Revisiting The Generative AI as a Writing Assistant: Writing quality And Efficiency

Trong Duc Vu[[1]](#footnote-1), Thao Quoc Tran [[2]](#footnote-2)

Abstract

This systematic review examines the impact of generative artificial intelligence (GenAI), particularly tools like ChatGPT, on English Language Learners’ (ELLs) writing quality and writing efficiency. Drawing from 24 peer-reviewed empirical studies published between 2022 and 2025, the review synthesises findings in two areas: (1) writing efficiency, which is measured by planning, drafting, editing, and revising processes; and (2) writing quality, which is defined in terms of lexical sophistication, syntactic complexity, and cohesion. The systematic review's findings showed a consistent improvement in surface-level writing characteristics, such as vocabulary usage, grammar correctness, and organisational coherence. Additionally, learners who use AI-assisted writing platforms report feeling more confident and motivated. Besides writing quality, GenAI improves writing efficiency by expediting draughting, simplifying idea generation, and offering real-time feedback during revision. Reduced student voice, an excessive dependence on AI-generated recommendations, and decreased syntactic complexity are still issues, though. Although GenAI has shown promise in the short term, especially when it comes to scaffolding lower-proficiency learners, its long-term effects on the development of independent writing are still unclear. The review offers pedagogical recommendations for the balanced integration of GenAI in writing instruction.

***Keywords*:** generative artificial intelligence, lexical sophistication, syntactic complexity, text cohesion, writing efficiency.

1. Introduction

Writing proficiency is a foundational skill in both L1 and L2 education, closely linked to academic success and communicative competence. Over the years, researchers have identified key indicators of writing quality, including lexical sophistication, syntactic complexity, and textual cohesion (Crossley, 2020; McNamara et al., 2009). High-quality texts often demonstrate advanced vocabulary, structural variety, and cohesive connections between ideas. However, not all features contribute equally. While lexical and syntactic markers have strong empirical links to writing quality, cohesion indices have shown weaker or inconsistent correlations (McNamara et al., 2009). Moreover, writing is best understood not only as a product but also as a process. The process-writing approach emphasizes recursive stages of planning, drafting, revising, and editing—each contributing to writing development (Seow, 2002). Effective instruction supports these stages through peer interaction, feedback, and task scaffolding (Graham & Sandmel, 2011). Thus, both linguistic output and procedural engagement are vital dimensions of writing quality in educational settings. The emergence of GenAI – notably large language models such as ChatGPT – has introduced a disruptive force in writing instruction. Unlike earlier rule-based AI systems, GenAI uses deep learning to generate human-like content, enabling applications in brainstorming, drafting, translation, and feedback (Banh & Strobel, 2023; Su & Yang, 2023). Early studies highlight the tool’s affordances in language education. Students report using GenAI for ideation, revision, and stylistic improvements (Jacob et al., 2024). In some contexts, AI-generated feedback matches or even surpasses teacher feedback in clarity and detail (Dai et al., 2023). Such tools may also support self-regulation and learner autonomy (Su & Yang, 2023), particularly in EFL settings where access to writing instruction can be limited. However, concerns persist. Educational professionals are concerned that relying too much on GenAI could undermine academic integrity, limit original thought, or lower language awareness (Cotton et al., 2023). Students showed variety of opinions on using GenAI, some believe it could deter individual effort or draw attention to their shortcomings (Chan et al., 2025). The conflicts amongst students underscore the significance of methodically examining how GenAI impacts writing quality as well as process. Research on GenAI's effects on writing is still novel, despite its increasing use in either classrooms or at home. Little is known about how GenAI tools affect the planning, drafting, and revising phases of the writing process (Graham & Sandmel, 2011; Seow, 2002). Findings from various studies are inconsistent, which makes matters even more complicated. Some report gains in efficiency and idea generation (Barrett & Pack, 2023), while others highlight over-reliance or lack of meaningful engagement (Su & Yang, 2023).

