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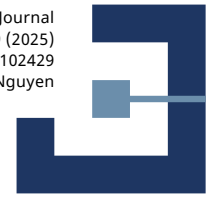

Castledown

ChatGPT-assisted language learning: Effects on Vietnamese English majors' writing skills and motivation

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This study investigated the effects of ChatGPT-assisted instruction on Vietnamese English majors' writing skills and motivation. Using a mixed-methods sequential explanatory design, the study compared two groups of first-year English majors (N = 76) over a 15-week semester. The experimental group received ChatGPT-assisted writing instruction, while the control group followed traditional instruction. Data were collected through pre- and post-tests using IELTS writing assessments, motivation questionnaires, and semi-structured interviews. ANCOVA results revealed significant improvements in the experimental group's writing performance across all domains, with particularly strong effects on task achievement ($\eta p^2 = .30$) and coherence ($\eta p^2 = .27$). Notable enhancements were also observed in writing motivation dimensions, especially self-efficacy ($\eta p^2 = .31$) and engagement ($\eta p^2 = .29$). Qualitative findings indicated that ChatGPT's immediate feedback and scaffolded support facilitated an iterative learning process, transforming students' approach from task completion to active engagement. The study demonstrates that ChatGPT-assisted instruction can effectively enhance both writing skills and motivation when implemented within a structured pedagogical framework. However, successful integration requires a sufficient adjustment period and careful attention to developing balanced approaches that promote learner autonomy.

Keywords: ChatGPT, EFL writing skills, writing motivation, English majors, Vietnam

Introduction

The integration of Artificial Intelligence (AI) into educational settings has ushered in a transformative era, redefining conventional teaching and learning methodologies across various disciplines. As a combination of machine learning, deep learning, algorithms, and natural language processing technologies,

AI has demonstrated remarkable capabilities in emulating human cognitive abilities and adaptive responses in educational contexts (Gignac & Szodorai, 2024; Hashim et al., 2022). This evolution is particularly significant in language education, where AI-powered tools offer unprecedented opportunities for authentic language practice and personalized instruction. The application of AI in English Language Teaching (ELT) has gained substantial momentum, especially with the emergence of sophisticated language models and conversational AI tools, as English remains one of the most widely used languages for international communication, commerce, and academic purposes (Lan et al., 2020).

In the Vietnamese English as a Foreign Language (EFL) context, writing has consistently emerged as one of the most challenging language skills for students to master. Research has identified several critical issues that Vietnamese English majors face in academic writing, ranging from surface-level linguistic challenges to deeper cognitive difficulties. At the surface level, students struggle significantly with linguistic aspects including grammar, vocabulary usage, and word choice (Dan et al., 2017; Do, 2023b). These challenges are particularly evident in areas such as tense usage, word forms, subject-verb agreement, and singular/plural nouns among first-year English majors. Beyond these surface-level issues, Vietnamese EFL learners encounter more complex challenges at deeper levels of writing, including idea development, logical organization, and coherent expression of thoughts (Do, 2023b).

The situation is further complicated by systemic challenges within the Vietnamese educational context. Traditional teacher-centered approaches still dominate many writing classrooms, with limited opportunities for students to engage in meaningful writing practice or receive constructive feedback (Nguyen & Vu, 2024). Large class sizes and heavy workloads often prevent teachers from providing detailed, individualized feedback on students' writing. Additionally, students report receiving insufficient guidance on academic writing conventions and limited exposure to collaborative learning activities that could enhance their writing development (Do, 2023a). These pedagogical constraints have led to outdated assessment practices focused primarily on summative evaluation and grammatical accuracy rather than holistic writing development (Thanh, 2016).

The emergence of ChatGPT and similar large language models has created new possibilities for addressing these challenges in language learning contexts. Recent studies have shown that AI-powered writing assistants can provide immediate feedback on grammar, vocabulary, and style (Dong, 2023), helping learners develop their writing skills through targeted practice and revision. The introduction of large language models has further expanded the possibilities for writing instruction, offering capabilities for engaging learners in extensive intelligent conversations and providing writing models across various genres (Pozdniakov et al., 2024). Recent empirical research demonstrates these models' distinctive educational value in writing contexts. Farrokhnia et al. (2023) found that TPACK-informed LLM implementation resulted in stronger gains in argument development and organizational coherence than traditional

approaches. Mahapatra (2024) reported significant improvements in ESL students' writing performance with ChatGPT, particularly in content development. Unlike previous automated tools focused primarily on error correction, these AI systems can engage in sophisticated dialogue about writing choices and provide contextualized examples (Zou et al., 2023). This capacity for "dynamic scaffolding" (Akgun & Greenhow, 2022) is particularly significant in EFL contexts where learners often face limited opportunities for authentic language practice outside the classroom (Lee, 2022).

However, despite the promising potential of AI in education, research on the effectiveness of ChatGPT in enhancing EFL writing skills, particularly in the Vietnamese context, remains limited. While AI applications in language learning are more prevalent than in other educational domains (Crompton et al., 2022), there is a notable gap in understanding how ChatGPT-assisted instruction can address the specific challenges faced by Vietnamese English majors in academic writing. Furthermore, while studies have identified motivation as a crucial factor in writing development (Nguyen, 2021), there is insufficient research examining how AI-assisted learning environments impact students' writing motivation and engagement in the Vietnamese EFL context.

The significance of this study lies in its potential to bridge crucial gaps in both theoretical understanding and practical application of AI-assisted language learning in EFL contexts. First, it will contribute to the emerging body of literature on the educational applications of large language models by providing empirical evidence of ChatGPT's effectiveness in enhancing writing skills. Second, by focusing on the Vietnamese context, the study will offer valuable insights into how AI-assisted instruction can be adapted to address specific cultural and pedagogical challenges in EFL environments where traditional teaching approaches predominate. Finally, the findings regarding students' motivation and engagement could inform the development of more effective blended learning approaches that combine AI assistance with traditional instruction, potentially leading to improved writing outcomes for Vietnamese English majors.

