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Implementing AI-integrated English writing: university English language learners writing strategies and perceptions

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ABSTRACT

This study examines the writing strategies and perceptions of Korean university English language learners (ELLs) regarding the integration of generative artificial intelligence (AI) in their writing process. A total of 85 university students participated by completing surveys and participating in in-depth interviews. The findings indicated that ELLs predominantly employed writing strategies such as brainstorming, translating from their first language (Korean), and using digital tools, particularly translation apps, for revision and feedback. Students perceived AI tools positively, noting significant cognitive and emotional benefits, including enhanced vocabulary, grammar learning, and increased writing confidence. However, ELLs expressed concerns regarding ethical issues, potential dependency on AI, and the risk of reduced human interaction. The study advocates for incorporating generative AI as a supplementary instructional resource within English as a foreign language (EFL) writing education, emphasizing the need for careful instructional design to foster independent critical thinking and effective writing practices. The research offers practical insights for English language teaching (ELT) educators who utilize AI technology to support EFL learners while upholding academic integrity and student autonomy.

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1. INTRODUCTION

The rapid advancement of generative artificial intelligence (AI) technologies has attracted considerable attention for their transformative potential across diverse language-learning contexts. The emergence and increasing accessibility of AI-powered tools such as ChatGPT and Grammarly have significantly reshaped language education, introducing novel dynamics in instructional methodologies and learner engagement [1]–[3]. These innovations have not only facilitated language acquisition but also redefined the roles of educators and learners within English as a foreign language (EFL) setting [4], [5]. Generative AI, in particular, has become a pivotal force in enhancing both the quality and accessibility of English language education. Recent developments have expanded its applications, enabling AI tools to serve as personalized tutors that deliver tailored instructional content. These systems offer instantaneous feedback, respond to learner queries, and provide scaffolded explanations across various language domains.

Contemporary research emphasizes the substantial promise of generative AI as an educational aid for EFL students, especially in vocabulary acquisition, grammatical accuracy, and writing fluency. Additionally, AI-enhanced instruction has been correlated with increased learner motivation and the

promotion of self-regulated learning behaviors [6]–[8]. A growing body of empirical evidence substantiates the pedagogical value of generative AI in supporting English language learners (ELLs) across the four foundational language skills. For example, studies have demonstrated that AI tools improve reading comprehension and writing proficiency by delivering personalized, context-sensitive feedback [7]–[9]. For instance, Bailey *et al*. [7] reported that integrating AI technologies into English classrooms significantly heightened student engagement and motivation, fostering a more interactive and stimulating educational environment. Similarly, Sumakul *et al*. [8] found that English language teaching (ELT) professionals maintain positive attitudes toward AI integration, highlighting its ability to streamline instructional processes and support individualized learning. Complementing these findings, Alhalangy and Abdalgane [9] underscore the substantial pedagogical benefits realized through AI adoption in ELT, affirming that generative AI plays a decisive role in contemporary language education.

Despite these advances, the growing adoption of generative AI in language learning raises critical ethical and academic integrity concerns [10]–[12]. As AI tools become increasingly sophisticated and ubiquitous, educators confront challenges such as plagiarism, overreliance on machine-generated content, and potential declines in critical thinking skills. These issues underscore the need to establish clear guidelines and pedagogical frameworks that promote the responsible and ethical use of AI in educational settings. While existing literature has predominantly addressed the affective advantages and motivational aspects of generative AI in EFL contexts, empirical investigation remains focused on its integrative role in writing instruction. Specifically, limited research has examined how generative AI influences the writing strategies of university-level ELLs or how the learners perceive its instructional utility in academic writing environments [13], [14].

To address this gap, this study explores the integration of generative AI as a feedback tool within university-level English writing instruction. It examines the writing strategies employed by Korean EFL learners when interacting with AI-based tools. It examines their perceptions regarding the efficacy and impact of AI-assisted English writing pedagogy. By examining both behavioral and attitudinal dimensions, this research aims to provide deeper insights into the pedagogical potential and practical implications of incorporating generative AI into EFL writing classrooms.