To address this gap, the present study conducts a systematic review of empirical research on the impact of generative AI on writing quality and writing efficiency. Guided by PRISMA methodology, we synthesize studies published between 2022 and 2025 that assess GenAI tools in educational writing contexts.

The review focuses on two research questions:

**Research question 1:** How does Gen AI impact English Language Learners’ Writing Quality?

**Research question 2:** How does Gen AI impact English Language Learners’ Writing Efficiency?

By consolidating empirical evidence across diverse contexts and educational levels, this review aims to provide a clearer understanding of how GenAI tools influence writing development. The findings will inform both pedagogical practice and future research into the responsible, effective integration of GenAI in writing instruction

2. Literature Review

2.1. Constructs of Writing Quality

Crossley’s tripartite linguistic model encapsulates these three dimensions, showing that higher-rated essays tend to use more advanced vocabulary, complex syntactic structures, and effective cohesive ties (Crossley, 2020). Empirical studies confirm this link: for example, lexical sophistication, syntactic complexity, text cohesion (Crossley, 2012; Crossley & McNamara, 2014; Kim & Crossley, 2018) have been identified as essential components of academic writing that collectively predict a substantial portion of writing quality In L2 writing, texts with greater lexical diversity and global cohesion generally receive higher scores (Crossley & McNamara, 2016; Kyle & Crossley, 2016). These findi ngs underscore that improving linguistic features is a key avenue for enhancing writing performance.

2.2. Efficiency in writing

Equally important is the process by which writing is produced. Process writing theory views writing as a recursive, staged endeavor of planning, drafting, receiving feedback, and revising. This approach, rooted in works like Flower and Hayes’s cognitive model, has become a cornerstone of writing pedagogy. It is widely regarded as an effective method for improving student writing (Graham and Sandmel, 2011; Williams & Beam, 2019). Through process-oriented instruction, writers are encouraged to generate ideas, organize them, and refine their text in multiple iterations, often with formative feedback guiding each cycle. Such feedback-driven revision is known to yield better text quality and foster self-regulation in writers. Consistent formative feedback (from peers, teachers, or tools) encourages students to think critically and make significant changes, which improves the coherence and clarity of their work. Research has shown that giving students feedback on their writing improves their motivation and the calibre of their revisions (Olsen & Huns, 2023).

2.3. Generative AI in Writing

Recent empirical research has increasingly integrated product-focused and process-focused insights, often leveraging new technologies. Advances in natural language processing and AI writing assistants have created opportunities to blend these perspectives. Modern automated writing evaluation tools can analyze a draft’s linguistic features and provide instant feedback, effectively merging product analysis with the writing process (Crossley & Kyle, 2022). For example, ChatGPT and similar GenAI can function both as a real-time evaluator of text and as a collaborative peer in idea development. Su and Yang (2023) conceptualize ChatGPT as a dual-role assistant: an “evaluator” that gives feedback on language and structure, and a “virtual peer” that engages in dialogue to help writers expand ideas and tackle content problems. In a simulated study of argumentative writing, this AI provided scaffolded support at different writing stages, from brainstorming to editing, illustrating how technology can uphold process writing principles (iterative feedback, dialogue) while honing the linguistic quality of the text. Such integration means that writers can receive immediate, targeted suggestions on their drafts’ lexis, grammar, and coherence during the writing process, blurring the line between developing the text and evaluating it.

