated that AI tools helped streamline the feedback process, allowing teachers to give more personalized and timely comments, which improved students' revision practices. Other studies have demonstrated that AI tools can enhance language learning and reduce common writing errors, contributing to overall student proficiency [13–15]. However, most research has focused exclusively on the short-term effects, overlooking the potential long-term impacts on students' independent writing abilities. As such, the long-term influence of AI-assisted writing on the development of autonomous writing skills remains underexplored, leaving a significant gap in the current literature that warrants further investigation.

This issue is also evident in the Indonesian context, where the majority of research on the impact of AI on students' writing abilities has primarily focused on its short-term effects [16, 17]. Upon reviewing the existing literature, a systematic approach was used to identify relevant studies through databases like Scopus, Web of Science, and Google Scholar, using keywords such as 'AI-assisted writing' and 'long-term impact.' Articles were analyzed for methodologies and focus areas, revealing an emphasis on short-term benefits like improved grammar and organization. However, there is a clear gap in research exploring the long-term effects of AI tools on students' independent writing skills, making this conclusion well-founded. Furthermore, much of the research in Indonesia has concentrated on English as a Foreign Language (EFL) students, with limited exploration of AI's impact on those studying Indonesian language [18–20]. This is likely due to the prioritization of English for global mobility and career prospects, alongside fewer resources and

incentives for developing AI tools suited to the local linguistic context. However, writing skills are equally foundational for academic and professional success in Indonesian language education, underscoring the need for more research in this area. In fact, writing skills are also foundational for academic and professional success in Indonesian language education. Students in this field are expected to develop strong independent writing abilities, enabling them to critically engage with texts, produce coherent arguments, and demonstrate linguistic competence. This study specifically examines how AI writing tools influence essential skills, such as grammar, coherence, organization, critical thinking, and creativity, as these are foundational for independent writing development and essential for academic success. Given the increasing presence of AI in this learning environment, it is crucial to assess its effects on students' ability to write independently [21, 22]. While AI offers benefits like error detection and vocabulary enhancement, concerns arise regarding whether these tools may hinder the development of cognitive and creative processes essential for independent writing. Thus, exploring the long-term impact of AI on Indonesian Language Education students is necessary to address this overlooked area in the current literature.

In line with the foregoing discussions, this research aims to explore the long-term effects of sustained use of AI writing tools on students' writing skills. By examining these aspects, the study seeks to understand how prolonged reliance on AI tools may influence both the technical and creative dimensions of student writing. Therefore, the research question guiding this study is: How does the long-term use of AI writing tools affect students' development of independent writing skills?

Addressing this research question is urgent as AI tools are rapidly becoming integral to education. Understanding the long-term effects of AI writing tools on students' writing development is crucial to avoid fostering dependency on technology, which could undermine students' independent writing skills. In Indonesian language education, where writing is vital for success, exploring the balance between AI assistance and skill development is essential for ensuring students' long-term academic and professional growth.

II. LITERATURE REVIEW

This literature review provides an overview of the benefits and challenges of AI-assisted writing in educational contexts, with a focus on its role in shaping students' independent writing skills and the potential long-term impacts on learning and skill retention.

A. AI-Assisted Writing: Benefits and Challenges in Educational Contexts

AI writing tools have become increasingly popular in educational settings, offering various benefits to students and educators alike. One of the most significant advantages is the ability of AI tools, such as Grammarly and ChatGPT, to provide immediate feedback on grammar, sentence structure, and word choice, which can enhance students' technical writing skills [23, 24]. This real-time assistance allows students to correct mistakes as they write, helping them produce cleaner, more polished work without waiting for

teacher feedback. In addition, AI tools offer suggestions for improving style and tone, making them a valuable resource for students who may struggle with these aspects of writing [25, 26].

However, recent studies indicate that Indonesian students, particularly those at the university level, still face challenges in producing well-organized and coherent academic writing despite AI integration. Research by Marzuki *et al.* [2] and Werdiningsih *et al.* [4] found that many EFL students in Indonesia heavily rely on AI tools like ChatGPT to enhance content and structure in their essays, but often struggle with independent idea generation and cohesive argumentation. This reliance raises concerns about their ability to internalize core writing competencies necessary for academic and professional success.

Despite these benefits, over-reliance on AI tools can undermine independent writing development [27–29]. By automating many aspects of the writing process, such as grammar correction and idea organization, AI tools may reduce the need for students to engage deeply with their work. This reliance on automation can hinder the development of critical thinking and problem-solving skills, which are essential for producing original and creative writing [30–32]. Moreover, students may become less attentive to learning the underlying rules of language when they expect AI to manage these tasks for them.

