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ORIGINAL

Factors Influencing AI-Assisted Thesis Writing in University: A Pull-Push-Mooring Theory Narrative Inquiry Study

Factores que influyen en la escritura de tesis asistida por IA en la universidad: Un estudio de investigación narrativa de la teoría Pull-Push-Mooring

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ABSTRACT

This study aims to examine the factors that motivate, attract, and anchor students to adopt AI tools during the writing process in the context of push-pull-mooring (PPM) theory. Utilizing a narrative inquiry research approach, this study employed observation, in-depth interviews, and document analysis for data collection. The analysis identified the key factors through reflexive thematic methods. Key pull factors include the generation of credit authorship contributions and the integration of AI into academic writing. The pull factors encompass topic selection, dynamic literature review, research questions, proposal conceptualization, designing research methods, data analysis, revising drafts, and managing references. AI integration incorporates active learning, self-regulated learning (SRL), inquiry-based learning, and overcoming linguistic challenges. The push factors identified include reference inaccuracies, confidentiality of research, and overreliance on AI. Three anchoring principles guide the ethical incorporation of AI in thesis writing: institutional academic policies, AI augmentation, and comprehensive contextual learning approach. But the study's limitations include the small sample size of ten students from a single university, which affects the generalizability of the results.

Keywords: ChatGPT; Co-pilot Microsoft; Inquiry Narrative; Pull-Push-Mooring Theory; Self-Regulated Learning.

RESUMEN

Este estudio tiene como objetivo examinar los factores que motivan, atraen y anclan a los estudiantes a adoptar herramientas de IA, como ChatGPT y Microsoft Co-Pilot, durante el proceso de escritura en el contexto de la teoría de empuje-atracción-anclaje (Pull-Push-Mooring Theory). Utilizando un enfoque de investigación basado en la indagación narrativa (inquiry narrative), el estudio empleó observación, entrevistas en profundidad y análisis de documentos para la recopilación de datos. El análisis identificó los factores clave mediante métodos temáticos reflexivos. Los principales factores de atracción incluyen la generación de contribuciones con autoría reconocida y la integración de la IA en la escritura académica. Entre los factores de atracción se encuentran la selección de temas, la revisión de literatura dinámica, la formulación de preguntas de investigación, la conceptualización de propuestas, el diseño de métodos de investigación, el análisis de datos, la revisión de borradores y la gestión de referencias. La integración de la IA abarca el aprendizaje activo, el aprendizaje autorregulado (self-regulated learning, SRL), el aprendizaje basado en la indagación y la superación de desafíos lingüísticos. Los factores de empuje identificados incluyen

inexactitudes en las referencias, confidencialidad de la investigación y una dependencia excesiva de la IA. Tres principios de anclaje guían la incorporación ética de la IA en la redacción de tesis: las políticas académicas institucionales, la mejora mediante IA y un enfoque integral de aprendizaje contextual. Sin embargo, las limitaciones del estudio incluyen un tamaño de muestra reducido de diez estudiantes de una sola universidad, lo que afecta la generalización de los resultados.

Palabras clave: chatGPT; co-piloto de Microsoft; Narrativa de Consulta; Teoría De Atracción-Empuje-Amarre; Aprendizaje Autorregulado.

INTRODUCTION

In recent years, tertiary education has seen a significant increase in the use of artificial intelligence (AI). Its use has expanded across various domains, including adaptive learning,[1] academic data analysis,[2,3] automated assessment,[4] and enhancing the efficacy and personalization of pedagogy.[5,6,7]

One notable AI application, ChatGPT, has demonstrated enhanced effectiveness and efficiency in various tasks, including thesis composition. Furthermore, it can assist students in organizing ideas[8] and editing content[9] during the academic writing process.[10,11,12,13] Despite its potential, adopting this technology remains controversial and presents several challenges. Thus, this study examines the factors associated with the adoption of AI in thesis writing through pull (PPM) theory to address this controversy.

The push-pull-mooring (PPM) theory examines the factors influencing an individual's decision to migrate, select an alternative product, choose a location, adopt a new technology, or engage in switching behaviour.[14] In the realm of academic writing, a deep understanding of students' motivations and the factors that drive their use of AI tools can assist educators and institutions in the effective integration of these tools into scholarly writing. This integration can significantly enhance the quality and efficiency of academic work while maintaining academic integrity. In this framework, AI's benefits are pull factors. Barriers are push factors. Furthermore, mooring factors encompass discussions about ethical considerations and policy implications.

Aligned with this, previous research has identified several benefits of AI in academic writing as pull factors, including enhanced time efficiency and writing quality. AI can scan and synthesize large volumes of literature with speed, increasing the efficiency of the literature review process by providing concise summaries and insights along with sophisticated data analysis support.[15,16] AI algorithms can process and analyze large datasets with precision and identify patterns, trends, and correlations that are challenging for human researchers to detect.[17] AI-powered writing assistants provide immediate feedback on grammar, style, and coherence, ensuring that a thesis maintains clarity and academic rigor.[18,19] Machine learning techniques enable AI tools to generate personalized research recommendations, thereby facilitating students' rapid identification of pertinent information.[20] Moreover, AI tools streamline tasks, such as academic formatting and referencing, ensuring adherence to the highest academic standards.[21,22]

Yet, the leveraging of AI presents significant challenges, such as ethical considerations, privacy concerns, and resistance from academics and students. Questions about the authenticity of writing and potential overreliance on technology further complicate AI adoption in academic environments. Although AI tools offer large support, it is crucial to acknowledge that they intend to complement rather than replace students' efforts.

Given the theoretical basis of this study, its implementation has become very important in its integration into scientific writing because established models, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), still dominate previous research,[23,24] while the application of PPM theory is still limited. The current study found that Indonesian final-year students used AI tools to overcome various challenges in writing their theses. The challenges they experience include inadequate understanding of the authors' contributions, linguistic barriers, limited access to current references, inadequate research infrastructure, including libraries and technology resources, and a lack of student learning autonomy or significant dependence on supervisor guidance. Thus, this study aimed to investigate the factors that motivate, attract, and keep individuals utilizing AI tools for thesis writing by addressing the following research questions:

What is the push, pull, and mooring factors influencing the adoption of AI-assisted thesis writing tools in higher education?