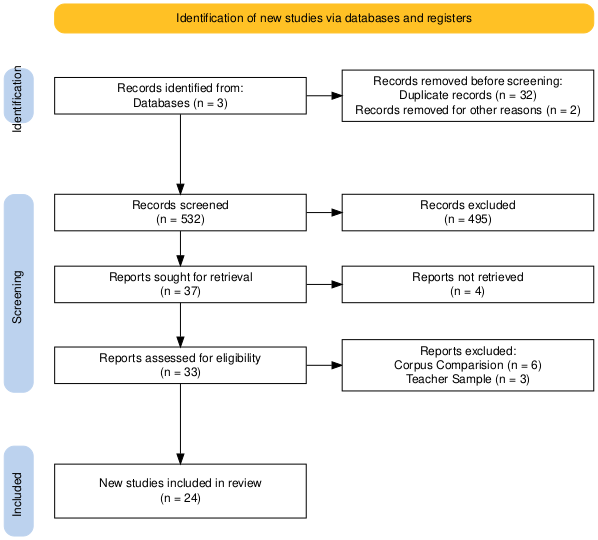
Empirical findings from 2022–2025 demonstrate the benefits of this integrated approach. In a quasi-experimental study, Poláková and Ivenz (2024) examined the impact of iterative ChatGPT feedback on EFL university students’ writing. They found significant improvements in multiple aspects of writing – notably better conciseness, more accurate grammar, inclusion of key content points, and more appropriate use of structures – after students revised their drafts with AI-provided feedback. Qualitative responses from students in the same study were also positive, with a majority reporting that ChatGPT’s detailed evaluations helped them identify and correct weaknesses in their writing, thereby improving their skills. Similarly, Werdiningsih et al. (2024b) reported that postgraduate EFL students perceive GenAI as a versatile tool that enhances both language use and idea development. Learners noted that using ChatGPT expanded their vocabulary, improved grammatical accuracy, aided in organizing essays, and even stimulated idea generation when they faced writer’s block. This suggests that AI support not only refines the linguistic product (by offering synonyms, fixing errors, suggesting cohesive links) but also enriches the process (by brainstorming content and improving organization). In another study, Indonesian EFL students consistently described ChatGPT as a valuable writing assistant for overcoming uncertainties, clarifying word choices, and providing content suggestions, thereby allowing them to focus more on higher-level ideas and message clarity (Werdiningsih et al., 2024a). The AI’s instant feedback on grammar and vocabulary was seen to “significantly enhance the overall quality” of their essays by relieving them of some lower-level concerns. These empirical insights illustrate how process-based interventions (like iterative feedback and revision) mediated by technology can directly lead to improved linguistic outcomes in writing.

3. Methodology

In order to guarantee methodological rigour and transparency, the review procedure was directed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Page et al., 2021; Moher et al., 2009). This study was carried out in three key phases: (1) identifying relevant studies across multiple databases, (2) screening and selecting eligible publications in accordance with PRISMA guidelines, and (3) extracting and synthesizing data from the fully retrieved studies to answer the research questions.

**Figure 1**

*PRISMA 2020 Flow Diagram*



3.1. Search strategies

This study adopted SPIDER framework (Cooke et al., 2012) to ensure a focused and reproducible strategy. The SPIDER criteria specified that the Sample (S) was students in secondary, or tertiary education; the Phenomenon of Interest (PI) was the use of GenAI tools in writing (e.g., ChatGPT); the Design (D) included empirical studies only (qualitative, quantitative, or mixed-methods); the Evaluation (E) required studies to report explicitly outcomes related to writing quality or the writing process (measures of lexical sophistication, lexical density, syntactic complexity, cohesion, as well as aspects of the writing process like idea generation, brainstorming, planning, revising, or editing); and the Research type (R) was limited to peer-reviewed journal articles (excluding non-journal sources). Guided by these criteria, targeted search queries were run in four databases – Scopus, Web of Science, ERIC, and Google Scholar – combining GenAI terms (e.g., “generative artificial intelligence”, “Gen AI”, “Chat GPT”, “Bard”, “Copilot”, “Grok”) with writing-related terms focusing on quality and process (e.g., “writing quality”, “lexical sophistication”, “lexical density”, “syntactic complexity”, “cohesion”, “idea generation”, “brainstorming”, “drafting”, “revising”, “editing”). This search strategy initially identified approximately 532 records across the databases before screening. Following the PRISMA guidelines for study selection, duplicates were removed and the remaining records underwent title/abstract screening and full-text eligibility assessment based on the SPIDER-defined inclusion criteria (See figure 1). This rigorous screening process yielded 24 studies that met all criteria and were included in the review.