To address these challenges, practical strategies can be implemented to help educators balance AI usage with the development of independent writing skills. Assignments can be alternated between those with and without AI assistance, encouraging students to develop both assisted and independent writing skills [9]. Reflection-based activities provide students with opportunities to evaluate how AI tools influence their learning, fostering metacognitive awareness and thoughtful engagement [33]. Collaborative writing exercises offer another avenue for development, as they allow students to cultivate their individual voice while still benefiting from the technical support provided by AI tools [2]. These strategies aim to integrate AI thoughtfully into educational contexts, balancing productivity with the cognitive and creative processes necessary for independent writing. These strategies aim to balance the productivity gains of AI tools with the cognitive and creative processes essential for independent writing.

Frequent use of AI-generated suggestions may also dilute personal voice and expression. Studies show that AI-assisted writing can become formulaic, leading to homogenized outputs and limiting opportunities for creative exploration [34, 35]. Students relying heavily on AI might struggle to experiment with their writing or develop distinctive styles [36, 37]. Structured activities that require students to write without AI support, alongside reflective exercises and peer collaboration, can help mitigate this issue by promoting creativity and reinforcing personal expression. While AI tools offer substantial benefits, their use requires careful management to avoid dependency and ensure skill retention. Thoughtfully designed learning activities enable students to harness AI's strengths while continuing to develop essential cognitive, creative, and technical abilities.

B. The Role of AI in Shaping Independent Writing Skills

AI tools play a complex role in shaping students' independent writing skills by influencing their cognitive, creative, and technical abilities. On one hand, AI tools such as GPT, Grammarly, Jenni, Copy AI and Jasper assist students in structuring their writing more efficiently, providing scaffolding for tasks like idea generation, grammar correction, and vocabulary enhancement [38]. This kind of assistance can support students in producing higher-quality writing, especially when they struggle with technical accuracy or organization. In this sense, AI helps students overcome initial barriers to writing, giving them the confidence to complete assignments more independently [20]. On the other hand, studies on Indonesian students highlight that frequent reliance on AI can weaken independent writing abilities [2, 4, 20]. Students often bypass brainstorming and critical thinking when using AI, reducing their ability to generate original ideas without assistance. This reliance on AI may result in "skill atrophy," where students gradually lose essential writing skills, including creativity and problem-solving.

AI's influence on students' cognitive engagement with writing tasks raises concerns about its effect on deep learning and creativity. By automating key parts of the writing process, such as brainstorming and drafting, AI tools can reduce the mental effort students invest in thinking critically or creatively about their work [39, 40]. As a result, students may become more passive in their writing, relying on AI-generated content rather than engaging in the complex cognitive processes needed to produce original ideas and thoughtful arguments. This cognitive "offloading" can diminish students' ability to develop independent writing skills, as they may not fully internalize the steps involved in crafting a well-developed piece of writing [41, 42].

In addition to the cognitive impact, AI tools also affect the development of students' creative expression. Research suggests that while AI can enhance efficiency, it often does so by offering pre-structured, predictable outputs, which may limit students' opportunity to explore their own creative potential [43]. When students consistently rely on AI tools for tasks like word choice, sentence structure, or even content ideas, they may lose the ability to experiment with language or develop their personal writing style. Consequently, AI's role in shaping independent writing skills is a double-edged sword, providing technical support while potentially stifling the very creativity and cognitive engagement needed for long-term skill development [44–46].

C. Long-Term Impacts of AI Usage on Student Learning and Skill Retention

The long-term use of AI writing tools presents both opportunities and challenges for student learning and the retention of fundamental writing skills. In the short term, AI tools such as Grammarly, ChatGPT, Jenni AI, Copilot and Gemini can enhance learning by providing real-time feedback, improving students' technical proficiency in areas like grammar, punctuation, and style [47–49]. This immediate correction helps students recognize and fix common errors, potentially reinforcing their understanding of language rules. However, research suggests that over time, students may become overly dependent on these tools, using them as a

crutch rather than a learning aid [50, 51]. This dependency can lead to a decline in the retention of core writing skills, as students rely on AI to correct mistakes instead of internalizing the knowledge themselves.

Studies have shown that prolonged use of AI writing tools can result in "skill atrophy," where students' ability to write independently deteriorates due to frequent reliance on AI for idea generation, grammar correction, and even sentence structuring [52–54]. When students depend on AI for these tasks, they may not fully engage with the cognitive processes required for effective writing, such as brainstorming, organizing ideas, and editing their work. As a result, their long-term learning may be compromised, and their capacity to self-edit, generate original content, and write with fluency may weaken. This atrophy not only affects their technical skills but also diminishes their confidence in their ability to write without assistance [55].