2. LITERATURE REVIEW

Since the emergence of generative AI, a growing body of research has examined its potential to support ELLs throughout the writing process [14]–[17], generative AI tools such as ChatGPT, Grammarly, and Quillbot have attracted significant attention for their ability to deliver immediate, automated feedback, enabling ELLs to revise their writing more efficiently and independently [18]–[20]. Beyond tool-specific features, recent studies have investigated the broader pedagogical impacts of generative AI in EFL writing contexts [21]–[23]. For example, Liu *et al*. [5] explored the role of reflective thinking within AI-based writing environments. They reported significant improvements in students' writing outcomes, self-efficacy, and self-regulation, accompanied by reductions in cognitive load. These findings underscore the importance of integrating reflective practices into AI-supported learning designs to optimize both cognitive and metacognitive benefits. Similarly, Bailey *et al*. [7] examined the experiences of secondary school EFL learners using ChatGPT, noting increased motivation and learning satisfaction; however, statistically significant improvements in engagement were not observed. This result suggests that the influence of generative AI may vary according to individual learner profiles and contextual factors.

Building upon these insights, Sumakul *et al*. [8] found that ELLs generally held positive attitudes toward AI integration, citing enhanced enjoyment and observable improvements in writing competence. Expanding on this, research by Alhalangy and Abdalgane [9] identified three core benefits of AI use in academic writing classes: i) increased student engagement through more interactive learning experiences; ii) improved flexibility and accessibility as AI tools accommodate diverse learner needs and provide on-demand resources; and iii) substantial support for academic tasks including research planning, topic selection, and drafting. These studies highlight the transformative potential of AI tools across multiple stages of the academic writing process, fostering learner autonomy, interaction, and access to high-quality linguistic input.

Recent investigations have focused on implementing generative AI in English writing instruction within Korean educational contexts [24]–[27]. Study by Choi [3] examined university students' perceptions of ChatGPT-generated feedback, emphasizing its cognitive benefits in enhancing content development, text organization, and language use. ELLs additionally reported gains in confidence, time management, and willingness to engage in writing activities. Barrot [10] analyzed ChatGPT's application throughout the writing process—including planning, drafting, and revision—and found the tool instrumental in facilitating idea generation, structural organization, and textual revision. Furthermore, Jeong [4] conducted a quasi-experimental study comparing an AI-integrated writing group to a traditional control group over 10 weeks.

The study reported significantly greater improvements in writing performance, as well as elevated psychological satisfaction and emotional well-being, in the experimental group. These results emphasize the holistic benefits of AI integration in academic writing contexts.

However, concerns were raised regarding occasional inaccuracies, ethical ambiguities, and the risk of learner overreliance, which could potentially impede the development of independent writing skills. Despite the promising capabilities of generative AI as both a tutor and a linguistic input source, its deployment introduces significant pedagogical and ethical challenges. While these tools provide real-time feedback on grammar, coherence, and style, concerns about overreliance, diminished critical engagement, and academic dishonesty persist. ELT educators must remain vigilant in mitigating plagiarism and superficial learning, particularly when incorporating AI tools into instructional practices [28]–[30].

Given the increasing prevalence of generative AI in EFL instruction, a notable gap remains in empirical research investigating its impact on students' writing strategies and perceptions within integrated writing instruction contexts. To address this gap, this study explores the following research questions:

- What writing strategies do ELLs employ in an AI-supported English writing environment?
- How do ELLs perceive AI-enhanced English writing?

This study aims to offer pedagogically relevant insights into the integration of generative AI in English writing instruction by addressing the research questions. The findings aim to inform evidence-based guidelines for the practical and ethical use of AI in language education, with a focus on promoting learner autonomy, engagement, and academic integrity.

3. RESEARCH METHOD

3.1. Research design

This study employed a mixed-methods research design to gain a comprehensive understanding of university students' experiences with AI-supported English language learning. The rationale for adopting this approach stems from the complex and multifaceted nature of learner engagement, perceptions, and challenges. By integrating both quantitative and qualitative methodologies, the research aimed to capture broad trends and rich, nuanced insights into individual learner experiences and attitudes. Specifically, the participant group consisted primarily of first-year university students enrolled in general English courses, a demographic with relatively limited exposure to advanced, discipline-specific English instruction. The quantitative component was designed to gather comprehensive data on students' overall attitudes, perceived usefulness, and motivational factors related to the use of generative AI. Concurrently, the qualitative component provided a platform for in-depth exploration of participants' reflections, challenges, and adaptive strategies when interacting with AI tools. The complementary nature of these data sources ensured that triangulated analysis could reveal surface-level trends and deeper cognitive and affective dimensions.