3.2. Inclusion and Exclusion Criteria

This review followed the PRISMA guidelines and employed a two-stage screening process: title and abstract screening, followed by full-text review. Studies were included if they met all of the following criteria: focused on GenAI tools (e.g., ChatGPT) used for writing tasks; involved ESL/EFL students in formal education (secondary to tertiary); used an empirical design (qualitative, quantitative, or mixed methods); reported outcomes on writing quality (e.g., lexical sophistication, syntactic complexity, cohesion) and/or writing processes (e.g., planning, revising, editing, drafting); were peer-reviewed and published between 2022 and 2025; and were available in English with full text. Studies were excluded if they focused on general education without an ESL/EFL writing component, involved only teachers, used only computational or corpus-based analysis without student data, targeted non-writing skills, were non-empirical, or lacked English full-text access.

3.3. Analysis of extracted publications

This study review extracted data based on the following categories: general information (title, authors, year, sample size, educational level, and learning context), type of GenAI tool used, writing task characteristics, and reported outcomes. Outcomes were classified according to two dimensions aligned with the Crossley (2020) on writing quality constructs (e.g., lexical sophistication, syntactic complexity, cohesion), and process-based indicators of writing efficiency (e.g., idea generation, planning, revising, and feedback use). These data were analyzed to address RQ1 on how GenAI impacts writing quality, and RQ2 on how GenAI influences writing efficiency.

4. Results

4.1. General findings

Twenty-four recent studies have examined how GenAI tools—primarily ChatGPT and other AI chatbots or automated feedback systems like Grammarly and Wordtune—affect English Language Learners’ (ELLs’) writing. These studies span secondary to tertiary contexts across a wide range of countries, with research conducted in Vietnam, China, Indonesia, Malaysia, Saudi Arabia, Poland, Canada, and others. Study designs include quasi-experiments (e.g., Duong & Chen, 2025; Tsai et al., 2024), mixed-method studies (e.g., Mahapatra, 2024; Liu & Jin, 2025), case studies (e.g., Werdiningsih et al., 2024b), and surveys (e.g., Luu & Bui, 2025; Xiao & Zhi, 2023).

Writing tasks ranged from short essays and exam prompts to academic reports and collaborative or narrative compositions. The studies assessed writing quality using specific metrics such as lexical sophistication (e.g., Kim et al., 2025; Pitura, 2024;), grammatical accuracy (e.g., Li et al., 2024), and cohesion (e.g., Strobl et al., 2024), while others applied holistic scoring or analyzed learners’ perceptions of improvement (e.g., Alzubi, 2024; Werdiningsih et al., 2024a). In terms of writing efficiency, many studies evaluated the writing process through observation, usage tracking, or self-reports, particularly focused on planning, drafting, revising, and editing stages.

Overall, the research indicates that GenAI tools can enhance both the quality and efficiency of L2 writing. However, some studies raise concerns about overreliance and the risk of diminishing learner autonomy and authenticity (Kim et al., 2025; Seo, 2024; Werdiningsih et al., 2024b). The following sections present a synthesis of findings across the two focal domains: writing quality and writing efficiency..

4.1. GenAI and Writing Quality

Of the 24 studies, 23 explicitly investigated AI’s impact on writing quality through dimensions such as lexical sophistication, syntactic complexity, and cohesion. Most studies report statistically or descriptively significant improvements in one or more of these dimensions following AI-assisted writing..