Furthermore, AI tools may inadvertently hinder the development of higher-order thinking skills, such as critical analysis and creative problem-solving. While AI can efficiently handle technical corrections, it often offers pre-formulated suggestions that limit students' opportunities to engage deeply with their writing [56, 57]. In the long run, this reliance on AI-generated content can reduce students' ability to approach writing as an intellectual challenge. As their reliance grows, students may struggle to retain essential writing skills and face difficulties when required to write without the aid of AI tools, suggesting that the long-term impact of AI usage on skill retention is complex and potentially detrimental if not managed carefully [58–60].

III. MATERIALS AND METHODS

A. Research Design

The study employed a qualitative case study methodology to thoroughly investigate the long-term effects of the sustained use of AI writing tools among students majoring in Indonesian Language Education as they develop their writing skills. This approach is particularly well-suited for the research, as it allows for an in-depth exploration of complex issues in their natural context, providing a comprehensive understanding of the phenomena being examined [58]. The qualitative case study framework offers the advantage of capturing rich, detailed narratives from a selected group of participants, revealing nuanced dynamics and individualized insights into their interactions with various AI writing tools. By prioritizing depth of analysis, this approach aims to provide a detailed account of the students' experiences and the strategies they employ, elements that might be overlooked in large-scale, quantitative studies [59].

B. Research Participants

The research aimed to gain an in-depth understanding of the perspectives of second-year master's students (third semester) majoring in Indonesian Language Education at two universities in Indonesia, focusing on the long-term effects of AI writing tools on their writing activities. The universities were selected to provide diverse institutional contexts. The first is a large, urban-based university located in a metropolitan area, known for its strong emphasis on

integrating technology into education and providing access to advanced digital tools, including AI-assisted writing platforms. Its diverse student population reflects a range of academic and cultural backgrounds, fostering an innovative teaching and learning environment. The second is a regional university recognized for its focus on community-based education and cultural preservation. While its technological infrastructure is more modest, it actively promotes the use of digital tools to enhance learning outcomes, particularly in language education. Participants were selected using convenience sampling, with specific inclusion criteria to ensure relevance and robust representation. Only students with direct experience using AI writing tools in an educational context were considered, and they needed to have at least one year of experience with tools such as Grammarly, ChatGPT,

Gemini, Copy AI, Jenni, and other AI tools. Willingness to participate was assessed through initial recruitment emails, and participants had to be available for the study.

The selection process involved sending emails to potential participants that explained the study's aims, their roles, data collection methods, and ethical considerations, such as confidentiality and the right to withdraw. Fifteen participants were ultimately chosen, with anonymity maintained by assigning identifiers from Student 1 to Student 15. Informed consent was obtained, detailing participants' rights and the voluntary nature of their involvement. This recruitment strategy ensured ethical standards were met while capturing a diverse range of experiences, thus enhancing the validity and reliability of the research findings. Participant demographics are provided in Table 1 for reference.

Table 1. Demography of participants

Participants Code	Experience in Using AI Writing tools (Years)	Types of AI Frequently used	Institution Status	Region of the Institution
Student A	>1	Jenni AI	Public	Makassar, South Sulawesi
Student B	>2	Grammarly	Public	Makassar, South Sulawesi
Student C	>1	Gemini	Private	Makassar, South Sulawesi
Student D	>1	ChatGPT	Private	Semarang, Central Java
Student E	>1	Jasper	Public	Semarang, Central Java
Student F	>1	Copy AI	Private	Semarang, Central Java
Student G	>1	Copilot	Public	Semarang, Central Java
Student H	>2	Grammarly	Public	Semarang, Central Java
Student I	>1	ChatGPT	Private	Makassar, South Sulawesi
Student J	>1	Jasper	Public	Makassar, South Sulawesi
Student K	>1	Copy AI	Public	Makassar, South Sulawesi
Student L	>1	Gemini AI	Private	Makassar, South Sulawesi
Student M	>1	Jenni	Private	Malang, East Java
Student N	>1	ChatGPT	Private	Malang, East Java
Student O	>2	Grammarly	Public	Malang, East Java

C. Research Instrument

The primary instrument of data collection for this study was the semi-structured interview, chosen for its strategic balance between structured and unstructured formats. This approach allowed the researcher to explore specific topics in depth while maintaining flexibility, enabling a nuanced exploration of participants' experiences. Semi-structured interviews offer the advantage of probing deeply into personal experiences, emotions, and perceptions, yielding richer data than standard surveys or fixed questionnaires. Given the diverse experiences students had with various AI writing tools, this format was especially suited to the research. It allowed the interviewer to tailor questions to each participant's unique journey while adhering to a consistent core framework.