To address these research gaps, this study aims to investigate the effectiveness of ChatGPT-assisted language learning in enhancing Vietnamese English majors' writing skills and motivation. Specifically, the study addresses the following research questions:

1. To what extent does ChatGPT-assisted language learning instruction enhance Vietnamese English majors' academic writing skills compared to traditional instruction?
2. How do Vietnamese English majors perceive the impact of ChatGPT-assisted language learning on their writing motivation and engagement?

Literature review

Theoretical framework

The theoretical foundations of this study rest upon three pillars: social constructivism, language learning motivation theory, and the TPACK framework.

Social constructivism, developed by Vygotsky (Schreiber & Valle, 2013), emphasizes the critical role of social interaction in the learning process. Within language learning contexts, this theory posits that learning occurs through dynamic interactions between learners and their social environment, particularly during collaborative endeavors with more knowledgeable peers. The concept of the Zone of Proximal Development (ZPD) is central to this framework, representing the gap between a learner's current independent problem-solving abilities and their potential development through collaborative learning (Ibrahim et al., 2023). In ChatGPT-assisted language learning environments, the AI system functions as a knowledgeable peer, providing scaffolded support and immediate feedback that facilitates learners' progression through their ZPD.

Language learning motivation theory provides a framework for understanding how technology-enhanced environments influence learners' engagement and persistence in language acquisition. Drawing upon Zimmerman's (2002) self-regulation theory, motivation in language learning is intrinsically linked to learners' ability to regulate learning processes and receive timely feedback. The theory suggests that motivation increases when learners have access to personalized learning experiences and immediate feedback mechanisms (Fathi et al., 2023). Through the lens of this theory, AI-assisted learning environments, characterized by continuous availability of feedback and guidance, can strengthen learners' self-efficacy and motivation, thereby fostering sustained engagement in writing tasks.

The Technological Pedagogical Content Knowledge (TPACK) framework offers a structured approach for understanding the integration of technology in language learning contexts. This framework emphasizes the critical intersection of technological, pedagogical, and content knowledge required for effective technology-enhanced instruction (Roll & Wylie, 2016). In ChatGPT-assisted writing instruction, TPACK illuminates how AI technology intersects with writing pedagogy and content knowledge. Empirical research by Zou et al. (2023) demonstrated that EFL instructors with well-developed TPACK competencies achieved significantly better outcomes when implementing automated feedback systems, with students showing 27% greater improvement in revision behaviors compared to technology-centered approaches. The framework's relevance to AI writing tools is further evidenced in Farrokhnia et al.'s (2023) study, which found that TPACK-informed implementation resulted in stronger gains in argument development and organizational coherence than technological integration lacking pedagogical and content considerations. The framework posits that successful technology integration necessitates a deep understanding of not only the technical aspects of AI tools but also their potential to enhance pedagogical practices and content delivery in writing instruction.

Technology-enhanced writing instruction

The integration of technology in writing instruction has evolved significantly over recent decades, fundamentally transforming traditional pedagogical approaches to teaching and assessing writing skills. This evolution has progressed from basic word processing tools to sophisticated artificial intelligence-powered writing assistants, marking a significant shift in how writing is taught, practiced, and evaluated in language learning contexts (Chang et al., 2021). The development of various digital tools and platforms has created unprecedented opportunities for enhancing writing instruction through immediate feedback, collaborative writing spaces, and personalized learning experiences.

Early applications of technology in writing instruction primarily focused on word processing and basic grammar checking tools, which, while revolutionary for their time, offered limited support for developing higher-order writing skills (Kruse & Anson, 2023). Contemporary writing technologies have expanded to include sophisticated features such as automated writing evaluation (AWE) systems, collaborative writing platforms, and AI-powered writing assistants that can provide comprehensive feedback on various aspects of writing, from surface-level corrections to deeper rhetorical concerns (Fleckenstein et al., 2023). These advancements have particularly benefited second language writers by providing continuous access to writing support and reducing the anxiety often associated with writing in a foreign language.

Research on technology-enhanced writing instruction has demonstrated several key benefits for language learners. Studies indicate that digital writing tools can significantly improve students' revision behaviors, with learners making more substantial and meaningful revisions when using technology-enhanced feedback systems (Nazari et al., 2021). For instance, automated writing evaluation systems have been shown to provide immediate, detailed feedback that helps students identify and correct errors more efficiently than traditional methods. Additionally, technology-enhanced writing environments have been shown to promote greater learner autonomy and self-regulated learning behaviors, as students can receive immediate feedback and make improvements without constant teacher intervention (Akgun & Greenhow, 2022).

However, the implementation of technology in writing instruction also presents notable challenges that require careful consideration. One significant concern is the potential for over-reliance on automated feedback, which may lead to decreased critical thinking and self-editing skills. Research by Hosseini et al. (2023) highlighted that while students appreciate immediate feedback from digital tools, there is a risk of developing dependency on these systems, potentially hampering the development of independent writing skills. Furthermore, issues related to digital literacy, access disparities, and the need for comprehensive teacher training in using these technologies effectively continue to pose significant challenges in many educational contexts (Passey et al., 2024).

The emergence of large language models, particularly ChatGPT, represents the latest evolution in technology-enhanced writing instruction. These systems offer unprecedented capabilities for providing contextualized writing support,

including help with brainstorming, organization, and revision (Farrokhnia et al., 2023). Unlike previous writing technologies, these AI-powered tools can engage in sophisticated dialogue about writing choices, explain linguistic concepts, and provide examples tailored to specific writing contexts. However, research on their effectiveness in diverse educational settings, particularly in EFL contexts, remains limited and requires further investigation.

The integration of these advanced writing technologies necessitates careful consideration of pedagogical frameworks and clear guidelines for ethical use. Studies suggest that the effectiveness of technology-enhanced writing instruction depends largely on how these tools are implemented within broader instructional strategies (Akgun & Greenhow, 2022; Farrokhnia et al., 2023; Zou et al., 2023). Successful integration requires balancing automated support with human instruction, maintaining focus on developing critical thinking skills, and ensuring that technology serves as a scaffold rather than a substitute for the writing process. This is particularly crucial in EFL contexts, where cultural and pedagogical traditions may influence how technology is perceived and utilized in writing instruction.