3.2. Data collection procedures

Data collection was conducted at the end of the fall of 2024. The quantitative phase commenced with an online survey during the final week of the semester. All students received a detailed informed consent form outlining the study's objectives, data confidentiality, and the voluntary nature of their participation. The survey was disseminated via the university's official learning management system to ninety enrolled students in the general English courses offered by the liberal arts college. The survey instrument was developed to assess multiple dimensions of students' engagement with AI tools, including their attitudes toward AI integration, perceived effectiveness of the technologies, and affective factors such as motivation and engagement levels. Efforts were made to ensure that survey items were linguistically accessible, and prior pilot testing was conducted with a similar cohort to enhance reliability and validity.

Following the survey phase, qualitative data were gathered through individual semi-structured interviews to gain deeper insight into the lived experiences of AI integration in language learning. Four participants volunteered for the interview sessions, selected to represent a range of attitudes and proficiency levels as indicated by their survey responses. The interviews were conducted across four sessions, each lasting approximately 30 minutes, and were held via Zoom video conferencing. This remote format ensured flexible accessibility, accommodating participants' diverse schedules and geographic locations while preserving the intimacy and spontaneity of face-to-face interaction. The interview protocol was designed to be open-ended and focused, allowing participants to elaborate on their usage patterns, perceived benefits, challenges, and emotional responses related to AI tools. This format facilitated dynamic dialogues in which emerging themes could be explored through probing questions, while ensuring that core topics were consistently addressed across all interviews.

3.3. Data analysis

The survey instrument employed in this study was adapted from Park [30] research on AI-integrated English writing. Park [30] original questionnaire was developed to assess EFL students' writing strategies and perceptions when using generative AI tools, demonstrating acceptable psychometric properties in the EFL context. The original instrument consisted of 34 items distributed across four primary constructs: writing strategies (19 items) and perceptions of AI effectiveness (15 items). All items utilized a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Table 1 presents the reliability of the research instruments used in the study, as measured by Cronbach's alpha coefficients. Two main categories were assessed: writing strategies and perceptions of learning English using AI. The writing strategies scale consisted of 19 items and yielded a Cronbach's alpha of .746, indicating acceptable internal consistency. The second scale, which assessed students' perceptions of learning English with AI, comprised 15 items and demonstrated good reliability (Cronbach's alpha=.856). These results suggest that the survey instruments employed in this study were psychometrically sound and suitable for further statistical analysis.

Table 1. Research instrument reliability

Category	Number of questions	Cronbach's alpha
Writing strategies	19	.746
Perceptions of learning English using AI	15	.856

For the present study, the original instrument underwent systematic adaptation and validation procedures. Minor modifications were made to ensure contextual appropriateness for the target population, including refining three items related to institutional AI policies and adding two demographic questions. The adapted instrument maintained the four-factor structure of the original questionnaire while incorporating current developments in generative AI technology. The quantitative data were analyzed using IBM SPSS statistics, version 24. Descriptive statistics were computed to provide a comprehensive overview of learners' perceptions, affective responses, and behavioral intentions. These analyses identified prevailing trends regarding the acceptance and perceived value of AI tools in English instruction, laying the foundation for further qualitative exploration.

Data analysis followed the rigorous six-phase thematic analysis framework articulated by Braun and Clarke [31] for the qualitative component. All interviews were recorded with informed consent, and recordings were reviewed multiple times to ensure transcription accuracy and capture nuanced paralinguistic features. Transcripts were securely stored in a shared Google Drive folder, accessible only to authorized research team members, to maintain data confidentiality and facilitate collaborative analysis. Initial coding was conducted through open coding, in which the research team independently identified salient data segments relevant to the research questions. Subsequent team meetings were held to discuss, compare, and reconcile initial codes, enhancing inter-coder reliability. Through iterative cycles of coding and reflection, codes were aggregated into higher-order categories and thematic constructs. This recursive process involved constant comparison both within and across transcripts to identify convergent patterns and points of divergence.

To enhance conceptual clarity, preliminary themes were systematically reviewed, refined, and renamed, thereby preserving the richness and complexity of the original data. The final thematic map thus captured the multidimensional nature of students' cognitive, affective, and behavioral experiences with AI-supported English learning. This methodological rigor ensured that the qualitative findings complemented and enriched the quantitative results, yielding a nuanced and holistic understanding of the research questions.

3.4. Study participants

The study was conducted with 85 university ELLs enrolled in an English writing course. To account for potential attrition and non-response rates, 90 students were initially invited to participate through purposive sampling from the available population of 120 students enrolled in the English writing course during the spring 2024 semester. The sampling frame included all students meeting the inclusion criteria: i) enrollment in the mandatory English writing course; ii) EFL status with Korean as their first language; and iii) voluntary consent to participate. Of the 90 invited participants, 85 students completed the survey instruments, yielding a response rate of 94.4%, which exceeds the recommended threshold for survey-based educational research.