1) Key topics and interview design

The interview questions were constructed based on concepts identified during the literature review, focusing on constructs such as cognitive engagement, creativity, personal writing style, and skill retention. These key concepts ensure alignment between the questions and the research objectives, addressing both the advantages and challenges associated with AI tools in writing. The questions were designed to explore both behavioral and cognitive aspects of writing, including how students engage with their ideas, the influence of AI on their confidence, and their ability to retain core writing skills. Table 2 outlines the interview topics, along with detailed questions used to probe students' experiences.

Table 2. Key topics in the interview

Key Topics	Questions
Long-term impact of AI tools on writing process	How often do you use AI tools like GPT, Grammarly, or Jasper in your writing? How has your writing process evolved since you started using these tools?
Influence of AI on brainstorming and thought organization	How do AI tools influence your brainstorming and thought organization? Do you feel these tools change the way you approach planning and structuring your writing?
Impact on personal writing style or voice	Have you noticed any changes in your writing style since using AI tools? Do you think AI tools have influenced your personal voice in writing?
Perceptions of cognitive engagement, creativity, and self-efficacy	Do you find that AI tools impact your creativity and engagement in writing? How confident do you feel in writing without the assistance of AI tools?
Challenges in balancing AI assistance with independent skill development	What challenges have you encountered when balancing AI assistance with developing your independent writing skills? How do you ensure that AI tools complement rather than replace your efforts?

Taken together, these questions aim to provide a nuanced understanding of how AI tools impact students' academic writing over time. The goal is to identify both the advantages and risks associated with using AI tools, helping educators and students develop strategies for balanced and mindful integration of these technologies to support sustainable skill development and authentic learning.

2) *Validity and reliability of interview questions*

To ensure the validity of the interview questions, the formulation was informed by a literature review of recent scholarly work, including [5, 27, 30, 34, 53]. These studies provided key insights into constructs such as cognitive engagement, creativity, and skill retention, helping to align the questions with the research objectives. Following the literature review, a content validity check was conducted by consulting academic experts with specific expertise in areas relevant to the study. These included specialists in AI-assisted language learning, experts in instructional design for higher education, and researchers with a focus on academic writing pedagogy. The experts reviewed the questions to confirm that they effectively captured the intended constructs and were aligned with the study's objectives, ensuring both relevance and accuracy in the data collection process. The experts reviewed the questions to confirm that they captured the intended constructs and aligned with the study's objectives.

To ensure the reliability of the interviews and the analysis of the results, several steps were taken. First, the interview questions were piloted with a small group of participants similar to the target population. Feedback from these sessions was used to refine the questions, ensuring they were clear, focused, and easy to understand. In addition to piloting, measures were implemented to enhance consistency and reliability. All interviews followed a standardized protocol, and the researcher received training to minimize variations in delivery. Audio recordings and detailed notes captured the full content of the interviews, ensuring the data was accurate and comprehensive. The analysis process was carefully structured to maintain reliability. Multiple researchers independently coded a sample of transcripts, compared their findings, and resolved discrepancies to strengthen inter-reliability. To ensure consistency over time, repeated analyses of the same data were conducted, confirming stable interpretations and reinforcing intra-reliability. By combining piloting, standardized procedures, and rigorous checks for consistency, the study ensured that the interviews and analysis were reliable, transparent, and credible.

3) *Interview schedule and protocols*

The interview sessions were scheduled to last approximately 60 minutes, with some flexibility allowed to accommodate the varying depth of participants' responses. A calm and comfortable environment was arranged to ensure participants felt at ease and encouraged openness during the discussion. Each session began with a brief explanation of the study's objectives before transitioning into the interview itself. The questions were intentionally open-ended, allowing participants the freedom to share their experiences in their own words. The interviews were conducted in the Indonesian language, as this enabled participants to express their thoughts more naturally and comfortably, reducing language barriers and fostering a deeper connection with the questions. To capture the conversation accurately, the researcher took detailed notes and, with the participants' consent, audio-recorded the sessions. Afterward, the audio recordings were carefully transcribed manually, and these transcriptions, along with the researcher's notes, formed the core data for analysis. Throughout the process, strict protocols were

maintained to protect the confidentiality and anonymity of participants, ensuring their contributions remained secure and private.

D. *Data Analysis*

The qualitative data analysis in this study was conducted using a thematic case study approach, allowing for a systematic examination of the content. Following Braun and Clarke's guidelines [60], the goal was to identify recurring themes and patterns that aligned with the research objectives. The analysis process was divided into five key phases and did not involve any software; instead, the data was analyzed manually to maintain a close connection to the nuances in the participants' responses.