**Lexical Sophistication**

Numerous studies demonstrated that AI tools promote greater lexical richness. Tsai et al. (2024) observed that university students using ChatGPT in the revision process improved significantly in vocabulary use, displaying a more academic tone and increased lexical diversity. Similar findings were reported by Al Mahmud (2023) and Murgayah et al. (2025), whose students employed more precise, vivid, and contextually appropriate vocabulary after using AI tools like Wordtune and ChatGPT. In qualitative accounts, students described AI as helpful for paraphrasing and refining word choice (Werdiningsih et al., 2024a; Kim et al., 2025). Gayed et al. (2022) and Li et al. (2024) confirmed these effects through lexical analysis, showing elevated sophistication in student texts after using AI feedback platforms.

**Syntactic Complexity and Accuracy**

AI-assisted writing also yielded improvements in grammatical correctness and, to a lesser extent, syntactic complexity. Duong and Chen (2025) and Liu and Jin (2025) observed that students produced longer, more structurally varied sentences post-AI support. Polakova and Ivenz (2024) found that ChatGPT reduced grammatical errors in university students’ revisions, improving sentence fluency. The results of studies conducted by Truong and Tran (2022) and Mahapatra (2024), students wrote more syntactically diverse texts, incorporating complex constructions and appropriate clause usage. Conversely, Seo (2024) observed a minor drop in syntactic complexity in post-AI versions, implying that some students might simplify their language under AI direction for clarity. Kim et al. (2025), where students embraced AI-generated phrasings that favored correctness over syntactic variation, mirrored Seo's (2024) outcome. Still, most studies—including Strobl et al. (2024) and Chan et al. (2025)—found more coherent grammatical structure and improved sentence-level accuracy.

**Cohesion and Coherence**

Many studies highlighted improved text organization and cohesion after AI integration. Song and Song (2023) reported significant increases in organization scores, attributing these to AI-assisted outlining and transitions. Strobl et al. (2024) and Escalante et al. (2023) observed better paragraph structure and referential clarity in students’ revised drafts. Nguyen and Nguyen (2025), Seo (2024), and Alzubi (2024) all noted that AI helped learners improve logical flow through better use of cohesive devices. Werdiningsih et al. (2024a) and Xiao and Zhi (2023) emphasized that learners saw ChatGPT as a useful tool to restructure their ideas more clearly and logically. While Tsai et al. (2024) raised fairness concerns—namely, that weaker students’ writing appeared more polished than warranted—the general trend indicates a substantial positive impact on cohesion and coherence when AI is used with reflection and teacher guidance.

4.2. GenAI and Efficiency

Twenty-four of the reviewed studies examined how AI influences the efficiency of ELLs’ writing process, particularly in the stages of planning, drafting, editing, and revising.

**Planning**

AI tools helped reduce cognitive load and planning-related anxiety by supporting idea generation and organization. Duong and Chen (2025) and Werdiningsih et al. (2024b) found that lower-proficiency learners used AI primarily during planning to generate vocabulary and outline content. Kim et al. (2025) and Xiao and Zhi (2023) reported that students relied on ChatGPT to brainstorm ideas and build outlines. Studies by Song and Song (2023) and Luu and Bui (2025) emphasized that AI use in this phase helped students start writing more confidently and systematically. However, Shi et al. (2025) warned that overreliance on AI could suppress creativity and original thinking, suggesting a need for teacher-mediated guidance during planning.

**Drafting**

With GenAI-assisted during drafting stage, drafting tended to be faster and more fluent. Advanced students, as observed by Duong and Chen (2025), used AI during composition to elaborate ideas and refine expression. Chan et al. (2025) and Tsai et al. (2024) also found that students completed fuller drafts more quickly when supported by ChatGPT. Murgayah et al. (2025) and Li et al. (2024) reported that AI assistance helped learners maintain focus and develop content in greater detail. Several learners across studies (e.g., Strobl et al., 2024; Werdiningsih et al., 2024b) described the AI as a collaborative partner, easing the pressure of composing in English. At the same time, some learners reported diminished ownership of their writing when AI-generated phrasing dominated their drafts (Kim et al., 2025).