Writing instruction in Vietnamese EFL context

Writing instruction in Vietnamese EFL contexts faces several persistent challenges despite its crucial role in language education. Traditional approaches remain deeply rooted in teacher-centered methodologies, with excessive emphasis on grammatical accuracy and rigid structural patterns rather than developing students' communicative competence (Do, 2023a; Nguyen, 2009; Nguyen & Vu, 2024). Vietnamese teachers predominantly employ product-oriented instruction, focusing on final written products while neglecting the writing process and critical thinking development (Truong, 2017). Cultural factors, particularly Confucian philosophy, further complicate writing instruction as students tend to adopt an indirect, inductive approach that often conflicts with the direct, thesis-driven style expected in English academic writing (Trinh & Nguyen, 2014). Additionally, large class sizes, varying proficiency levels, and an exam-oriented educational system pose significant challenges to effective writing instruction (Pham & Bui, 2021).

Recent developments in technology integration have shown promise in addressing these traditional challenges, with students demonstrating increased motivation and engagement when technology is incorporated into writing classes (Pham et al., 2020). While Vietnamese students show high motivation for learning English writing skills, they often lack confidence in their abilities, suggesting a need for innovative instructional approaches (Hwang et al., 2023). However, technology integration remains limited due to insufficient institutional support and inadequate teacher training in educational technology (Pham et al., 2020). Despite the growing global interest in AI-assisted language instruction, there is a notable absence of empirical research examining the effectiveness of such tools in the Vietnamese EFL context, particularly in addressing the unique cultural and pedagogical challenges faced by

Vietnamese learners. This gap is particularly significant given the potential of AI tools to bridge the traditional-modern instructional divide while respecting local educational contexts and student needs (Pham & Bui, 2021).

ChatGPT and student motivation in academic writing

Since its release in late 2022, ChatGPT has emerged as a transformative tool in academic writing, representing a significant advancement in natural language processing and potentially influencing student motivation in writing development (Teng, 2024). The model demonstrates sophisticated capabilities in generating human-like responses, maintaining coherent conversations, and providing contextually appropriate feedback across various academic domains (Ali et al., 2023). Its distinctive features include the ability to generate well-structured academic texts, edit content, and correct language mistakes while maintaining appropriate formal register (Gultom et al., 2024).

In writing instruction, ChatGPT serves multiple pedagogical functions throughout the writing process while potentially influencing student motivation and engagement. The tool assists learners with brainstorming, content organization, and final editing while providing instant feedback on grammar and style (Imran & Almusharraf, 2023). For non-native English writers, it offers valuable support in articulating ideas more clearly in academic English (Alberth, 2023). ChatGPT's capability to provide detailed metalinguistic feedback makes it particularly valuable for supporting self-regulated learning and peer assessment activities, which can enhance student motivation through immediate response and guidance (Mahapatra, 2024).

Several key factors influence students' writing motivation in second language contexts when using AI tools like ChatGPT. Research has established that intrinsic motivation, rather than external rewards, significantly impacts language learners' writing success (Chhor et al., 2024). Students' self-efficacy beliefs, perceived task value, and emotional engagement play crucial roles in maintaining motivation (Gan et al., 2023). In EFL writing contexts, motivation is particularly affected by learners' confidence in language ability, anxiety about making errors, and perceived relevance of writing tasks to their goals (Sabti et al., 2019).

Empirical research examining the intersection of ChatGPT usage and academic writing motivation has yielded mixed results. While Bašić et al. (2023) found no significant improvement in university students' essay grades with ChatGPT-assisted writing, Mahapatra (2024) reported positive impacts on ESL students' writing performance and motivation, particularly in content development and organizational coherence. Studies consistently highlight benefits such as immediate feedback and reduced writing anxiety (Ali et al., 2023), while also noting challenges including potential over-reliance on AI-generated content and concerns about academic integrity (Yan, 2023).

The integration of ChatGPT in writing instruction requires careful consideration of motivational factors. Research emphasizes the need for explicit training in effective tool use, clear guidelines for ethical implementation, and

integration within a broader instructional framework that promotes critical thinking and autonomous learning (Farrokhnia et al., 2023; Kumar, 2023). Studies examining AI tools in writing contexts reveal complex patterns in student motivation. While AI tools can increase learners' willingness to engage by providing immediate feedback and reducing anxiety (Xiao et al., 2024), research indicates that effectiveness depends on how these tools are integrated into the writing process (Khalifa & Albadawy, 2024). Some students report enhanced confidence with AI writing assistants, while others experience decreased motivation due to over-reliance on automated support (Li et al., 2023).

Methodology

Research design

This study employed a mixed-methods sequential explanatory design (Creswell & Creswell, 2022) investigating ChatGPT-assisted language learning's effectiveness on Vietnamese English majors' writing skills and motivation. The quantitative phase utilized a quasi-experimental design with pre-test and post-test measures, involving two intact classes randomly assigned to experimental and control groups. The experimental group received ChatGPT-assisted writing instruction, while the control group followed traditional instruction over a 15-week semester. The subsequent qualitative phase employed semi-structured interviews to provide deeper insights into students' perceptions and experiences, particularly regarding motivation and engagement with ChatGPT-assisted learning, following established mixed-methods protocols (Cohen et al., 2017).

Participants

The participants comprised 76 first-year English majors (n = 38 per group) from a public university in Northern Vietnam, selected based on their enrollment in the BA English Language program, completion of one semester of academic writing, intermediate English proficiency (B1 CEFR), and no prior ChatGPT experience in academic writing. To ensure randomization, the researcher first obtained a complete list of eligible students from two intact classes, assigned each student a unique identification number, and used a computerized random number generator to assign participants to either the experimental or control group. This process ensured equal probability of assignment to either condition while controlling for potential confounding variables. Prior to randomization, statistical analysis confirmed no significant differences between the two intact classes in terms of previous semester English GPA ($t(74) = 0.87$, $p = .38$) or baseline writing proficiency ($t(74) = 0.76$, $p = .45$). Sample size was determined through a priori power analysis ($\alpha = .05$, power = .80, $d = 0.50$), with a 20% increase to account for potential attrition (Akgun & Greenhow, 2022). Participants (82% female, 18% male) ranged from 18–20 years ($M = 18.7$, $SD = 0.6$), with previous semester English GPAs between 2.5–3.8 ($M = 3.2$, $SD = 0.4$).