The first phase involved a thorough review of the interview transcripts, repeatedly reading them to gain a deep understanding of the data. In the second phase, we developed initial codes by grouping relevant phrases and keywords that corresponded to the research goals. In the third phase, these codes were carefully reviewed, categorized, and refined to reveal consistent themes and connections. To ensure the reliability of these themes, we implemented peer debriefing, where independent researchers evaluated the themes for accuracy and relevance. Additionally, member checking was employed by sharing the identified themes with selected participants to confirm that our interpretations matched their experiences. During this phase, comparisons were made to identify any emerging patterns. In the final phase, the refined themes were synthesized into distinct categories, offering a clear representation of the qualitative data. To further validate the themes, they were cross-referenced with existing literature, ensuring that they were well-supported within the broader research context. This process ensured a thorough and systematic exploration of the data, with the thematic analysis closely aligned with the study's aims and reinforced by established methodologies and prior research insights.

IV. RESULT AND DISCUSSION

A. *Findings*

The objective of this research is to explore the long-term effects of AI tools usage on the students' writing skill development. Based on our findings, three major themes were successfully identified from the students' responses during the interview: dependence on AI leading to reduced cognitive effort and creativity, loss of personal writing style or voice, and over-reliance on AI tools affecting confidence and skill retention. Each of these themes is discussed in detail below.

1) *Dependence on AI leading to reduced cognitive effort and creativity*

The responses from students A, C, D, F, M, and N indicate a clear pattern of dependence on AI tools leading to reduced cognitive effort and creativity. These students express concerns that their reliance on AI tools like Jenny AI, GPT, Gemini AI, and Copy AI has caused them to engage less actively in the writing process. For instance, Student A mentions that Jenny AI completes tasks so quickly that they no longer think through their ideas as deeply, resulting in weaker critical thinking:

“[...] I think I’m starting to depend on it too much. I do not really think through my ideas as much because Jenny AI does it all so fast. It’s nice, but I feel like my own thinking isn’t as strong anymore [...]” (Student A)

Similarly, Student M admits to becoming “lazy” because they know Jenny AI will handle the organization of their thoughts:

“[...] I’ve gotten lazy because I know Jenny AI will do it for me. I am not thinking through my ideas as much as I used to [...]” (Student M)

Student D and Student N both describe how GPT has taken over their brainstorming process, making them less confident in their own ability to generate ideas:

“I use GPT a lot [...], but now I feel like I rely on it too much. When I have to come up with my own ideas, I get stuck. GPT does the thinking for me, and I am not as confident without it. GPT does the thinking for me, and I’m not as confident without it.” (Student D)

“[...] GPT is great for generating ideas when I am stuck, but I feel like it has taken over my brainstorming process. It is making me less confident in my creativity [...]” (Student N)

Student F acknowledges a decline in creativity, as they no longer push themselves to come up with original wording:

“[...] Copy AI is really good at giving me quick suggestions for phrases and sentences [...] I don’t try as hard to come up with my own wording [...] I’m not pushing myself to be creative.” (Student F)

Similarly, Student C reflects on how the ease of Gemini AI makes writing faster but leaves them wondering whether they are becoming complacent in their idea development:

“[...] Gemini AI helps me improve how my writing flows, but sometimes I just accept what it suggests without really thinking. It’s made me write faster, but I wonder if I’m becoming lazy with my own ideas [...]” (Student C)

Collectively, these responses highlight that while AI tools offer convenience, they can also reduce students’ motivation to engage fully in creative and critical aspects of writing, ultimately hindering their ability to think independently and generate original content. This phenomenon is further compounded by another concern raised by the students—the loss of personal writing style or voice.

2) Loss of personal writing style or voice

The responses from students E, J, and O reveal a shared concern about the loss of personal writing style or voice due to their reliance on AI tools like Jasper and Grammarly. These students express that while the AI tools are helpful in improving technical aspects of their writing, they feel disconnected from their own creative expression. Student E explains that, previously, their writing was more “relaxed and personal,” but now it feels like they are “just copying what Jasper suggests,” indicating a shift away from their authentic

voice:

“[...] Jasper has made my writing sound more polished, but I feel like I’ve lost my own style [...]. Before, my writing was more relaxed and personal, but now it feels like I am just copying what Jasper suggests. It doesn’t feel like my voice anymore [...]” (Student E)

Similarly, Student J worries that their personal style is being overshadowed by Jasper’s suggestions, as they no longer enjoy crafting sentences on their own:

“[...] Jasper helps me make my writing sound professional, but I feel like it’s taken away some of my creativity [...] I am worried that I’m losing my personal style. I used to enjoy coming up with my own sentences, but now I just accept whatever Jasper suggests [...]” (Student J)

This overreliance on AI-generated content has also led to a loss of confidence in their ability to write in a way that reflects their individual style. Student O adds another dimension to this issue, acknowledging that their dependence on Grammarly to catch errors has reduced their efforts to learn grammar rules independently, further weakening their sense of independent writing:

“[...] Grammarly has been really helpful for fixing my grammar, but I feel like I’ve stopped trying to improve my grammar on my own [...]. I rely on Grammarly to catch everything, so I do not spend as much time learning the rules myself. It is like I am not as independent anymore[...]