**Editing**

The most consistent efficiency gains appeared in editing. Real-time grammar correction and rephrasing suggestions from AI tools allowed learners to polish their texts with minimal delay. Al Mahmud (2023), Escalante et al. (2023), and Nguyen and Nguyen (2025) all reported that students corrected errors more efficiently with Grammarly, Wordtune, or ChatGPT. Chan et al. (2025) and Polakova and Ivenz (2024) noted that AI feedback led to tighter, more concise writing. Mahapatra (2024) emphasized that in large ESL classrooms, AI-enabled editing reduced students’ dependence on teacher feedback and enabled iterative self-correction.

**Revising**

Research also underlined how GenAI influences revising stage. Students created model texts or received direct editing suggestions using GenAI. Students who compared their drafts to AI-generated texts made more substantive changes, according to Strobl et al. (2024) and Yang et al. (2023). Targeting clarity, cohesiveness, and argument strength, Chan et al. (2025) found that students corrected more actively when guided by ChatGPT's feedback. One round of AI-informed revision, according to Tsai et al. (2024), usually yields notable improvements in rubric domains. AI-facilitated revision resulted in higher learner confidence and metacognitive awareness, confirmed Werdiningsih et al. (2024b) and Xiao and Zhi (2023). Simultaneously, authenticity and fairness issues remain unresolved; teachers worry that significant AI changes would conceal students' actual capacity (Tsai et al., 2024).

5. Discussion

Results of 24 recent empirical studies on how GenAI tools affect ELL's writing quality and writing efficiency were compiled in this systematic review. The findings shed light on how artificial intelligence, especially tools including ChatGPT, Grammarly, and Wordtune, either helps or hinders L2 writing development. Two key research questions were addressed: (1) How does generative AI affect the quality of ELL students’ writing? and (2) How does it influence the efficiency of the writing process?

**5.1 Writing Quality: Gains in Lexical, Grammatical, and Organizational Features**

A consistent pattern across the literature is the positive impact of GenAI tools on writing quality, particularly in lexical sophistication, grammatical accuracy, and textual cohesion. These findings align closely with Crossley’s tripartite linguistic model, which underscores vocabulary depth, syntactic complexity, and discourse coherence as predictors of proficient writing.

Several studies showed statistically or descriptively significant improvements in lexical diversity and appropriateness following AI-assisted revision. For example, learners revised their drafts using more precise and academic word choices after receiving AI feedback (Tsai et al., 2024; Al Mahmud, 2023; Murgayah et al., 2025). In some qualitative studies, learners attributed their enhanced vocabulary and phrasing skills to features like paraphrasing suggestions and synonym generation (Kim et al., 2025; Werdiningsih et al., 2024b). Syntactic complexity was another area of substantial improvement. Students produced more error-free sentences and showed increased length of T-Unit or the number of dependent clauses per clause or T-Unit following AI-supported drafting and editing (Duong & Chen, 2025; Polakova & Ivenz, 2024; Li et al., 2024). While some studies observed modest increases in syntactic complexity (Mahapatra, 2024; Truong & Tran, 2024), others (e.g., Seo, 2024) raised concerns that students sometimes adopted simplified AI-generated structures, potentially reducing syntactic variety in favor of correctness. AI also supported improvements in textual organization. Studies documented gains in coherence, logical sequencing, and paragraph structure when learners used AI to plan or revise their work (Song & Song, 2023; Strobl et al., 2024; Nguyen & Nguyen, 2025). Learners often described AI as helpful for organizing ideas, generating outlines, and suggesting transitions—especially beneficial for those with lower writing proficiency (Xiao & Zhi, 2023; Werdiningsih et al., 2024a). Nonetheless, several studies cautioned against the potential masking of students’ actual abilities, particularly when AI significantly reshapes texts. Educators must remain aware of the distinction between improved outputs and genuine learner development. When used as a scaffold rather than a crutch, however, AI appears to enhance core linguistic aspects of ELL writing effectively..