Table 2 provides a detailed overview of the demographic characteristics of the university students who participated in the study. The data illustrate the gender distribution, academic year, major fields of study, and prior experience with AI-based learning tools. The participants were predominantly male (78.8%) and

mainly composed of first-year students (92.9%), reflecting the demographic composition of the target course enrollment rather than deliberate sampling bias. Most participants majored in science, technology, engineering and mathematics (STEM)-related fields (58.8%), followed by students from the department of undeclared major (34.1%), with only a small proportion representing arts and other disciplines (7.1%). This disciplinary distribution mirrors the institutional enrollment patterns, as the participating university has a strong emphasis on science and technology programs. Moreover, while nearly one-third of the students (31.8%) reported prior experience using AI tools for learning, a significant majority (68.2%) had no such experience before the study period.

The resulting sample composition, while statistically adequate for the planned analyses, has certain limitations in terms of generalizability. The demographic homogeneity, particularly the predominance of first-year STEM students, may limit the transferability of findings to more diverse academic populations or students at different developmental stages. However, this demographic profile is representative of the institutional context and provides valuable insights into AI tool usage among a specific but educationally significant population segment. This demographic context is essential for interpreting students' perceptions and strategies, as it reflects both the limited disciplinary diversity characteristic of specialized institutions and the varying degrees of familiarity with AI-enhanced learning environments among contemporary university students. Table 2 shows demographic data of survey participants.

Table 2. Demographic data of survey participants

Category		Frequency (N=85)	Percentage (%)
Gender	Male	67	78.8
	Female	18	21.2
Grades	Freshmen	79	92.9
	Sophomores	2	2.4
	Juniors	1	1.2
	Seniors	3	3.5
Majors	STEM	50	58.8
	Department of Undeclared Major	29	34.1
	Arts	3	3.5
	Natural Science	1	1.2
	Software	1	1.2
	Department of Smart Infrastructure Engineering	1	1.2
Previous AI learning experience	Yes	27	31.8
	No	58	68.2

4. RESULTS

4.1. Writing strategies and perceptions of learning English using AI

Table 3 presents the overall descriptive statistics for students' writing strategies and their perceptions of learning English using AI. On average, participants reported a high level of engagement in writing strategies (M=4.45, SD=.443), indicating frequent and consistent use of diverse techniques throughout the writing process. Students demonstrated active pre-writing behaviors-such as thinking about the topic, consulting model texts, and organizing ideas. However, fewer participants reported global planning behaviors, such as drafting a complete writing plan beforehand, suggesting a localized approach to preparation.

Table 3. Descriptive statistics for writing strategies and perceptions of learning English using AI

Category	M	SD
Writing strategies	4.45	.443
Perceptions of learning English using AI	3.55	.568

During the composing stage, a firm reliance on L1 (Korean) was evident: ELLs often thought in Korean first and sometimes drafted in Korean before translating into English. Writing directly in English was less common, which may reflect both language proficiency levels and strategic comfort zones. Digital tools were widely used, particularly Papago and bilingual dictionaries. AI tools such as ChatGPT were moderately used, and students often reviewed and reflected on AI-generated feedback, though they were somewhat hesitant to adopt it without modifications. Post-writing behaviors, such as re-reading drafts, and motivational strategies, also contributed to the overall high writing strategy score.

In contrast, students' perceptions of learning English using AI were somewhat less enthusiastic (M=3.55, SD=.568), though still positive. As detailed in the extended analysis, students acknowledged

AI's value in supporting vocabulary, grammar, exam preparation, and writing skills. The cognitive and functional support from AI was well received, yet affective and motivational impacts were slightly more moderate. Students reported that AI increased enjoyment and confidence, but did not significantly elevate their intrinsic motivation. Importantly, students found AI-generated feedback helpful and believed AI fosters critical thinking, suggesting a degree of active engagement with AI outputs rather than passive reliance.

Nonetheless, some limitations were identified. Students reported moderate difficulty in using AI tools and expressed concerns about reduced human interaction in AI-mediated learning environments. While they generally did not perceive AI as a complete replacement for human instructors, they strongly supported the idea that AI is educationally relevant in preparing learners for future academic and professional demands. Taken together, these findings illustrate a generally high level of strategic engagement in English writing and a cautiously optimistic attitude toward AI-assisted learning. While students appear to recognize the cognitive and technological benefits of AI, they also value human elements and express a need for guided integration in pedagogical contexts.