For the qualitative phase, 12 participants from the experimental group were purposively selected for interviews, representing varying levels of writing improvement, supplemented by two focus groups (n = 8 each).

Instruments

Three instruments were employed in this study. First, an IELTS Academic Writing rubric assessed participants' writing skills across four domains: task achievement, coherence and cohesion, lexical resources, and grammatical range and accuracy. Two experienced IELTS instructors independently rated the pre-test and post-test writing samples, achieving high inter-rater reliability ($r = 0.88$). Second, a 25-item writing motivation questionnaire adapted from Waller and Papi (2017) measured four dimensions: writing self-efficacy (6 items), perceived value of writing (7 items), writing anxiety (6 items), and writing engagement (6 items). The questionnaire used a 5-point Likert scale and demonstrated strong internal consistency (Cronbach's $\alpha = 0.89$). Third, a 12-item semi-structured interview protocol explored participants' experiences with ChatGPT-assisted writing, focusing on perceived benefits, challenges, and impact on motivation. The protocol was piloted with 3 students and refined based on their feedback.

Data collection procedures

Data collection occurred from January to May 2024. In the pre-test phase (Week 1), participants completed a 60-minute IELTS-style argumentative essay and the motivation questionnaire. During the 15-week intervention (Weeks 2–14), the experimental group received ChatGPT training through a structured three-phase approach. The initial phase (weeks 2–4) focused on technical orientation, with students learning basic prompting strategies through twice-weekly 45-minute workshops and using an instructor-developed handbook of starter prompts targeting specific writing aspects (e.g., "Analyze this paragraph's coherence," "Suggest alternative transitions for improved flow"). The second phase (weeks 5–8) emphasized strategic implementation, where students practiced iterative writing refinement using guided prompting sequences for drafting, content development, organization, and editing. The final phase (weeks 9–14) developed autonomous use, with students formulating their own strategic prompts based on self-identified writing needs and instructor feedback on their prompting approaches. Throughout the intervention, students maintained structured interaction logs documenting their ChatGPT sessions (including prompts used, ChatGPT responses, and writing decisions made) and submitted bi-weekly reflection notes (250–300 words) analyzing how AI feedback informed their revisions and influenced their writing process. These documentation activities constituted 25% of assignment grades (15% for interaction logs, 10% for reflection notes), ensuring students engaged critically with AI suggestions rather than merely copying content. Evaluation criteria included prompt effectiveness (25%), critical analysis of ChatGPT responses (40%), and

evidence of thoughtful implementation in revisions (35%). Students were required to complete at least two revision cycles per assignment based on ChatGPT interactions.

To prevent cross-contamination, several measures ensured control group integrity. Control group participants signed agreements not to use ChatGPT during the study period. Writing assignments were completed during supervised in-class sessions with monitored internet access. Submissions underwent periodic analysis using AI detection tools, and post-study interviews with a sample of control group participants (n=8) verified compliance. No unauthorized ChatGPT use was detected throughout the study. Both groups completed six academic writing assignments focusing on argumentation, exposition, and analysis. The post-test phase (Week 15) replicated the pre-test conditions. Subsequently, 12 purposively selected participants from the experimental group participated in individual interviews (30–45 minutes) conducted in Vietnamese and recorded for analysis.

Data analysis methods

Quantitative data analysis employed both descriptive and inferential statistics using SPSS 26.0. After confirming normality and homogeneity assumptions, one-way ANCOVAs examined between-group differences in writing performance and motivation, with pre-test scores as covariates. Effect sizes were calculated using partial eta squared. For writing assessment, inter-rater reliability was established through Pearson correlation coefficient ($r = 0.88$) between the two raters' scores. The motivation questionnaire's internal consistency was verified using Cronbach's alpha ($\alpha = 0.89$).

For qualitative data, audio-recorded interviews were transcribed verbatim, translated to English, and analyzed using thematic analysis (Boyatzis, 1998). Two researchers independently coded the transcripts, identifying recurring patterns and themes. Disagreements were resolved through discussion until consensus was reached. Member checking with participants validated the accuracy of transcriptions and interpretations.

Ethical considerations

This study adhered to ethical guidelines outlined by the American Psychological Association (APA, 2017). Participants received detailed information about the study's purpose, procedures, and potential risks and benefits through informed consent forms in both English and Vietnamese. They were assured of voluntary participation, confidentiality, and their right to withdraw at any time without penalty.

To protect participant privacy, all data were anonymized using numerical codes, and pseudonyms were used in reporting interview data. Digital data were stored on password-protected devices, with access restricted to the research team. Participants were informed about the recording of interviews and their right to review transcripts. The control group received access to

ChatGPT training after study completion to ensure equal educational opportunities. All participants were debriefed about the study's findings.

Results

Effects of ChatGPT-assisted instruction on Vietnamese English majors' writing skills

Initial analyses revealed comparable baseline writing proficiency between the experimental (M = 5.82, SD = 0.68) and control groups (M = 5.79, SD = 0.71) at pre-test. Following the 15-week intervention, post-test scores demonstrated substantial differences in writing performance. The experimental group achieved notably higher overall writing scores (M = 6.89, SD = 0.59) compared to the control group (M = 6.12, SD = 0.64).

ANCOVA results, controlling for pre-test scores, revealed a significant main effect of ChatGPT-assisted instruction on overall writing performance, $F(1, 73) = 28.45$, $p < .001$, $\eta p^2 = .28$. Domain-specific analyses indicated varying degrees of improvement across the four IELTS writing criteria. Task achievement showed the most substantial enhancement ($F(1, 73) = 31.24$, $p < .001$, $\eta p^2 = .30$), followed by coherence and cohesion ($F(1, 73) = 27.86$, $p < .001$, $\eta p^2 = .27$), lexical resources ($F(1, 73) = 25.92$, $p < .001$, $\eta p^2 = .26$), and grammatical range and accuracy ($F(1, 73) = 24.78$, $p < .001$, $\eta p^2 = .25$). Table 1 presents the detailed statistical analysis across all domains.