**5.2 Writing Efficiency: Streamlining the Writing Process**

In addition to quality improvements, GenAI tools were found to enhance efficiency throughout the writing process—particularly during planning, drafting, editing, and revising. This aligns with process writing theory, which views writing as iterative, developmental, and responsive to feedback (Flower & Hayes, 1981; Graham et al., 2013). During planning, AI tools were widely used to reduce anxiety, support brainstorming, and provide topic outlines. Learners reported feeling more confident and organized after using ChatGPT for idea generation and structure building (Duong & Chen, 2025; Kim et al., 2025). However, some researchers warned that excessive AI use may inhibit original thought (Shi et al., 2025), emphasizing the need for teacher mediation and reflection. In the drafting phase, GenAI tools helped students elaborate ideas and express themselves more fluently. Higher-proficiency learners used AI for sentence construction and content expansion (Chan et al., 2025; Tsai et al., 2024), while others treated AI as a collaborative writing partner (Werdiningsih et al., 2024b). However, some students expressed concern that overuse of AI phrasing reduced their sense of ownership over the text (Kim et al., 2025). Editing was where efficiency gains were most pronounced. AI tools provided instant feedback on grammar, spelling, and sentence style, reducing the time required for error correction (Al Mahmud, 2023; Escalante et al., 2023; Nguyen & Nguyen, 2025). Students claimed greater autonomy in fixing mechanical problems (Mahapatra, 2024). Lastly, in the revising process, GenAI tools enabled more deliberate and significant changes. Students used AI to compare drafts, restructure material, and handle clarity and cohesiveness problems (Strobl et al., 2024; Chan et al., 2025; Yang et al., 2023). Often deeper and more effective than those done alone. Still, questions about authenticity and fairness surfaced, particularly in light of AI-generated changes to the original student output (Tsai et al., 2024).

6. Conclusion

This systematic review synthesized 24 recent empirical studies that investigated how GenAI tools, like ChatGPT, affected the efficiency and quality of ELLs' writing. The results show that GenAI technologies can be useful writing assistant for the entire writing process when used carefully. GenAI tools speed up the writing process by making idea generation, drafting, revising, and editing easier. They also improve the final written product in terms of lexical sophistication, syntactic complexity, and text cohesion. The majority of the reviewed studies asserted that learners who receive AI support generate more coherent texts, fewer grammatical errors, complex clauses, and vocabulary that is more appropriate for academic settings. The results from those studies explicitly stated that AI-assisted writing can simultaneously promote several aspects of writing quality. Additionally, students affirmed that they feel more self-assured and independent, particularly when using AI to organize and edit their writing – two processes that many ELLs have historically found difficult. Lower-proficiency learners also benefit most from these advantages since they have access to real-time feedback and language scaffolding that they might not otherwise have. In contrast to benefits offered by GenAI, systematic reviewed studies also highlight vital obstacles. Higher-order skills like syntactic variation, original thought, and independent revision may be hampered by an uncritical reliance on GenAI, despite the fact that it can improve writing fluency and lower barriers. Furthermore, evaluating writing that is heavily AI-assisted without taking into consideration outside assistance raises fairness issues because it may conceal a learner's actual aptitude. According to the review, pedagogical frameworks should encourage the thoughtful and strategic application of AI in order to maximize GenAI's potential while preserving learning outcomes. Instructors should assist students in striking a balance between the advantages of immediate feedback and the obligations of authorship and cognitive engagement. Furthermore, continuous AI literacy training is essential to guarantee that students comprehend the limitations of AI in addition to using it efficiently.