Theoretical background

Bansal and Taylor introduced the pull-push-mooring (PPM) theory in 2005 to explain human migration patterns. This framework explains why individuals, consumers, and populations move and change their service providers. Experts consider the negative aspects of the current situation that precipitate departure as push factors, whereas individuals find the positive features of the alternative that attract them as pull factors.

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Mooring factors encompass personal, social, or situational variables that ease or impede migration. This theory provides a comprehensive model to understand the motivations underlying migration and decision-making across diverse scenarios, including adopting new technology.[25,26,27] By applying this theory to the academic writing context, educators can gain insights into the dynamics of technology adoption, thereby identifying strategies that can help more effective transitions and enhance the efficacy of novel educational technologies.

Several previous studies have identified factors influencing students' use of AI in academic writing. For instance, Kim et al.[28] posited that AI functions as a multifaceted writing assistant and has emerged as a motivating factor for students to incorporate AI into their academic writing processes. Their findings suggest that students perceive AI-assisted academic writing as more than a mere content-generation tool. Instead, they see it as an active learning partner. It is both a virtual instructor and a digital collaborator.

Similarly, Bantoto et al.[29] found that students in their study demonstrated readiness for AI adaptation in their English language learning, including writing skills. Readiness aligns with three domain expectations: performance, effort, and social. So, educational contexts, governments, and organizations have utilized AI.

According to Wang[30], the use of ChatGPT facilitates students in generating and structuring ideas, addressing both comprehensive and specific aspects of writing. The AI tools assist with overarching elements such as coherence, organization, and argumentation, as well as more detailed components including grammar, lexical choice, and sentence construction.

Songkram et al.[31] studied 3,860 K-12 students on using ChatGPT for schoolwork. Their findings suggest that ChatGPT facilitates students' generation of initial concepts, which researchers categorize as promoting innovative cognitive skills.

Jin et al.[32] classify artificially assisted models into three categories: basic or technical support, textual development, and transformation. Self-regulated learning (SRL) influences these categories, which affect students' learning outcomes. The study revealed that researchers observed the most significant effects on writing quality, motivation, and critical thinking abilities.

Bacon and Maneerutt[33] implemented peer-assisted learning (PAL) as mentors and utilized artificial intelligence (AI) to enhance academic writing in English within the EFL context. This method led to a significant increase in the students' engagement and confidence, which improved their writing scores. In PAL centers, peer mentors use ChatGPT. It gives instant, tailored feedback on writing tasks. The results demonstrated significant improvements in both writing scores and student confidence and engagement. This study provides empirical evidence of the synergistic effects of AI and PAL in EFL pedagogy and offers practical implications for educators.

In conclusion, based on the literature review, it is evident that students can enhance their academic writing skills using AI tools. The current study looked at what motivates and attracts students to use AI tools when they write

METHODS

Research design

This study employs a narrative inquiry design. For this purpose, the researchers considered several important factors: (1) content: students' novel experiences of AI use in the context of academic writing. The use of AI in tertiary institutions in Indonesia is a recent development. Thus, researchers aimed to get a comprehensive understanding of students' experiences and perspectives of AI-assisted thesis compositions. (2) Context: AI-assisted thesis writing for final-semester university students. The context of this research inquiry pertains to EFL students in their final semester, who compose theses as a rule for obtaining a bachelor's degree. (3) Institution: at present, there are no established institutional academic regulations governing the permissible use of AI in theses in the current study. This significant consideration required researchers to investigate students' perspectives, which may serve as a foundation for institutional policymakers to uphold academic integrity. (4) Flexibility and adaptability: the researchers selected this research design because it can ease flexible data collection for student consent. It enables real-time data gathering during student use of AI tools. Furthermore, if researchers must extra verification, they can arrange meetings with students at convenient times, including at off-campus locations. This approach aimed to establish an environment conducive to students sharing their experiences without perceived pressure.[34]

Respondents' characteristics

The research participants were ten final-semester English students engaged in thesis writing. The sample consisted of an equal distribution of five female and five male students. The participants were under 26 years of age, with some engaging in freelance work. The students used various artificial intelligence (AI) tools to assist with their thesis composition. These tools include ChatGPT, Google Translate, Grammarly, QuillBot, and Microsoft Copilot. However, seven participants exclusively employed the ChatGPT because of its cost-free nature and rapid response generation, although they did not always meet their expectations. Participants were selected using a purposive sampling method, specifically targeting those who sought independent solutions

to expedite thesis completion. This approach was adopted to mitigate the potential pressure from thesis supervisors during the guidance process.

Data collection

This study employed multiple data-collection instruments, including observations, in-depth inquiry guides, and documents. Observations were conducted to directly examine the participants' utilization of AI tools for thesis writing during their unstructured time. The in-depth inquiry guide elicited detailed narratives from respondents regarding their experiences with AI tools throughout the thesis writing process, from topic selection to reference utilization. Documents, specifically the students' thesis drafts, were analyzed to compare the quality and content before and after supervision. This comparison aimed to examine the role of AI tools in facilitating thesis writing and the influence of thesis supervisor feedback on the final drafts. By employing these three instruments, the researchers sought to obtain a comprehensive understanding of the factors influencing students' selection of AI-based tools for thesis writing. The researchers asked the following questions to guide participants and ensure their understanding of the intended inquiries:

1. "Would you like to share your experience writing your thesis?"
2. "How do AI tools assist, facilitate, or influence your thesis writing process?"
3. "How do motivating factors impact your thesis writing?"
4. "How do supervisors provide feedback on the thesis?"
5. "How do you suggest AI tools to institutional?"

Data analysis

To answer the research question, Braun and Clarke[35]'s reflexive thematic analysis (RTA) was implemented. The researchers adhered to the following stages: (1) familiarization with data: the researchers conducted multiple readings of the data and documented key observations about the motivations influencing AI-assisted thesis writing. (2) Noting and coding data: data were coded under pull factors, AI integration, push factors, and ethical principles. (3) Theme identification: the researchers categorized similar codes into broader themes. (4) Naming themes: themes were classified as positive (pull factors) or negative (push factors). The generation of credit authorship contributions and integration of AI into academic writing were identified as pull factors, whereas ethical considerations were recognized as push factors. In addition, the principles guiding the ethical incorporation of AI in thesis writing were delineated.