4.2. Interview findings

Integrating qualitative interview responses with quantitative findings, the analysis further elucidates the writing strategies and perceptions of Korean university students regarding generative AI in English writing contexts. Consistent with the survey results, interviewees strongly relied on digital translation tools, notably Papago Translator, Google Translate, and Grammarly, to address challenges in vocabulary selection, nuanced expressions, and sentence structures. ELLs explicitly emphasized the importance of translating Korean into English to ensure linguistic accuracy, reflecting quantitative results that indicate substantial use of first-language planning and translation strategies. As one participant mentioned:

> "*The most challenging aspect for me is accurately conveying the nuances and vocabulary. I often struggle to incorporate and express various Korean nuances into English effectively*."

Another participant highlighted their strategy:

> "*I usually write in Korean first and then use translation tools such as Naver Papago. I primarily rely on translation applications since well-structured Korean writing reduces issues when translating into English*."

Notably, interviewees reported varying degrees of engagement with generative AI tools, aligning with survey findings of moderate utilization. Students primarily utilized generative AI for vocabulary enhancement, sentence refinement, and grammar correction. A participant highlighted the nuanced improvement in vocabulary, exemplified by ChatGPT substituting simpler expressions with more sophisticated terminology, thereby enriching textual quality. For example, an interviewee expressed:

> "*What impresses me most about ChatGPT is its ability to grasp the meaning of my writing and rephrase it using more sophisticated terminology without explicit guidance*."

Interviewees generally valued AI-generated feedback, aligning with the survey's positive attitudes toward AI's instructional efficacy. They underscored that AI tools provided immediate and precise feedback, significantly reducing anxiety and mental exhaustion associated with English writing tasks. One participant stated:

> "*Reviewing AI-generated corrections helps alleviate my anxiety, regardless of whether the suggestions are entirely accurate, as it is less stressful than relying solely on my writing*."

However, the interview data revealed critical reflections on AI usage, with respondents consistently expressing concerns about over-reliance and the potential loss of individual creativity. One participant notably mentioned:

> "*I completely avoid using AI when writing because it makes me feel like the writing is no longer my own*."

It reinforcing quantitative findings of moderate caution and selective acceptance of AI-generated suggestions. Moreover, participants recognized limitations in AI accuracy, as indicated by moderate skepticism in the survey results. Interviewees frequently emphasized the importance of cross-checking AI-generated content,

thereby advocating for active, critical engagement rather than passive acceptance of AI-generated suggestions. As an interviewee emphasized:

> "*Cross-checking information is essential. Cross-checking is necessary in any research or writing process, not just when using AI*."

The qualitative insights suggested integrating instructional practices that encourage the critical evaluation of AI-generated feedback, aligning closely with the study's recommendation for balanced instructional designs that foster student autonomy and critical thinking. Overall, qualitative interview analyses support and deepen the quantitative findings, highlighting the multifaceted role of generative AI in English writing contexts. These insights underscore the importance of carefully structured instructional frameworks that leverage AI's strengths-such as efficiency and cognitive support-while proactively addressing potential drawbacks, including dependency and reduced human interaction.

5. DISCUSSION

The findings of this study provide valuable insights into the writing strategies and perceptions of university-level ELLs regarding the integration of generative AI tools in English writing instruction. These results broadly align with the existing literature, while highlighting specific characteristics of the Korean educational context that warrant further pedagogical attention. Consistent with previous research [5], [7], [9], participants reported employing a variety of cognitive and technological strategies, including brainstorming, organizing ideas in their first language (L1), and extensively utilizing digital resources such as translation applications and generative AI platforms. These practices reflect the increasingly digital, multilingual, and technologically mediated nature of contemporary EFL writing. The findings support earlier studies emphasizing generative AI's facilitative role in supporting the writing process by providing immediate feedback, content suggestions, and structural guidance [12], [13]. Moreover, the cognitive and affective benefits reported by participants align with those of Choi [3] and Jeong [4].

ELLs indicated improvements in vocabulary acquisition, grammatical accuracy, writing fluency, and increased confidence in managing writing tasks. These outcomes reinforce prior evidence regarding AI's potential to enhance both linguistic competence and emotional engagement [6], [7]. Additionally, in agreement with previous research by Liu *et al.* [5] and Sumakul *et al*. [8], students acknowledged that AI tools increased motivation and learner engagement. Nonetheless, motivational gains observed in this study were relatively modest, suggesting that AI alone may be insufficient to sustain long-term motivation. This result highlights the ongoing significance of teacher mediation and intrinsic motivational factors in EFL instructional contexts. Despite these promising effects, participants expressed concerns paralleling those documented in prior literature [8].