(Student O)

Overall, these responses suggest that while AI tools can enhance technical accuracy, they may also dilute students’ personal voice and style, leading to a more formulaic and less authentic form of expression. The concern extends beyond stylistic dilution—students also report diminished confidence and a weakening of core skills due to their reliance on AI tools, underscoring the importance of balancing technical support with active learning.

3) Over-reliance on AI tools affecting confidence and skill retention

The responses from students B, G, H, I, K, and L highlight the issue of over-reliance on AI tools, leading to a decline in confidence and skill retention. These students express that their trust in tools like Grammarly, Copilot, GPT, Copy AI, and Gemini AI has caused them to become less attentive to fundamental writing skills. For instance, Student B admits to not paying as much attention to grammar rules because they rely on Grammarly to correct mistakes, leading to a gradual “forgetting of the basics”:

“[...] Grammarly has boosted my confidence with writing [...] I do not pay as much attention to the rules because I know Grammarly will fix it. It’s like I’m forgetting the basics [...]” (Student B)

Similarly, Student G confesses that using Copilot for more difficult writing tasks has made them less careful and

thoughtful, signaling a decline in engagement with their work:

“I use Copilot to help with my coding and writing [...] I’ve started to trust Copilot to do the hard parts for me, and I think that’s made me less careful and thoughtful about what I’m writing [...]” (Student G)

Student H’s reliance on Grammarly has undermined their confidence, making them feel unsure about their grammar when writing without the tool:

“[...] Grammarly gives me peace of mind because I know it will catch mistakes [...] I rely on it too much. When I write without it, I feel unsure about my grammar. It’s like I’ve lost some of the confidence I had before [...]” (Student H)

This sense of reduced confidence is echoed by Student I, who finds themselves less confident in their own ideas because of their reliance on GPT:

“[...] GPT is great for giving me a head start when I’m stuck, but now I feel like I always need it. I used to spend more time thinking about how to start my essays, but now I just let GPT do it. It is making me less confident in my own ideas [...]” (Student I)

Additionally, Student K observes that Copy AI has slowed their progress in improving their writing skills:

“[...] Copy AI helps me when I can’t find the right words, but sometimes I feel like I’m not learning how to write better on my own. I am not improving as much [...]” (Student K)

Student L admits that they no longer pay close attention to their work because they trust Gemini AI to handle all the checking:

“[...] I use Gemini AI a lot for checking my work, and it’s really good at catching mistakes. But after a while [...] I’ve started depending on it to do all the checking, and I’m not paying as much attention [...]”
(Student L)

Collectively, these responses reveal that while AI tools provide valuable support, over-reliance on them can erode students’ confidence and impede their ability to retain and apply essential writing skills independently. The findings suggest that reliance on AI fosters a passive learning approach, where students increasingly offload fundamental tasks to technology rather than actively engaging with the writing process. This disengagement risks not only weakening their technical proficiency but also diminishing their ability to trust in their own capabilities when AI tools are unavailable.

B. Discussion

This research aimed to explore the long-term impact of sustained use of AI tools on students’ writing processes, specifically within the Indonesian Language Department. Through in-depth interviews, three major themes were identified, reflecting students’ evolving writing habits. These themes are further divided into relevant sub-themes for a more structured analysis.

1) Dependence on AI leading to reduced cognitive effort and creativity

Students’ reliance on AI tools like Jenny AI, GPT, Gemini AI, and Copy AI has reduced their cognitive engagement in tasks such as brainstorming and content organization. As a result, their writing has become more formulaic, with diminished originality and critical thinking.

a) Reduced engagement in brainstorming and idea generation

Participants reported that reliance on AI tools such as Jenny AI, GPT, Gemini AI, and Copy AI has significantly reduced their cognitive engagement during brainstorming and idea development. They disengaged from active thinking, depending on AI to handle tasks that traditionally require critical thought. As a result, students no longer push themselves to generate original ideas or organize content independently. This aligns with Dergaa *et al.* [61], who argue that reliance on AI tools leads to “cognitive offloading,” reducing students’ engagement in problem-solving. While these tools improve efficiency, the findings highlight that the cognitive ease they offer may discourage students from fully immersing themselves in the writing process. The tendency to bypass brainstorming can diminish not only problem-solving skills but also students’ resilience in working through challenging tasks.