Trustworthiness

Ensuring trustworthiness in a qualitative study is essential for establishing validity and reliability. To achieve this, researchers implemented measures to enhance the credibility of the study by employing the member-checking technique. The researchers requested the respondents to verify the data and confirm the accuracy of the results. In this regard, researchers adhered to McKim's[36] perspective, which suggests that, after presenting the findings of the study to all participants, researchers can solicit their opinions regarding the alignment of the findings with their experiences. In compliance with the Institutional Review Board (IRB) standards, this study complied with the Standard Research Integrity protocols of Musamus University. To maintain participant privacy, all the respondents' identities were pseudonymized. This approach aimed to ensure the responsible conduct of the research.

RESULTS

In response to the research question regarding the push, pull, and mooring factors that influence the adoption of AI-assisted thesis writing tools in higher education, we identified those factors illustrated in figure 1.

(1) Pull (positive) Factors

The primary motivation for university students to undertake thesis writing stems from the opportunity to gain authorship recognition and receive substantial support in their academic pursuits. These factors serve as key drivers that encourage students to engage actively in their thesis work. A comprehensive analysis of these elements revealed their profound influence on students' determination and commitment to successfully complete their research endeavours.

Generating credit authorship contribution

Authorship generation or author contribution is the process of attaining recognition as the principal contributor or author of academic or scientific publications. This is typically accomplished through the production of research, composition, and publication of works that adhere to academic standards, thereby enabling an individual's name to be credited in the publication. Such acknowledgment is significant as it can enhance one's academic and professional standing as well as provide recognition for intellectual contributions. Contribution patterns were categorized into eight distinct types, as described below.

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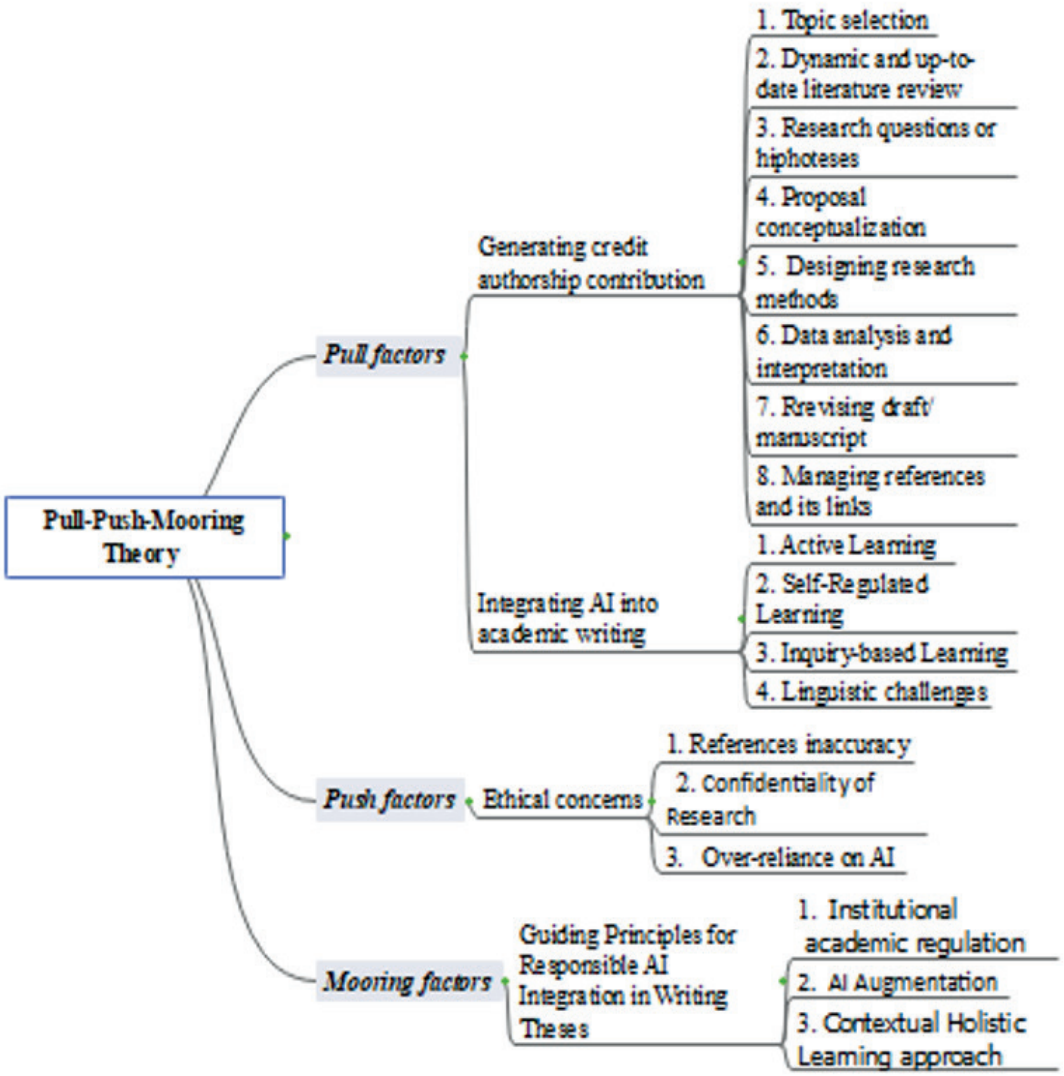

Figure 1. Factors Associated with Leveraging AI-Assisted Theses Writing

Topic selection

This study found that the integration of artificial intelligence into the thesis writing process significantly assisted students in selecting research topics. The participants acknowledged that AI, specifically ChatGPT, efficiently provides a diverse range of contemporary and compelling research subjects. It also facilitated the identification of underexplored research gaps, enabling students to identify novel and significant topics. This integration offers topics aligned with the latest research trends and identifies subjects with significant contribution potential. By leveraging these capabilities, students can efficiently select relevant and engaging topics in their theses, thereby enhancing their academic work's overall quality and impact.

*(1)*Student 1 noted, "Utilizing ChatGPT facilitated the identification of a unique and current topic that I would not have considered otherwise. It expedited the selection process and ensured my research was relevant and innovative." (Student 1)

This excerpt highlights the practical benefits of AI in aiding topic selection during thesis writing. Our findings are consistent with those of the previous studies. For instance, Xu et al.[37], demonstrated that AI can expedite the selection of research topics, ensuring that they are both relevant and innovative. Similarly, Lin & Chen[38] highlighted the role of AI in enhancing various academic aspects, including efficient and pertinent topic selection. These studies collectively support the notion that AI in education enhances the efficiency and effectiveness of academic processes. However, some studies have presented opposing views. Liu et al.[39] argued that excessive reliance on AI might diminish students' creativity and innovation in topic selection. Darwin et al.[40] cautions that AI may lack a nuanced understanding of complex research contexts, potentially leading to less-comprehensive recommendations. Xu et al.[37] highlighted concerns regarding bias in AI training data, which can result in potentially unfair or inaccurate recommendations.