Table 1. Descriptive statistics and ANCOVA results for writing performance across domains

		Pre-test		Post-test		ANCOVA results		
Writing domain	**Group**	**M**	**SD**	**M**	**SD**	**F(1,73)**	**p**	**ηp²**
Overall score	Exp	5.82	0.68	6.89	0.59	28.45	< .001	.28
	Cont	5.79	0.71	6.12	0.64			
Task achievement	Exp	5.75	0.70	6.95	0.58	31.24	< .001	.30
	Cont	5.78	0.69	6.15	0.63			
Coherence & cohesion	Exp	5.80	0.71	6.88	0.60	27.86	< .001	.27
	Cont	5.77	0.72	6.08	0.65			
Lexical resources	Exp	5.85	0.67	6.85	0.61	25.92	< .001	.26
	Cont	5.82	0.70	6.10	0.66			
Grammatical range & accuracy	Exp	5.88	0.65	6.87	0.57	24.78	< .001	.25
	Cont	5.80	0.73	6.15	0.62			

Note. Exp = Experimental Group (n = 38); Cont = Control Group (n = 38). All ANCOVA analyses controlled for pre-test scores. Writing performance was measured on a 9-point scale aligned with IELTS scoring criteria.

These differential improvements across writing domains reflect the TPACK framework's emphasis on integrated knowledge development. The greater gains in task achievement and coherence suggest ChatGPT's effectiveness in

developing higher-order skills that require complex technological-pedagogical-content integration, a finding reinforced in interviews: "Learning which prompting techniques to use for different writing problems helped me focus on developing arguments rather than just fixing grammar" (Student 4).

The impact of ChatGPT-assisted instruction became particularly evident in students' writing development trajectories throughout the semester. Analysis of the six academic writing assignments revealed a consistent upward trend in the experimental group's performance, with the most substantial improvements occurring between weeks 6 and 10 of the intervention (mean improvement = 0.72 points). This pattern suggests an initial adjustment period was necessary for students to effectively utilize ChatGPT in their writing process.

Individual interviews provided valuable insights into the mechanisms underlying these quantitative improvements. A recurring theme among experimental group participants was the iterative nature of writing enhancement facilitated by ChatGPT, particularly in developing arguments and maintaining coherence. As one participant explained:

> ChatGPT helped me understand how to develop my ideas more logically. When I submitted a paragraph, it would point out gaps in my argument and suggest ways to strengthen the connections between ideas. This helped me write more coherently. (Student 7)

The tool's impact on vocabulary development and grammatical accuracy was similarly noteworthy. Analysis of writing samples showed that experimental group participants demonstrated greater lexical sophistication in their post-test essays, with a 28% increase in academic vocabulary usage compared to an 11% increase in the control group. One participant highlighted this aspect:

> The most helpful feature was getting explanations about word choices and collocations. ChatGPT wouldn't just suggest alternative words; it would explain why certain terms were more appropriate in academic contexts. (Student 12)

The integration of quantitative and qualitative data revealed three key factors contributing to improved writing performance. First, the immediate feedback mechanism enabled students to make real-time adjustments to their writing, particularly in areas of coherence and grammatical accuracy. Second, the experimental group demonstrated greater engagement with revision, with 87% of participants reporting multiple revision cycles compared to 45% in the control group. Third, the scaffolded nature of ChatGPT assistance appeared to support the development of independent writing skills, as reflected in the progressive improvement pattern observed across assignments.

However, the data also revealed important nuances in the effectiveness of ChatGPT-assisted instruction. While the overall trend was positive, individual performance variations were notable, with improvement ranges from 0.5 to 1.8 points in the experimental group. Interview data suggested these variations were partially attributed to differences in students' ability to effectively

utilize ChatGPT's features and their willingness to engage in detailed revision processes.

Figure 1 illustrates the trajectory of writing performance improvement across the semester, highlighting the diverging patterns between experimental and control groups, particularly after week 6 of the intervention.

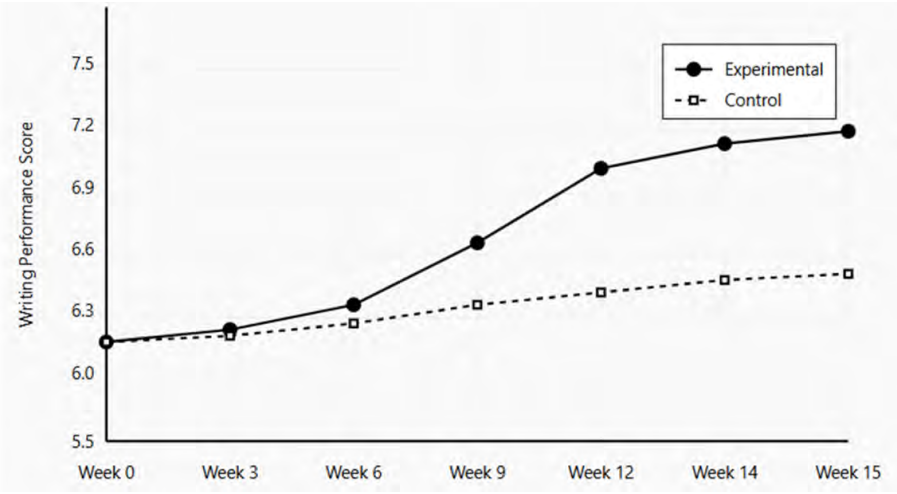

Figure 1. Writing performance trajectories over the 15-week intervention

These findings suggest that while ChatGPT-assisted instruction significantly enhanced writing performance across all domains, the effectiveness of the intervention was mediated by students' developing ability to utilize the tool strategically and their willingness to engage in multiple revision cycles. The consistent pattern of improvement, supported by both statistical evidence and student perspectives, indicates that ChatGPT can serve as a valuable scaffold for writing development when integrated systematically into instruction.

Effects of ChatGPT-assisted instruction on Vietnamese English majors' writing motivation and engagement

Analyses of writing motivation and engagement metrics revealed distinct patterns of development between experimental and control groups throughout the 15-week intervention. While initial motivation questionnaire scores showed comparable baseline levels between experimental ($M = 3.42$, $SD = 0.52$) and control groups ($M = 3.38$, $SD = 0.49$), post-intervention data demonstrated marked differences. The experimental group exhibited substantial growth in overall motivation scores ($M = 4.18$, $SD = 0.45$), significantly outperforming the control group ($M = 3.56$, $SD = 0.48$).