Atkinson and Barker’s [62] observation that AI tools suppress creative thinking by offering predictable outputs reinforces the idea that students may adopt a shallow approach to writing. This shift away from deep engagement threatens the development of self-regulated learning—an essential component for long-term academic success. If students become too dependent on AI-generated ideas, they may struggle to tackle complex writing tasks independently, a concern that has implications for their future academic and professional performance.

b) Weakened critical thinking and cognitive engagement

The findings indicate that students are increasingly allowing AI tools to take over cognitively demanding tasks such as brainstorming, content organization, and idea formulation. As AI automates these tasks, students experience diminished cognitive effort and depth of thinking. For instance, the speed of Jenny AI reduced Student A’s motivation to think through ideas critically. This reduced engagement supports Atkinson and Barker’s [62] observation that AI suppresses deep cognitive involvement. This trend aligns with Abbas *et al.* [27] and Tolan *et al.* [63], who argue that automating cognitive tasks with AI can inhibit the development of higher-order thinking skills and long-term creative growth. Without consistent practice in these areas, students risk becoming passive learners, unable to exercise critical judgment or adapt their thinking in novel contexts. The danger lies not only in skill atrophy but also in the gradual erosion of students’ confidence in their ability to engage independently with challenging tasks, ultimately compromising their intellectual autonomy.

c) Decline in creativity and originality

Participants acknowledged that the convenience of tools like GPT and Copy AI has reduced their creative output.

Instead of striving to develop original content, many students rely on AI-generated suggestions. Their writing has become more formulaic and reflects less personal input, echoing the concern from Jaiswal *et al.* [64] that AI automation can hinder creative development. The findings reflect a broader concern that the ease of AI use inhibits experimentation with original ideas, potentially restricting students' creative growth.

2) Loss of personal writing style or voice

Students reported that reliance on AI tools like Jasper and Grammarly has diminished their ability to express a unique personal style in writing. While these tools enhance technical aspects, they often overshadow creative expression, leading to standardized language and reduced confidence in independent writing. Additionally, students feel less motivated to engage with grammar rules, further weakening their writing autonomy.

a) Standardization of writing style and homogenization of expression

Participants noted that AI tools like Jasper improve sentence structure but reduce the personal touch in their writing. By frequently accepting AI-generated suggestions, students found that their work became more formulaic, with less individuality. AI-driven tools often lead to homogenization, as they promote standardized language and discourage writers from experimenting with tone, structure, or stylistic elements [65]. In line with this, AI tools also prioritize technical polish over personal expression, resulting in mechanical writing that lacks authenticity [66]. This process limits opportunities for students to develop their own voice, restricting their ability to differentiate their writing from others and reducing creative satisfaction.

b) Reduced confidence in independent sentence crafting

AI tools' convenience has affected students' confidence in crafting sentences without assistance. Participants admitted that they rely heavily on tools like Jasper, often accepting its suggestions without actively experimenting with their own ideas. The risk of this dependency is highlighted, observing that technical precision from AI may come at the cost of creative engagement, reducing writers' confidence in constructing original content [37]. Over time, students may become increasingly hesitant to rely on their own skills, preferring AI-generated content over personal experimentation. This dependency discourages students from refining their sentence-building techniques, limiting their long-term growth as independent writers.

c) Weakened motivation to learn grammar rules independently

Participants found that tools like Grammarly, while effective for error correction, diminished their motivation to learn grammar rules on their own. As students increasingly trust AI to handle technical accuracy, they engage less with the fundamental aspects of grammar, leading to weaker independent writing skills. Over-reliance on AI grammar tools reduces writers' sense of ownership, as users bypass the learning process in favor of quick corrections [66]. This dependency diminishes opportunities for active learning, where students engage with and internalize language rules through practice and reflection. As a result, students may

become disengaged from the intricacies of grammar, weakening their ability to self-correct and refine their writing independently. Such dependency fosters skill atrophy, as students fail to internalize essential rules of language, creating a long-term reliance on AI tools for basic writing functions [39]. This reliance risks undermining their long-term writing development, leaving them ill-equipped to produce error-free work without technological assistance, particularly in high-stakes academic or professional environments where independent proficiency is crucial.

3) Over-reliance on AI tools affecting confidence and skill retention

Participants reported that over-reliance on AI tools such as Grammarly, Copilot, GPT, Copy AI, and Gemini AI has negatively impacted their confidence and retention of essential writing skills. Many admitted that this reliance reduced their attentiveness to core elements of writing, such as grammar, organization, and idea development. Trusting AI tools to correct errors and manage complex tasks diminishes students' engagement, making them increasingly dependent on these technologies.

a) Erosion of basic writing skills and skill atrophy

The findings suggest that frequent use of AI tools leads students to neglect fundamental writing skills, assuming that tools like Grammarly will catch and fix errors. This reliance fosters "skill atrophy," where the user's proficiency gradually declines as they offload responsibilities to AI [67]. Similarly, participants relying on GPT for idea generation and Copilot for more challenging writing tasks reported reduced engagement, which further weakens their ability to self-edit and organize ideas independently. This diminished effort in learning and applying fundamental skills risks creating a long-term dependency on AI tools, which can inhibit personal growth in writing.