Dynamic and up-to-date literature review

The dynamic and current nature of literature reviews serves as a motivating factor for university students to utilize artificial intelligence (AI) in the process of writing their theses. AI technology can access the most recent information and updates, thereby ensuring that academic research remains both current and relevant. This capability ensures that scholarly work is consistently based on the latest information, thereby enhancing its relevance and impact. The utilization of AI in thesis writing is proposed to facilitate up-to-date literature reviews; track developing technologies, research methods, and knowledge; increase credibility; and prevent research duplication, as evidenced by the following statement:

(2). "I prefer utilizing ChatGPT in writing my thesis proposal because its references are dynamic, not monotonous, unlike Google Scholar." (Student 2)

(3) "Artificial intelligence facilitates the efficient identification of necessary references. In the absence of artificial intelligence, the process of locating these references would likely require greater time." (Student 3)

ChatGPT was the preferred choice for Student 2 when composing the thesis proposal because of its capacity to provide more diverse and current references compared with the relatively static nature of Google Scholar. Dezuanni and Osman[41] posited that these dynamic references enable authors to maintain currency with scientific progress and offer contemporary contexts. Utilizing ChatGPT's references assists authors in avoiding the duplication of existing research, emphasizing that employing recent literature through ChatGPT can enhance the credibility of scholarly work. They state that up-to-date references allow researchers to incorporate cutting-edge technologies and methodologies. This preference aligns with the push-pull-mooring (PPM) theory, where dissatisfaction with static reference sources such as Google Scholar functions as a 'Push' factor, while ChatGPT's appeal serves as a 'Pull' factor. These elements collectively influenced Student 2's decision to adopt ChatGPT. In conclusion, the utilization of current and relevant references from ChatGPT can enhance the quality and reliability of academic writing, consistent with PPM theory. In this context, we assert the importance of conducting appropriate research in relevant literature.

Research questions or hiphoteses formulation

The findings from our interviews indicated that artificial intelligence (AI) provided substantial assistance to students in formulating the research questions and hypotheses. Participants observed that AI's capacity for rapid and accurate information processing afforded them direct access to relevant research questions, which are typically challenging to identify through conventional manual searches. Moreover, AI's data analysis capabilities enable students to discern trends and patterns within their datasets, facilitating the development of more targeted and evidence-based hypotheses. One participant stated,

(4) "AI helped me analyze data more quickly and accurately, so I could formulate better hypotheses." (Student 4)

The abovementioned quotes suggest that creating AI-centric research investigations serves as a motivating factor, prompting students to shift from less efficient conventional methodologies. Traditional approaches are often time-consuming and can produce inaccurate results, leading students to seek superior alternatives. Furthermore, our investigation revealed that AI appeals to students by providing fast and precise solutions to data examinations. In this vein, we are in line with a study conducted by Wang et al. (2024)[26], which showed that AI can increase students' productivity and access to information while fostering critical thinking skills. These factors contribute to the students' inclination to incorporate AI into their research. Moreover, our findings corroborate those of Moundridou et al.[42], who determined that generative AI not only assisted students in formulating research questions and testing hypotheses but also supported educators in designing instructional activities, including discussions, assessments, and quizzes.

Nevertheless, barriers such as the learning curve of AI or concerns about analytical results can be overcome through proper training and assistance. Smith et al.[43] found that AI collaboration can facilitate students' task completion and foster creativity, ultimately increasing their confidence in using this technology. Furthermore, our study agrees with Tariq[44] stated that AI can accelerate data analysis and identify relevant patterns, thereby assisting students in formulating targeted and data-driven hypotheses.

Proposal conceptualization

Our findings revealed that AI significantly assisted students in conceptualizing research proposals. Participants indicated that AI facilitated the formulation of initial ideas, development of research frameworks, and organization of pertinent variables. One student remarked,

(5) "AI helped me in designing research concepts more quickly and in a structured manner." (Student 4)

This observation suggests that students are inclined to deviate from conventional research methods due to time constraints and efficiency considerations. Traditional approaches often require substantial time and may not always yield accurate results, compelling students to adopt AI as an efficient and effective alternative. Concurrently, AI appeals to students by offering expeditious and precise solutions for the development of

research concepts. Lin et al.[45] demonstrated that AI can enhance students' efficiency in creating research frameworks and identifying relevant variables, thus encouraging its adoption in their research processes. However, it is imperative to consider ethical issues and academic integrity when conceptualizing research. Adel et al.[46] argued that ethical considerations demand attention from policymakers in the digital transformation of education and the integration of AI into educational settings.

Designing research methods

The interview findings revealed that students found artificial intelligence (AI) beneficial in crafting research methodologies for their thesis work. AI not only expedited the design process, but also enhanced the precision, rigor, and appropriateness of the research methods aligned with the students' research objectives. This is exemplified by the following statement:

(6) "AI helps me design research methods more efficiently and accurately, so I can focus on other aspects of my research." (Student 5)

This quotation demonstrates AI's significant contribution to the development of research methodology. Students use AI to create research designs that align with their objectives. They also acknowledge that, without AI support, their research method designs occasionally lack the precision expected by their advisors. AI has exerted a notable influence on this domain. Furthermore, AI presents an array of expeditious research methods that elicit student interests. Our study aligns with the work of Filetti et al.[47], who demonstrated that AI enhances efficiency and accuracy in research design, a feature that is highly appealing to students. AI enables students to formulate research methods more rapidly and precisely, thereby improving the quality of their research.

Moreover, artificial intelligence facilitates student comprehension and the incorporation of pertinent research variables, rendering research designs more accessible and visually comprehensible. This is corroborated by Smith et al.[43], who found AI's contribution to enhancing research design quality. Following Schmager et al.[48] study confirmed the effectiveness of AI in conceptualizing research designs. They noted that an AI-driven research design complemented human creativity and fostered an ongoing investigation. Concurrently, AI-assisted research methodologies have the potential to aid students in writing theses or enhance academic efficiency, quality, and output [49][16] given that research methods constitute the core of theses.