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**Appendix A: Table of Systematic Reviewed Articles**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Author(s) (Year)** | **Country/Context** | **Education Level** | **GenAI Tool Used** | **Writing Focus** | **Methodology** | **Writing Quality Aspects** | **Efficiency Aspects** |
| 1 | Al Mahmud (2023) | Saudi Arabia | University | Wordtune | Academic Essay | Quasi-experiment | Lexical sophistication, Grammar | Editing |
| 2 | Alzubi (2024) | Saudi Arabia | University | ChatGPT | Academic Writing | Survey | Cohesion | Planning, Revising |
| 3 | Chan et al. (2025) | Hong Kong | University | ChatGPT | Argumentative Writing | Mixed methods | Syntax, Cohesion | Drafting, Revising |
| 4 | Duong & Chen (2025) | Vietnam & Taiwan | High School | AI Chatbot | Essay Writing | Mixed methods | Syntax, Grammar | Planning, Drafting |
| 5 | Escalante et al. (2023) | Colombia | University | ChatGPT & AWE | General Writing | Mixed methods | Cohesion | Editing |
| 6 | Gayed et al. (2022) | U.S. | University | Grammarly | Short Essay | Quasi-experiment | Lexical sophistication | Editing |
| 7 | Kim et al. (2025) | Korea | University | ChatGPT | Various Types | Mixed methods | Lexical, Grammar | Planning, Revising |
| 8 | Li et al. (2024) | China | University | ChatGPT | Argumentative Essay | Experiment | Grammar, Lexical | Drafting, Editing |
| 9 | Liu & Jin (2025) | China | University | ChatGPT | Academic Writing | Mixed methods | Syntax | Planning |
| 10 | Luu & Bui (2025) | Vietnam | University | ChatGPT | Writing Support | Survey | Lexical | Editing |
| 11 | Mahapatra (2024) | India | University | ChatGPT | Research Writing | Mixed methods | Syntax, Grammar | Revising, Editing |
| 12 | Murgayah et al. (2025) | Malaysia | Secondary | ChatGPT | Creative Writing | Quasi-experiment | Lexical | Drafting |
| 13 | Nguyen & Nguyen (2025) | Vietnam | University | ChatGPT | Essay Writing | Mixed methods | Cohesion | Editing |
| 14 | Pitura (2024) | Poland | University | ChatGPT | Academic Writing | Survey | Lexical | Planning |
| 15 | Polakova & Ivenz (2024) | Czech Republic | University | ChatGPT | Academic Writing | Quasi-experiment | Grammar, Style | Editing, Revising |
| 16 | Seo (2024) | Korea | University | ChatGPT | Narrative Writing | Quasi-experiment | Cohesion, Accuracy | Planning, Editing |
| 17 | Shi et al. (2025) | China | University | ChatGPT | Argumentative Writing | Mixed methods | Cohesion | Revising |
| 18 | Song & Song (2023) | Korea | University | ChatGPT | General Writing | Quasi-experiment | Cohesion | Planning |
| 19 | Strobl et al. (2024) | Germany | University | ChatGPT | Academic Writing | Case study | Cohesion | Revising |
| 20 | Truong & Tran (2024) | Vietnam | University | ChatGPT | Essay Writing | Experiment | Syntax | Drafting |
| 21 | Tsai et al. (2024) | Taiwan | University | ChatGPT | Essay Revision | Experiment | Lexical, Cohesion | Drafting, Revising |
| 22 | Werdiningsih et al. (2024a) | Indonesia | University | ChatGPT | Thesis Writing | Case study | Cohesion | Revising |
| 23 | Werdiningsih et al. (2024b) | Indonesia | Graduate | ChatGPT | Academic Writing | Case study | Lexical | Planning |
| 24 | Xiao & Zhi (2023) | China | University | ChatGPT | General Writing | Survey | Cohesion | Planning, Revising |

1. Trong Duc Vu, B.A, Academic Department, IALC English Center, Ho Chi Minh City, Vietnam; *vuductrong379@gmail.com* [↑](#footnote-ref-1)
2. Thao Quoc Tran, Associate Professor, Faculty of Foreign Languages, Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam [↑](#footnote-ref-2)