Statistical analyses through ANCOVA, with pre-test scores as covariates, demonstrated differentiated effects across motivation dimensions. Writing self-efficacy emerged as the most significantly enhanced aspect ($F(1, 73) = 32.46$, $p < .001$, $\eta p^2 = .31$), with notable improvements also observed in engagement ($F(1, 73) = 29.78$, $p < .001$, $\eta p^2 = .29$), perceived value ($F(1, 73) = 26.92$, $p < .001$, $\eta p^2 = .27$), and anxiety reduction ($F(1, 73) = 24.56$, $p < .001$, $\eta p^2 = .25$). Table 2 presents the comprehensive analysis of these dimensions.

Table 2. Descriptive statistics and ANCOVA results for motivation and engagement dimensions

Motivation dimension	Group	Pre-test		Post-test		ANCOVA results		
		M	SD	M	SD	F(1,73)	p	ηp^2
Overall motivation	Exp	3.42	0.52	4.18	0.45	28.45	< .001	.28
	Cont	3.38	0.49	3.56	0.48			
Writing self-efficacy	Exp	3.35	0.54	4.25	0.46	32.46	< .001	.31
	Cont	3.32	0.51	3.48	0.50			
Writing engagement	Exp	3.40	0.53	4.15	0.44	29.78	< .001	.29
	Cont	3.38	0.50	3.52	0.49			
Perceived value	Exp	3.45	0.51	4.12	0.47	26.92	< .001	.27
	Cont	3.41	0.48	3.58	0.46			
Writing anxiety*	Exp	3.48	0.50	2.65	0.43	24.56	< .001	.25
		3.42	0.47	3.25	0.45			

Note. Exp = Experimental Group (n = 38); Cont = Control Group (n = 38). All ANCOVA analyses controlled for pre-test scores. Motivation dimensions were measured on a 5-point Likert scale.
*Lower scores in Writing Anxiety indicate reduced anxiety levels.

The temporal pattern in motivation development – with significant increases occurring after week 6 – aligns with TPACK's emphasis on integrated knowledge development. This transition period coincided with students progressing from basic technological competence with ChatGPT to more sophisticated integration with writing pedagogy and content knowledge. As one participant noted: "At first I focused on learning the commands, but later I understood how to connect the tool with different writing goals" (Student 8), illustrating the motivational benefits of developing integrated TPACK competencies.

Examination of student engagement patterns through the six academic writing assignments and motivation questionnaire responses yielded compelling insights into behavioral changes. Analysis of the assignments revealed substantially higher engagement levels in the experimental group, particularly in their revision practices. Interview participants consistently reported increased time investment in writing tasks, with experimental group members describing more frequent and detailed revision cycles compared to their previous writing habits.

The integration of quantitative measurements and student narratives illuminated the complex dynamics of motivation enhancement in ChatGPT-assisted writing environments. The data revealed that increased motivation stemmed primarily from students' evolving relationship with the writing process itself. As students gained proficiency with ChatGPT, their approach to writing transformed from a task-completion mindset to an iterative learning process. This transformation was evidenced by both statistical improvements in engagement metrics and students' reflective comments about their changing attitudes toward writing.

Students' emotional investment in the writing process also underwent significant changes. Interview data revealed that the availability of immediate

feedback created what students described as a "low-stakes practice environment," allowing them to experiment with language more freely. This reduced anxiety appeared to catalyze a positive feedback loop, where increased confidence led to more experimental writing approaches, which in turn generated more opportunities for learning and improvement. As one participant noted:

> I started seeing mistakes as learning opportunities rather than failures. Each interaction with ChatGPT taught me something new about academic writing, which made me more eager to practice. (Student 5)

The motivation questionnaire responses revealed noteworthy developmental patterns in students' engagement with the tool. Initial apprehension about ChatGPT usage, reported by 68% of experimental group participants, significantly diminished by week 6. Qualitative insights suggested this transition coincided with increased tool proficiency:

> Once I learned to frame my questions effectively, ChatGPT became an invaluable writing companion. Understanding how to use it properly made me feel more in control of my learning. (Student 8)

Figure 2 captures the progressive development of motivation dimensions across the intervention period, highlighting the divergent trajectories between groups after week 6.

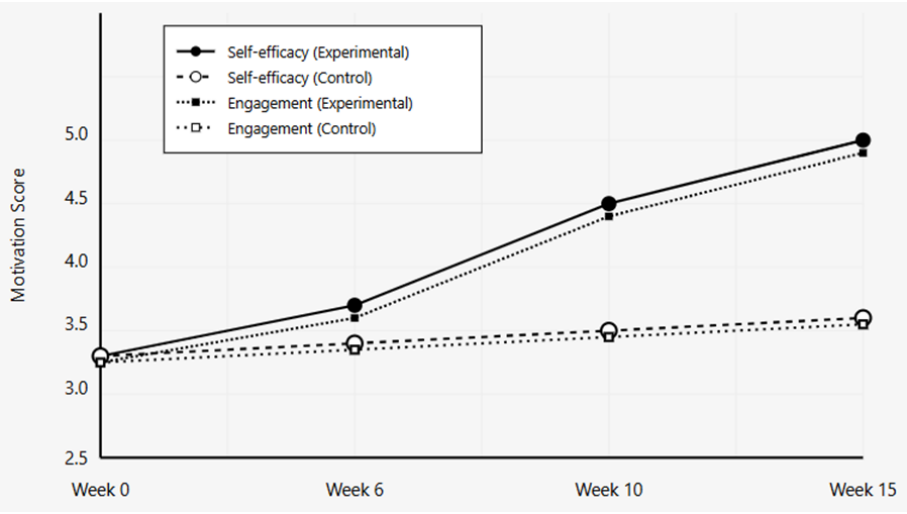

Figure 2. Progression of motivation dimensions over the 15-week intervention

Analysis of the six writing assignments in conjunction with interview responses pointed to significant interplay between motivation and writing quality. Higher motivation questionnaire scores typically corresponded with more sophisticated revision strategies and enhanced final drafts. Interview participants consistently emphasized the importance of developing balanced approaches to using AI assistance:

> The key was learning to use ChatGPT as a guide rather than a crutch.