Data analysis and interpretation

Our research revealed that AI-driven data analysis employs sophisticated algorithms and machine-learning techniques to uncover patterns within extensive and intricate datasets. Artificial intelligence can execute various tasks, including data cleansing, attribute extraction, and categorization, with greater speed and precision than conventional approaches. Furthermore, AI enhances data interpretation by offering comprehensive insights and dependable forecasts based on available information. This technology facilitates improved and more effective decision-making in an educational context, especially in academic writing. AI makes the data analysis process more adaptable and responsive to data fluctuations.

Using this approach, AI-enhanced data analysis can detect models or patterns that remain obscured in traditional research methodologies. It also provides data visualization capabilities that assist students in comprehending information. The presentation of the data analysis outcomes is further emphasized in the following statement.

(7). "AI greatly helps speed up the process and identify previously unseen pattern analysis. The insights provided are also more in-depth." (Student 6)

This excerpt elucidates the substantial influence of artificial intelligence (AI) in enhancing the data analysis process and improving the quality of information in university-level thesis writing. AI can accelerate analysis and elucidate latent patterns, enabling rapid data processing and facilitating students' task of filtering pertinent information. AI provides comprehensive insights and delivers expeditious and thorough analytical results. This depth of analysis empowers decision-makers to make more informed choices based on extensively examined data. Our findings also support those of Qazi et al.[50], who posited that AI-assisted writing promotes active learning among students. Their research illuminates how AI encourages students to engage with various levels of Bloom's taxonomy, allowing them to analyse their theses with AI support.

Revising draft/manuscript

Artificial intelligence (AI) plays a critical role in enhancing students' thesis revision. It provides comprehensive assistance by identifying and correcting grammatical and spelling errors while also suggesting improvements to the writing style. AI technology can be used to analyse sentence structures and enhance text comprehension. In addition, it can detect instances of plagiarism and propose alternative phrasing for content that closely resembles other sources. AI tools can also evaluate the overall coherence and structure of a text and offer recommendations for improvement. Furthermore, AI could suggest relevant citations to strengthen the

arguments presented in the students' manuscript as one student stated,

(8). "I found that using AI for my thesis revision is extremely beneficial, particularly in refining grammar and offering improved structural recommendations. This streamlines the writing process and results in a higher-quality final product." (Student 7)

This statement elucidates students' positive perceptions of integrating AI into the thesis revision processes. AI has demonstrated significant efficacy and time efficiency in refining, enhancing, and modifying thesis drafts. This observation aligns with Hsu's[51] assertion that AI presents opportunities, challenges, and implications for scholarly writing. Specifically, Hsu posited that AI could expedite the revision and editing processes of academic compositions.

However, aside from the potential of AI as mentioned previously, certain scholars have expressed apprehension regarding the possible compromise of academic integrity due to the extensive utilization of AI in scholarly writing, especially when students become excessively reliant on it. This concern is supported by the findings of Wang et al.[52], who examined 100 US universities and discovered the implementation of AI guidelines for both infrastructure and students. While these institutions viewed the guidelines as supportive of AI use, researchers noted that the established guidance necessitates careful consideration. Alkamel & Alwagieh [53] posited that the ChatGPT functions as an effective writing assistance tool for EFL learners by improving their academic writing skills. Nevertheless, they underscored the need to address the ethical considerations pertaining to academic integrity.

Managing references and links

Our research revealed that artificial intelligence (AI) enhances students' thesis writing processes by facilitating reference management and source linking. AI streamlined the organization of references according to specified formats, such as the American Psychological Association (APA) style. Furthermore, AI has facilitated the identification of pertinent literature, detection of plagiarism, and generation of bibliographies. This technology simplifies the management of online source links and potentially improves the efficiency. AI-assisted annotation and note-taking of references allowed students to focus more on their research content, as evidenced by the following:

(9) "AI not only reduces time expenditure but also ensures accuracy in reference matching. By utilizing AI's plagiarism detection capabilities, this researcher was able to verify that all citations were properly attributed, thus minimizing the risk of unintentional duplication." (Student 8)

The quotation from student 8 elucidates the advantages of artificial intelligence in academic and research contexts. AI technology offers substantial benefits, including enhanced time efficiency, precise reference matching, and effective plagiarism detection, which constitute compelling rationales for researchers to adopt this tool. The capacity of AI to mitigate duplication risks and ensure accuracy may serve as a significant factor, encouraging sustained utilization of the technology in academic environments. These features demonstrate the potential of AI as an exemplary solution for addressing scholarly and research requirements.

In contrast to our research, Safrai and Orwig[54] proposed that artificial intelligence can be used for academic writing. However, they observed that the AI produced inaccuracies and inconsistent references. Similarly, Preisler (2024) argues that AI-assisted reference correction presents significant challenges. He noted that AI-aided research is susceptible to hallucinations and ghost references. Moreover, he posited that AI-generated citations are analogous to fabricated sources. Although our empirical findings differed, we ultimately corroborated the potential application of AI in the composition of students' theses.

Utilizing AI to refine academic ability

The next section elucidates the various techniques, methods, and approaches students employ to enhance their scholarly writing proficiency, particularly in the context of thesis composition. Subsequent internal factors influence and motivate students to utilize artificial intelligence to enhance the quality of their thesis writing: (1) the active learning method (ALM), (2) self-regulated learning (SRL), (3) inquiry-based learning (IBL), and (4) linguistic challenges.

Active Learning Method (ALM)

When students try to leverage tools to assist them in writing theses, they use active learning methods. This method encourages students to be more active in writing their theses. AI facilitates students' activeness throughout: First, AI was used to search relevant literature, encouraging students to be more critically evaluative in references. Second, AI can help in the discussion and idea brainstorming and possibly encourage students to actively participate in developing research topics. Third, AI, as a feedback provider in real time, helped students revise and make strong arguments. Therefore, the students were actively involved in searching for references and information that supported their thesis writing.

(10) "I actively searched for relevant literature for my thesis, and after finding assisted AI, I discussed it

with my supervisor." (Student 9)

The aforementioned implies how students actively searched for relevant literature until they revised draft-assisted AI. Our findings align with those reported by Van Niekerk et al.[55], who characterized ALM as an approach that promotes student proactivity in pursuing academic interests. They emphasized that AI could provide more active support for students in the revision of their work. This perspective is corroborated by Ruiz-Rojas et al.[56], who posited that the integration of AI as a tool in higher education can facilitate collaborative learning and enhance critical thinking skills. Within this context, the current study contributes to the development of active learners in the academic writing domain.