b) Decline in confidence when writing without AI assistance

Participants also expressed a decrease in confidence when writing without AI support. Some admitted feeling insecure about their abilities to produce quality work without assistance, reflecting the findings of Cardon *et al.* [5], who observed that users reliant on Grammarly and GPT may struggle to maintain confidence in their skills when AI is unavailable. This reliance undermines students' belief in their abilities, making them hesitant to tackle writing tasks independently. The tendency to rely on AI-generated ideas further reinforces this insecurity, as students become less comfortable brainstorming or organizing content on their own.

c) Reduced focus and engagement in the writing process

The study highlights how students' trust in AI tools reduces their engagement with the writing process. Many participants indicated that they defer to AI for grammar corrections and idea generation, becoming passive users rather than active writers. This aligns with concerns that AI tools, while helpful, can contribute to a long-term weakening of users' abilities to focus, self-edit, and independently structure their ideas [68, 69]. This disengagement from the writing process

can have lasting consequences, limiting students' ability to retain and apply their skills effectively over time.

In summary, this study highlights important implications for the use of AI tools in academic and creative writing. While AI tools such as Jenny AI, GPT, Grammarly, and others enhance productivity and technical precision, overuse may result in diminished cognitive engagement, creativity, and confidence. These tools can reduce students' reliance on their own problem-solving abilities and idea generation, leading to standardized writing and a weakened personal style. Educators and institutions should carefully evaluate how these tools are integrated into the learning process to promote the continued development of critical thinking and creativity alongside efficiency. A balanced approach, where AI serves as a supplement rather than a substitute for active learning, is essential for fostering long-term cognitive growth and skill retention.

The study acknowledges several limitations. Reliance on self-reported data may introduce bias, as responses reflect participants' subjective perceptions. Additionally, using only semi-structured interviews limits the breadth of perspectives, as a broader view might have been captured with complementary instruments, such as surveys. Future research should adopt a mixed-methods approach to enhance the robustness and generalizability of findings. Expanding the sample size would also provide a more diverse understanding of how students from different backgrounds interact with AI tools. Finally, accounting for prior writing proficiency and the specific contexts in which AI tools are used will offer deeper insights into their nuanced impact on writing development.

V. CONCLUSION

The objective of this research is to explore the long-term effects of sustained use of AI writing tools on the writing development of students in the Indonesian Language Department. The study investigated the impact of various AI tools, including Grammarly, Jenni AI, ChatGPT, Gemini, Copy AI, and Jasper, through interviews with participants. The findings revealed several key themes related to the influence of these tools on students' cognitive engagement, creativity, personal writing style, and confidence in writing. First, the research highlighted that students' dependence on AI tools has significantly reduced their cognitive effort and creativity. By allowing AI to handle critical tasks like brainstorming and content organization, students are disengaged from active thinking, leading to formulaic and less creative writing. Second, the findings revealed concerns about the loss of personal writing style, with AI-generated suggestions often overshadowing the students' unique voices. This reliance on AI has not only diminished their creative expression but also weakened their confidence in independently crafting sentences. Finally, the study found that over-reliance on AI tools has led to a decline in confidence and skill retention, as students became less attentive to grammar rules and idea formulation, relying instead on AI to complete those tasks. These findings have important implications for the integration of AI tools in academic and creative writing contexts. While AI tools can improve efficiency and technical accuracy, over-reliance on them may

hinder students' development of critical thinking, creativity, and personal style. Educators and institutions must find a balance between using AI to enhance productivity and ensuring that students retain and develop core writing skills. A strategic approach where AI supplements, rather than replaces, active learning may foster long-term cognitive and creative development.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Conception and design: HS and M conceptualized and designed the research study, including the development of the research questions and methodology. W.P. and B.P. Contributed to the design phase, providing valuable insights and expertise in specific areas. analysis and interpretation of Data: Data analysis was primarily conducted by A.M. H, and M. They performed data analyses, interpreted results, and contributed to the generation of key findings. Drafting of the Paper: The initial draft of the manuscript was prepared by H and M and B. P. They were actively involved in writing the introduction, methods, and results sections. revising critically for intellectual content: substantial contributions to the critical revision of the manuscript were made by H, A.M. They provided feedback, revised content, and ensured the intellectual rigor of the paper. Final approval of the version to be published: all authors reviewed and approved the final version of the manuscript for publication. Accountability for all aspects of the work: all authors agree to be accountable for all aspects of the work, ensuring the integrity and accuracy of the research and manuscript.

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