> Understanding this balance actually strengthened my confidence in my own writing abilities. (Student 11)

These findings demonstrate that ChatGPT-assisted instruction catalyzed substantial enhancements in writing motivation and engagement. The sustained improvement in motivational metrics, coupled with students' articulated experiences in interviews, suggests that AI-assisted writing instruction can effectively nurture positive motivational outcomes within a structured pedagogical framework, particularly when students develop balanced and strategic approaches to utilizing the technology.

Results

Effects of ChatGPT-assisted Instruction on Vietnamese English majors' writing skills

The findings reveal that ChatGPT-assisted instruction significantly enhanced Vietnamese English majors' writing performance across all measured domains, with particularly strong effects on task achievement ($\eta p^2 = .30$) and coherence and cohesion ($\eta p^2 = .27$). These improvements align with social constructivist theory's emphasis on scaffolded learning through interaction with more knowledgeable others (Ibrahim et al., 2023), with ChatGPT effectively functioning as a consistent source of scaffolding and feedback.

The observed pattern of improvement, with strongest effects on higher-order writing skills, extends our understanding of TPACK in AI-assisted contexts. While previous research established TPACK's importance in technology integration (Zou et al., 2023), our findings demonstrate how the specific intersection of ChatGPT's technological capabilities with writing pedagogy creates unique opportunities for developing complex writing competencies. The developmental trajectory – with significant improvements emerging after week 6 – highlights the temporal dimension of TPACK development, suggesting students need time to progress from basic technological knowledge to the integrated application that facilitates higher-order skill development.

The substantial gains in task achievement and coherence suggest that AI assistance particularly benefits higher-order writing skills, addressing a critical gap in traditional Vietnamese EFL instruction that often emphasizes surface-level accuracy over deeper writing competencies (Do, 2023b). The observed enhancement in lexical resources ($\eta p^2 = .26$) and grammatical accuracy ($\eta p^2 = .25$) corresponds with previous findings on technology-enhanced writing instruction's benefits for language learners (Nazari et al., 2021). However, the current study extends these findings by demonstrating that ChatGPT's impact transcends the basic error correction capabilities of traditional automated writing tools. The 28% increase in academic vocabulary usage among experimental group participants, compared to 11% in the control group, suggests that ChatGPT's contextualized explanations of word choices and collocations

facilitate deeper linguistic understanding, supporting findings by Dong (2023) on AI-powered writing assistants' potential for vocabulary development.

The emergence of a clear developmental pattern, with the most substantial improvements occurring between weeks 6-10, provides important insights into the implementation of AI-assisted writing instruction. This pattern suggests a critical acclimatization period during which students develop the necessary skills to effectively utilize AI assistance, supporting Farrokhnia et al.'s (2023) emphasis on the importance of structured implementation frameworks for AI tools in writing instruction. The findings also align with the TPACK framework's assertion that successful technology integration requires time for developing technological pedagogical knowledge (Roll & Wylie, 2016).

However, the variation in individual performance improvements (ranging from 0.5 to 1.8 points) highlights important nuances in AI-assisted writing instruction's effectiveness. These variations, attributed to differences in students' tool utilization abilities and engagement with revision processes, echo concerns raised by Hosseini et al. (2023) about potential disparities in students' capacity to benefit from automated feedback systems. This finding suggests that while ChatGPT offers promising support for writing development, its effectiveness may be mediated by individual learner characteristics and approaches to technology use.

The qualitative insights regarding ChatGPT's role in facilitating iterative writing improvement and promoting independent skill development address previous concerns about AI tools potentially fostering dependency (Li et al., 2023). The high percentage of experimental group participants engaging in multiple revision cycles (87% compared to 45% in the control group) suggests that, when properly implemented, AI assistance can enhance rather than diminish student agency in the writing process. This finding aligns with Akgun and Greenhow's (2022) observations about technology-enhanced writing environments promoting learner autonomy.

These results have particular significance for the Vietnamese EFL context, where traditional teacher-centered approaches and large class sizes often limit opportunities for individualized feedback (Nguyen & Vu, 2024). ChatGPT's ability to provide immediate, detailed feedback addresses a critical gap in conventional writing instruction, potentially offering a scalable solution to the persistent challenge of providing personalized writing support in resource-constrained educational environments. However, the findings also suggest that successful implementation requires careful attention to training and support structures that enable students to effectively utilize AI assistance while developing independent writing capabilities.

This study's findings contribute to the emerging literature on AI-assisted language learning by providing empirical evidence of ChatGPT's effectiveness in enhancing EFL writing skills within a specific cultural and educational context. The results suggest that the tool's impact extends beyond surface-level improvements to facilitate deeper development of writing competencies, particularly when integrated within a structured pedagogical framework that promotes active engagement with the writing process.

The study's findings reveal significant positive effects of ChatGPT-assisted instruction on Vietnamese English majors' writing motivation and engagement, with particularly strong impact on writing self-efficacy ($\eta p^2 = .31$) and engagement ($\eta p^2 = .29$). These improvements align with Zimmerman's (2002) self-regulation theory, suggesting that the immediate feedback and personalized learning experiences provided by ChatGPT effectively support the development of self-regulatory writing behaviors. The substantial enhancement in writing self-efficacy addresses a critical challenge in Vietnamese EFL contexts, where students often exhibit low confidence in their writing abilities despite high motivation for learning (Hwang et al., 2023).

The marked reduction in writing anxiety among experimental group participants (mean decrease from 3.48 to 2.65) compared to minimal changes in the control group (3.42 to 3.25) provides empirical support for previous theoretical assertions about AI tools' potential to create low-stakes learning environments (Ali et al., 2023). However, this study extends beyond previous findings by demonstrating how reduced anxiety catalyzes a positive feedback loop of increased experimentation and learning engagement. This pattern aligns with language learning motivation theory's emphasis on the relationship between emotional factors and sustained engagement in language learning tasks (Fathi et al., 2023).