Self-Regulated Learning (SRL)

Our research indicated that self-regulated learning (SRL) plays a pivotal role in enhancing writing effectiveness. SRL encompasses setting goals, monitoring progress, and evaluating writing outcomes. Integrating artificial intelligence with SRL techniques enhances the efficiency and productivity of the writing process. A subset of students reported that this approach was particularly advantageous for composing their theses while still valuing guidance from supervisors.

(11) "The utilization of artificial intelligence in thesis composition significantly expedited the feedback process. Using AI to anticipate supervisory input, I acquired increased confidence in my theses work." (Student 10)

Self-regulated learning (SRL) with AI involves using artificial intelligence to support and enhance how learners regulate their thesis writing process. Time management and planning factors motivate learners to use these tools. AI tools can help learners manage their time and plan their study schedules. By analyzing deadlines, workloads, and learning habits, AI can suggest optimal study times, remind learners of upcoming tasks, and assist in organizing to improve the quality of their theses. Our study aligns with Jin et al.[32], who asserted that SRL-assisted AI influences students' writing quality, motivation, and critical thinking skills. In alignment with this perspective, Ardiningtyas et al.[57]; Leba et al.[58]; O'Neill & Russell[59] also posited that Grammarly, as an AI tool, demonstrated significant potential for self-regulated learning (SRL) students in enhancing their academic writing proficiency.

Inquiry-based Learing (IBL)

Inquiry-based learning (IBL) occurs when students engage in autonomous learning by formulating questions. This pedagogical approach facilitates the development of self-directed learners, critical thinkers, and individuals committed to lifelong knowledge acquisition.This investigation revealed that AI-enhanced writing tools influenced multiple aspects of inquiry-based learning (IBL). These tools primarily enhance students' research capabilities by efficiently processing extensive datasets and facilitating the identification of relevant literature. Additionally, the study underscored the significance of questions as central elements for learning in IBL, wherein students are encouraged to formulate inquiries that guide their investigative processes. Finally, AI demonstrated the capacity to provide comprehensive, structured information beyond the initial project scope, offering students more profound insights into their study topics.

(12) Through the application of artificial intelligence, numerous questions relevant to my thesis can be generated. This methodology produces more comprehensive data than previous inquiries. The formulation of effective questions occasionally presents a challenge in my research. (Student 1)

The aforementioned exerpt illustrates when student leverage AI assisted them to write their thesis thorough questions provided. AI potential provides rich literature systematically even beyond of what that student asked before. Our findings are consistent with those of Moundridou et al.[44], corroborating that artificial intelligence can support educators in developing and implementing inquiry-based learning (IBL) lesson plans. Moreover, they observed that AI-assisted IBL has the potential to facilitate students' thesis writing, particularly in formulating research questions or conceptualizing and testing hypotheses. In this context, we designated it as an attractive (pull) factor influencing students' utilization of AI in the writing process.

Linguistics challenges

Our study revealed that one of the primary factors attracting students to utilize AI tools during their thesis writing process was linguistic challenge. These challenges were most pronounced for the participants in this study as EFL learners. Difficulties with vocabulary, grammar, pronunciation, and comprehension compel students to seek alternative solutions. Challenges with idiomatic expressions and cultural references can also motivate students to search for tools that can aid them in understanding and expressing their ideas more effectively. Access to appropriate educational resources and support could be a significant contributing factor.

AI's capacity to provide immediate feedback, suggest improvements, and offer personalized support can attract students. Features such as language translation, voice-to-text conversion, and thesis structuring facilitated the writing process, drawing students towards AI-assisted thesis writing.

Furthermore, AI can provide interactive and engaging learning experiences, which encourages students to use these tools. The process becomes more accessible and less daunting with AI support. The availability of AI tools, whether at no cost or minimal expense, and their user-friendly nature serve as anchoring factors that support students' decisions to employ them as excerpt below:

(13) AI tools have been employed to facilitate my thesis writing because of the necessity for grammatical enhancement. My supervisor frequently identified the grammatical errors. To address this issue, I selected AI tools, specifically Grammarly and QuillBot. (Students 2)

The excerpt highlights that linguistic challenges significantly motivate students to use AI tools for thesis writing. For EFL learners, these challenges encompass difficulties in vocabulary, grammar, pronunciation, and comprehension. Struggling with idiomatic expressions and cultural references also drives students to seek AI assistance. Access to appropriate resources and support is a crucial factor. Our study supports Santoso[60], who discovered that linguistic challenges prompt students to use AI. Similarly, Selim[61] emphasized that linguistic barriers, including vocabulary, grammar, pronunciation, and comprehension difficulties, have made AI-powered tools essential aids for EFL university students in academic writing.

Push (negative) factors Challenges and Risks of AI in Writing Theses

Ethical ethics

Notwithstanding the advantages of utilizing AI-assisted academic writing, university students should consider several disadvantages when employing AI tools for thesis compositions. These include inaccuracies in references, privacy concerns, a lack of technical support, limited access to AI resources, insufficient engagement in critical thinking, overreliance on AI, and the potential to obscure the distinction between truth and error. A comprehensive explanation of these points is provided.

References inaccuracy

The results of this study indicate that AI-powered tools such as chatbots, Microsoft Copilot, and ChatGPT often generate incomplete or incorrect references. This poses a significant challenge in scholarly writing, where citation accuracy is crucial. The tendency of AI to produce inaccurate references may mislead students who do not have the necessary skills to verify the information. The inaccuracy of AI-generated references can be attributed to insufficient training data or outdated information sourced from online databases. AI systems, which operate on programmed algorithms, cannot evaluate the reliability of information found on the internet. Furthermore, AI-generated references may suffer from misinterpreting context, especially when more recent references are unavailable online, leading to inaccuracies. Students have highlighted that this issue can seriously undermine the credibility of their academic submissions.

(14) I used ChatGPT to search for references while composing my proposal; however, upon subsequent verification, I discovered that numerous references were invalid. Consequently, I cross-referenced these sources with a Google Scholar journal. (Student 1)

Student 1's experience showed that not all references generated by AI tools can be used in theses without thorough verification against trusted and credible databases. Inaccurate references may compromise academic integrity by obscuring the distinction between correct and incorrect information, potentially misleading researchers and readers. On the other hand, AI tools have the potential to blur truths and errors. Our findings align with Al-Sofi's[62] discussion in "What to do and not to do in AI-Powered Academic Writing." He argued that ChatGPT could undermine academic integrity and critical thinking in academic writing. Consequently, it is vital to offer substantive guidance on using ChatGPT to enhance academic writing skills and creativity. Similarly, Al-Bukhrani et al.[63] maintained that the adoption of AI tools in the academic writing process poses risks to academic integrity, scholarly homogeneity, and authorship. These concerns require that students apply greater critical thinking skills and cross-verify information from credible sources. AI can be a valuable tool for academic writing without compromising academic integrity.