Ethical issues were frequently cited, including plagiarism and excessive reliance on AI-generated content. Furthermore, students expressed concerns about potential reductions in meaningful human interaction and diminished opportunities for critical thinking. Such concerns underscore the need to implement AI within carefully designed pedagogical frameworks that promote ethical use and foster learner autonomy. The participants' cautious attitudes toward uncritical acceptance of AI-generated feedback demonstrate a metacognitive awareness, supporting Liu *et al*. [5] recommendation to integrate reflective thinking strategies into AI-assisted writing instruction. Significantly, this study revealed tendencies specific to the Korean EFL context. Many students reported drafting initial compositions in their L1 (Korean) before translating them into English.

In summary, this study extends existing research by elucidating the multifaceted role of generative AI in shaping EFL learners' writing strategies, affective responses, and perceptions. It underscores AI's dual potential as both a scaffold for learner development and a source of ethical and pedagogical complexity. These findings underscore the crucial need for balanced instructional designs that harness the benefits of AI while effectively mitigating its limitations. Future research should continue to investigate diverse instructional settings and learner populations to establish robust, context-sensitive guidelines for the effective and responsible integration of generative AI in English language education.

6. CONCLUSION

This study investigated EFL students' writing strategies and perceptions of using generative AI in the writing process through comprehensive surveys and structured interviews. The findings revealed that participants employed various digital resources to complete their English compositions, including online dictionaries, AI translation tools, and ChatGPT. These strategies highlight a diverse, technologically

mediated approach to overcoming challenges in EFL writing contexts, reflecting global trends in language learning that transcend geographical and cultural boundaries.

The findings offer practical insights with significant implications for EFL writing education worldwide. The study provides EFL educators across diverse international contexts with valuable insights into how to effectively integrate generative AI into EFL writing classrooms. The results demonstrate the universal capacity of generative AI to alleviate students' writing anxiety and difficulties while simultaneously boosting their confidence in English writing. These findings are particularly relevant for EFL educators globally who face similar challenges in supporting student writing development. However, the study also emphasizes the critical importance of carefully designed pedagogical instruction to mitigate the risk of over-reliance on AI tools. This concern resonates with international educational communities grappling with integrating emerging technologies into language-learning environments.

While this study offers valuable insights into the writing strategies and perceptions of Korean university students who use generative AI tools in EFL writing contexts, its findings have broader international relevance that transcends the specific Korean educational setting. The fundamental challenges faced by EFL learners are universal phenomena that characterize EFL education globally. Consequently, the strategies and perceptions documented in this research offer insights applicable to international EFL contexts, with pedagogical implications for educators worldwide navigating the integration of AI technologies into language instruction.

Nevertheless, several methodological limitations must be acknowledged that may affect the transferability of findings to international contexts. The relatively small sample size of 85 participants presents challenges regarding generalizability to broader international populations. The sample was drawn from a single Korean institution. It was heavily concentrated among first-year students (92.9%) and STEM majors (58.8%), resulting in limited diversity across academic disciplines and developmental stages. Such demographic concentration limits the generalizability of findings to more diverse international student populations, including those from humanities and social science backgrounds or students at advanced stages of academic development across different cultural and educational systems.

Future research should address these limitations by recruiting larger and more culturally diverse samples across multiple international institutions and educational systems. It should also employ longitudinal designs that account for temporal variations in technology adoption and pedagogical integration, and incorporate more robust qualitative methodologies, such as focus groups, classroom observations, and comprehensive analyses of writing artifacts. Such methodological enhancements would ensure a more nuanced understanding of how generative AI tools influence EFL writing instruction across diverse international educational contexts, thereby strengthening the global applicability and relevance of research findings in this rapidly evolving field.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors state no conflict of interest.

INFORMED CONSENT

Informed consent was obtained from all participants involved in the study.

ETHICAL APPROVAL

All procedures involving human participants in this study were conducted strictly with the ethical principles outlined in the Declaration of Helsinki. The study protocol was reviewed and approved by the appropriate Institutional Review Board (IRB), ensuring compliance with ethical standards related to participant safety, informed consent, confidentiality, and the protection of participants' rights. Before data collection, all participants voluntarily provided informed consent after receiving comprehensive information about the study's purpose, procedures, potential risks, and benefits.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [S-HJ], upon reasonable request.

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