The observed transformation in students' approach to writing, from a task-completion mindset to an iterative learning process, represents a significant shift in how Vietnamese learners engage with writing tasks. This change addresses a persistent challenge in Vietnamese EFL writing instruction, where product-oriented approaches often limit students' engagement with the writing process (Truong, 2017). The high percentage of experimental group participants engaging in multiple revision cycles suggests that ChatGPT's continuous availability of feedback can effectively counter the limitations of traditional teacher-centered instruction identified by Pham and Bui (2021).

The developmental pattern in students' motivation, characterized by initial apprehension followed by significantly increased engagement after week 6, provides important insights into the implementation of AI-assisted writing instruction. This pattern aligns with the TPACK framework's emphasis on the gradual development of technological pedagogical knowledge (Roll & Wylie, 2016). However, the findings extend beyond technical proficiency to demonstrate how mastery of AI tool use contributes to enhanced self-efficacy and motivation, supporting Mahapatra's (2024) observations about the relationship between tool competence and learning engagement.

The relationship between increased motivation and improved writing quality, evidenced by the correlation between higher motivation scores and more sophisticated revision strategies, challenges previous concerns about AI tools potentially diminishing student engagement (Yan, 2023). Instead, the findings suggest that ChatGPT-assisted instruction can foster what Gan et al. (2023) describe as productive engagement patterns, where enhanced confidence leads to more ambitious writing attempts and deeper learning engagement.

However, the study's findings also reveal important nuances in how students develop balanced approaches to AI assistance. The qualitative insights about learning to use ChatGPT as a guide rather than a crutch address concerns raised by Li et al. (2023) about potential over-reliance on AI support. The results suggest that when properly implemented within a structured pedagogical framework, AI assistance can enhance rather than diminish student agency and motivation in the writing process.

These findings have particular significance for understanding motivation in technology-enhanced EFL writing contexts. While previous research has established the importance of intrinsic motivation in writing success (Chhor et al., 2024), this study demonstrates how AI-assisted instruction can specifically nurture intrinsic motivation through enhanced self-efficacy and reduced anxiety. The sustained improvement in motivational metrics suggests that ChatGPT's impact extends beyond initial novelty effects to create lasting changes in students' relationship with writing.

The results contribute to the theoretical understanding of motivation in AI-assisted language learning by demonstrating how immediate feedback and personalized support can create a supportive learning environment that addresses both cognitive and affective factors in writing development. This finding is particularly relevant for Vietnamese EFL contexts, where traditional instructional approaches often struggle to maintain student engagement in writing tasks (Pham et al., 2020).

Theoretical and practical implications

This study's findings offer several significant theoretical and practical implications for AI-assisted language learning in EFL contexts. Theoretically, the results extend social constructivist theory by demonstrating how AI can effectively function as a "knowledgeable other" in the writing development process, suggesting a need to reconceptualize Vygotsky's Zone of Proximal Development in technology-enhanced learning environments. The findings also contribute to language learning motivation theory by illustrating how AI-mediated feedback can create a self-reinforcing cycle of increased confidence and engagement, particularly relevant in Asian EFL contexts where writing anxiety and face-saving concerns often inhibit language production.

The study advances the TPACK framework by providing empirical evidence of how technological, pedagogical, and content knowledge interact specifically in AI-assisted writing instruction. This theoretical extension is particularly relevant as educational institutions globally grapple with integrating AI tools into traditional language teaching paradigms. The findings suggest a need to expand current theoretical models of technology integration to account for the unique affordances and challenges of AI-assisted language learning.

Practically, the results provide concrete guidance for implementing ChatGPT-assisted writing instruction in EFL contexts. The identified six-week adjustment period suggests the need for structured orientation programs when introducing AI tools in writing courses. These findings have particular relevance for

Asian educational contexts sharing similar cultural and pedagogical traditions with Vietnam, where teacher-centered approaches and large class sizes often dominate.

For educational policymakers and administrators, the results suggest the potential of AI-assisted instruction to address persistent challenges in EFL writing education, particularly in resource-constrained environments. However, the findings also emphasize the need for comprehensive teacher training programs that address both technical and pedagogical aspects of AI integration. This has significant implications for teacher education programs and professional development initiatives across global EFL contexts.

Conclusion

This study provides empirical evidence for the effectiveness of ChatGPT-assisted instruction in enhancing Vietnamese English majors' writing skills and motivation. The findings demonstrate that AI-assisted instruction can significantly improve students' writing performance across multiple domains, particularly in task achievement and coherence, while simultaneously fostering higher levels of motivation and engagement. The study's mixed-methods approach has revealed both the quantitative impact of ChatGPT integration and the qualitative mechanisms through which this technology supports writing development and motivational enhancement.

Several key conclusions emerge from this research. First, the effectiveness of ChatGPT-assisted instruction appears to be developmental rather than immediate, requiring approximately six weeks for students to develop proficiency in utilizing the tool effectively. Second, the impact of AI assistance extends beyond surface-level improvements to facilitate deeper engagement with the writing process, as evidenced by increased revision activities and more sophisticated writing strategies. Third, the motivational benefits of ChatGPT integration appear to be sustainable rather than novelty-driven, suggesting potential for long-term impact on students' writing development.

However, this study has several limitations that should be acknowledged. The relatively small sample size and focus on first-year English majors at a single institution limit the generalizability of findings. Additionally, the 15-week intervention period, while sufficient to observe initial impacts, may not capture long-term effects or potential plateaus in learning gains. The study also did not control for variables such as students' prior technology experience or individual learning styles, which might influence the effectiveness of AI-assisted instruction.

Future research should explore several promising directions. Longitudinal studies could investigate the sustainability of writing improvements and motivational gains over extended periods. Cross-cultural comparative studies could examine how different educational contexts influence the effectiveness of ChatGPT-assisted instruction. Additionally, research investigating the optimal balance between AI assistance and traditional instruction could help develop more effective blended learning approaches.

Despite these limitations, this study contributes valuable insights into the potential of AI-assisted language instruction in EFL contexts. The findings suggest that ChatGPT, when properly integrated into writing instruction, can serve as an effective tool for enhancing both writing skills and motivation. However, successful implementation requires careful attention to implementation timelines, student training, and the development of balanced approaches that promote rather than replace student agency in the writing process.

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