Confidentiality of Research

In an academic context, it is imperative to maintain the confidentiality of research and scientific papers until they are published. However, artificial intelligence (AI) tools present an increased risk of research data leakage. Concerns exist regarding the data collected by AI and its potential utilization by users, as AI can produce consent letters that comply with the research data requirements. Author consent letters pertaining to the use of primary, secondary, or third-party data are essential for research ethics to mitigate unforeseen issues and conflicts. Private data gathered by AI may be susceptible to being targeted by malicious actors if they are inadequately protected. The data utilized by AI can become vulnerable to unauthorized access or misuse, if not properly secured. Irresponsible human exploitation of AI user data poses significant risks. Consequently, when employing AI for thesis writing, caution should be exercised while handling private data.

(15) While artificial intelligence tools facilitated my thesis writing process, concerns arose regarding

research privacy. Specifically, when I inputted data for the analysis, my participants' profiles were provided without anonymization. This has raised significant privacy concerns and created hesitation regarding the use of AI tools. (Student 3 &4)

Participants 3 and 4 expressed concerns regarding the confidentiality of their research owing to their utilization of AI tools for analyzing research data with fictitious information. They acknowledged that research privacy is occasionally overlooked owing to administrative requirements from faculty members, resulting in the input of all raw data into AI tools without considering the identities of the research participants. To overcome these concerns, we endorse the Indonesian government's Ministry of Higher Education, Science, and Technology's release of a guidance book on the utilization of Generative AI in higher education learning. However, this book remains rudimentary as it does not explicitly mandate the use of AI tools, which can be accessed as learning resources for university students. The Indonesian government recommends that higher education institutions incorporate AI in their academic regulations.

Over-reliance on AI

Our study notes that over-reliance on AI tend to make students be insufficient critical thinking engagement. It is cause by first, AI tools offer some easiness in looking for needed references. It can produce texts and organize important substance of their theses and ignored exixting concept of knowledge. Second is, AI tools offer suggest so that tend to lead students are lazy to be creative and criticized as the excerpt follows:

(16) ChatGPT proved to be a valuable resource for providing literature for my research; however, I experienced a lack of confidence when my supervisor requested a more detailed explanation. This experience resulted in a reprimand from my supervisor. Subsequently, I limited my use of ChatGPT to instances when I had exhausted my ideas. (Student 2)

Student 2's excerpt emphasizes the significance of thesis supervisors or educators in intervening in and monitoring artificial intelligence (AI) usage for academic work. This monitoring aimed to mitigate excessive reliance on AI by fostering critical thinking and metacognitive strategies among the students. For instance, prompting students to elucidate their findings about their research questions during thesis supervision could facilitate the assessment of their comprehension. If students can provide a comprehensive oral explanation, this indicates their substantive engagement with their theses. In this context, we endorse the metacognitive strategy proposed by Yao et al.[64] to ensure the academic writing proficiency of postgraduate students.

Mooring Factors

Guiding Principles for Responsible AI Integration in Academic writing

With respect to the perspectives of PPM theory, our investigation proposes guiding principles for the integration of artificial intelligence in academic contexts, specifically institutional academic regulation, avoidance of AI dependency, and the contextual holistic learning model.

Institutional academic regulation

As mooring factors, our study confirmed that institutional regulation is crucial for ensuring the safe use of AI in academic writing. According to the guidance book published by UNESCO in 2022, institutions should plan regulations and policies that maximize the advantages of AI tools and empower stakeholders, including teachers, learners, and researchers. In this context, institutions play a vital role in promoting the responsible use of AI in academic settings. Consequently, institutions should allocate additional budget for AI coaching and training for faculty members. Additionally, they can assist students in aligning with AI ethical issues.

(17) I hope that Musamus University leaders will facilitate student workshops as researcher agents in the future. (student 5) & "AI technology cannot be avoided, so campuses should be anticipated." (student 6)

Students' excerpts suggest that institutional intervention plays a crucial role in promoting responsible AI usage among faculty members and students. They posited that the advancement of technology, including AI, is inevitable and should be integrated into an academic context. In this regard, we corroborate the findings of Jin et al.[32], who asserted that to mitigate ethical concerns regarding GAI usage, universities should proactively establish policies concerning the eligibility of AI tools in academic settings.

AI Augmentation (AI tools as just co-pilot and human is pilot)

Educators and faculty members should provide appropriate instruction to reduce students' reliance on artificial intelligence (AI) tools for thesis composition. AI should be viewed as a tool to assist, rather than replace, human cognitive efforts. Students ought to be encouraged to develop critical thinking skills to assess the information generated by AI and not accept it without scrutiny. This approach underscores the importance of pedagogical oversight.

(18) yeah…while artificial intelligence tools facilitated the rapid compilation of numerous references, my supervisor recommended verifying them against reputable journals. Reputable journals typically employ a

double-peer review process to ensure reliability of their references. (Student 6)

The perspective of Student 6 suggested that artificial intelligence primarily serves as an auxiliary tool in thesis composition by quickly providing reference materials, although these sources still require thorough verification. Concerning AI enhancement, this study strongly supports the view of Nnorom[65], who argues that while AI technology offers educational benefits, it is crucial to maintain a balance between technological advancements and human principles. To tackle this issue, a multidisciplinary group of experts, including scientists, technologists, ethicists, policymakers, and social scientists, should work together to establish guidelines for the ethical implementation of AI in educational and social science fields.

Contextual Holistic Learning Approach

Based on in-depth interview results, our study proposes a Contextual Holistic Learning Model as a foundational factor. This model aims to guide students in using AI tools responsibly, particularly for academic purposes. Holistic learning, which includes cognitive, emotional, social, and contextual approaches, acts as a responsible guideline. AI tools cannot provide these four elements. By implementing this holistic model, we expect that AI policy usage will encourage students to take greater responsibility for their use of AI tools in any context.

As noted by Student 4, "while artificial intelligence (AI) tools can facilitate the rapid identification of numerous references, the critical evaluation of these sources remains necessary." This perspective was countered by Student 8, who posited that a more complex issue concerning AI utilization is the ambiguity surrounding accountability for inaccurate data generated by AI systems.

Based on the statements of both Students 4 and 8, it is empirically evident that one of the key mooring factors is the enhancement of contextual, socio-emotional, and cognitive aspects in the utilization of AI tools, which is referred to as a holistic approach. This approach facilitates students' improvement in their metacognitive skills, as the responsible use of AI incorporates these elements. While AI emphasizes rapid responses and operates based on prompt engineering without accountability risks, human cognition relies on reasoning and socio-emotional and cognitive processes, extending to metacognitive skills.

DISCUSSION

To address this research question, this section is divided into three subsections: push, pull, and mooring factors that influence the adoption of AI-assisted thesis writing tools in higher education within the Indonesian university context.

First, pull factors: (a) generating credit authorship contributions including (1) topic selection, (2) dynamic and up-to-date literature review, (3) research questions or hypotheses, (4) proposal conceptualization,(5) designing research methods, (6) data analysis and interpretation, (7) revising draft/manuscript, and (8) managing references and their links. (b) Integrating AI into academic writing includes (1) active learning, (2) self-regulated learning (SRL), (3) inquiry-based learning, and (4) linguistic challenges. The two primary pull factors, namely generating credit authorship contributions and integrating AI into academic writing, are potential motivations for encouraging students to utilize AI tools for academic purposes.

The undergraduate students in this study demonstrated limited comprehension of credit authorship contributions and the associated responsibilities in thesis writing. Furthermore, as previously noted in the introduction, the challenges they encountered prompted them to utilize advanced AI technology. Researchers have identified this approach as an innovative strategy to enhance academic writing skills. This strategy concurrently improves students' language proficiency as AI-assisted tools provide language corrections, which are often necessary for EFL learners. We posit that the more extensive the students' work validated by supervisors using AI-assisted tools for thesis writing, the greater their language proficiency. In this vein, we stand in line with Amer et al.[66], who asserted that EFL Jordanian supervisors perceive the ChatGPT as a language proficiency evaluation tool for academic writing.

Furthermore, researchers posit that students' motivating factors in incorporating AI into academic writing include active learning, self-regulated learning (SRL), and inquiry-based learning. These factors facilitate and enhance active learning through individualized approaches. Consequently, students can adopt a more proactive stance in conducting literature searches for their theses using tools such as ChatGPT and Microsoft Copilot. Additionally, students develop into active, self-directed learners as AI tools become text-driven. The immediate feedback provided by AI tools also exerts a positive influence on SRL during the thesis writing process. This study corroborates the findings of Schönberger[67], who posited that artificial intelligence can enhance material comprehension and knowledge retention among higher-education students, thereby promoting active engagement in the learning process, as confirmed by.[68,69]

In contrast, we respectfully disagree with renowned linguist Chomsky[70], who asserted that AI is "a way of avoiding learning." This statement is not relevant to our findings, as demonstrated by Student 9, who actively sought references with the help of AI: "I actively searched for relevant literature for my thesis, and after finding it with AI assistance, I discussed it with my supervisor." This was further supported by Student 10: "The

use of AI in thesis composition significantly expedited the feedback process. By employing AI to anticipate supervisory input, I gained increased confidence in my thesis work."

Second, the push factors influencing students' adoption of AI tools referring to PPM theory in thesis writing encompassed negative factors and ethical considerations, including (a) reference inaccuracies, (b) confidentiality of research, and (c) overreliance on AI. These three ethical considerations underscore the challenges students face in developing their academic writing skills. Consequently, students are encouraged to enhance and refine their cognitive, metacognitive, and critical thinking abilities to verify information generated by AI tools. Failure to do so may result in theses being deemed academically dishonest because of the use of inaccurate references. The findings of this study are consistent with those of Lund & Wang.[71] These researchers posited that while artificial intelligence technology possesses the potential to enhance learning experiences and foster creativity, it may simultaneously contribute to the deterioration of academic writing skills.

Three fundamental anchoring principles guide the ethical incorporation of AI in thesis writing: institutional academic policies, AI augmentation, and comprehensive contextual learning approach. These principles are designed to facilitate students to produce high-quality theses responsibly while maintaining academic integrity. It is emphasized that AI tools should function as assistants or co-pilots for tasks, rather than as substitutes. Although AI can facilitate writing assistance, students must adhere to institutional academic guidelines by disclosing the use of AI in their research methodologies. This ensures transparency in the academic application of AI. Furthermore, students should critically evaluate the information generated by AI tools from various perspectives, including empathy, social-emotional awareness, and cognitive and metacognitive aspects. While students may be reluctant to endorse AI-assisted data references, they should seek validation from their thesis supervisors. It is imperative to not accept AI-generated information without critical evaluation.

In this context, we concur with Chomsky[70], who posited that AI represents a form of 'high-tech plagiarism' for students. AI-generated content is susceptible to plagiarism or widespread academic dishonesty because it relies on information aggregated from Internet databases without due consideration for copyright and authorship. To address this issue, academic institutions should implement measures as mooring factors to mitigate student dependence on AI and preserve the integrity of scholarly writing, as explicitly stated in the guidance book published by UNESCO in 2022.

CONCLUSION

This study explored the use of AI-assisted thesis writing tools in Indonesian university to clarify students' motivations and challenges from PPM theory perspective. Its findings suggest that AI technology can serve as an innovative strategy for enhancing academic writing skills and language proficiency, particularly through active learning and self-regulation. However, it is crucial to acknowledge that this study included only ten students from a single university, which represents a significant limitation in the generalizability of the results.

Nonetheless, the study indicated that AI can facilitate high-quality thesis writing while addressing ethical challenges such as inaccurate references and research confidentiality. Academic institutions should enact policies that promote the ethical and transparent use of AI in academic writing, and students should commit to disclosing their use of AI and critically evaluating information.

Thus, the responsible adoption of AI technology not only helps students complete their academic tasks but also encourages them to become active and independent learners. The implications of this study highlight that academic institutions must establish clear ethical policies, while students should view AI as a tool, not a substitute, to uphold academic integrity. This study offers valuable insights for universities around the world on how to integrate AI into academic writing, foster the development of writing skills, and ensure ethics and transparency in the use of AI technology.

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