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Original Paper

Research on the Role of Large Language Models in Enhancing English Learners' Writing Skills: A Literature Review

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Abstract

This paper presents a systematic review of the research progress and practical applications of Large Language Models (LLMs) in supporting English writing instruction. It examines how key technologies, such as natural language generation and long-text optimization, contribute to writing pedagogy, outlines the dual supportive role of LLMs across the writing process along with their personalized instructional pathways, and evaluates their strengths and limitations. The study also explores the potential of LLMs in reducing writing anxiety. Lastly, it highlights the current scarcity of research focused specifically on children and adolescents and proposes future research directions, including age-appropriate LLM application strategies, cross-cultural considerations, and investigations into long-term outcomes.

Keywords

Large Language Models, English Writing Instruction, Personalized Learning, Writing Anxiety, Literature Review

1. Introduction

The rapid advancement of artificial intelligence, particularly the groundbreaking progress of Large Language Models (LLMs) in natural language processing (NLP), is revolutionizing paradigms for teaching and learning English writing. By generating coherent, idiomatic text and offering instant feedback, LLMs have emerged as powerful tools for enhancing the writing proficiency of English learners, thereby attracting significant scholarly interest. Research on LLM-assisted writing has evolved into an interdisciplinary field characterized by the integration of diverse methodologies, encompassing dimensions such as technological foundations, pedagogical models, evaluation mechanisms, and affective factors. Nevertheless, existing literature is marked by an uneven distribution

of research themes, a lack of theoretical depth, and insufficient focus on specific learner demographics, highlighting the need for a systematic review and critical analysis. This chapter aims to synthesize current research on LLM-assisted English writing. To this end, the review is structured as follows: it begins by outlining the core technological underpinnings of LLMs, then examines their diverse pedagogical roles and application pathways, evaluates their efficacy and challenges in writing assessment, explores their impact on learners' affective dimensions, and finally identifies research gaps and future directions.

2. Technological Foundations of LLMs in English Writing Assistance

The application of LLMs in English writing did not emerge in isolation. Their powerful functionality is grounded in a series of cutting-edge natural language processing technologies. Current research primarily focuses on the following key areas.

Natural Language Generation (NLG) constitutes the core capability of LLMs. In *Research on Natural Language Generation Technology in the Era of Deep Learning Large Models*, Liao Junwei (2023) offers an in-depth analysis of the principles, architecture, and development trends underlying large model-based text generation. The study highlights that modern NLG technology can produce high-quality, diverse natural language texts from specific inputs, supplying ample linguistic resources and expressive variants for English writing. This technology not only mitigates the rigidity of template-based writing but also provides learners with rich examples of language use, forming the foundational support for writing assistance. In contrast to earlier rule-based systems, neural network-driven generation exhibits greater flexibility and creativity, yielding more natural and idiomatic language outputs.

To enhance logical coherence in extended texts, long-text inference optimization plays an essential role. In *A Survey of Long-Text Inference Optimization Techniques for Large Language Models*, Tao et al. (2025) systematically examine enhanced techniques for long-text inference in LLMs, including optimized attention mechanisms, memory augmentation, and hierarchical representation learning. These advances allow LLMs to more effectively comprehend and sustain contextual coherence and logical flow across longer documents, thereby offering learners better-structured and more rigorous writing guidance. Improved long-text processing is especially critical in academic writing, where papers must often maintain consistency and argumentative depth across tens of thousands of words, a challenge beyond the reach of conventional writing aids.

The maturation of Artificial Intelligence-Generated Content (AIGC) technology has further expanded these applications. In *An Overview of Artificial Intelligence-Generated Content Technology*, Zhang et al. (2025) provide a comprehensive treatment of AIGC, underscoring the role of large language models as prime examples of systems capable of generating diverse text types. Within English writing instruction, AIGC technology can supply various writing templates, sample essays, and other exemplars, assisting learners in mastering the forms and styles of different genres and topics. When compared to earlier text

generation methods, AIGC exhibits marked improvements in creativity, diversity, and adaptability, allowing for the generation of tailored content that aligns with specific writing tasks and stylistic preferences.

In the 2021 article *Analysis and Application of a Grammar Error Correction Model for English Learners*, Ge Minmin examined grammar error correction models, shedding light on how large language models can be combined with specialized technologies. Although LLMs have inherent grammar-checking capabilities, integrating them with dedicated grammatical error correction systems can enhance the accuracy of error detection and correction for English learners, leading to greater writing proficiency. This integrated technological approach is especially relevant for specific learner groups, such as young or second language learners, who often encounter distinctive grammatical challenges.

Together, these technologies form the foundational capabilities that enable LLMs to support writing, elevating them beyond traditional computer-assisted writing tools (e.g., Ouyang, 2009; Li, 2004; Chen, 2009; Wang et al., 1993). Earlier studies mainly addressed basic computer-assisted writing functions such as spell checking, grammar correction, and formatting, whereas LLMs represent a leap forward, from mere error detection to creative content generation and rich interaction. This technological evolution has not only enhanced the efficiency and quality of writing support but has also opened new avenues for writing pedagogy, establishing a technical basis for personalized learning and adaptive instruction.

In summary, the advancements in NLG, long-text inference, and AIGC form the technical backbone that enables LLMs to transcend traditional writing aids. The following section will illustrate how these capabilities are translated into practical educational roles and integrated into the writing process.

3. The Diverse Roles and Application Pathways of LLMs in Writing Instruction

In educational practice, LLMs fulfill multiple roles and are embedded throughout the entire writing process, establishing a multi-tiered and holistic support system. Scholars widely recognize LLMs as "intelligent assistants" that enhance instructional effectiveness and deliver personalized support, with applications now permeating all facets of writing pedagogy.

From the perspective of role allocation, LLMs perform a "dual-support" function: aiding both teachers and students, thereby fostering a new paradigm of pedagogical collaboration. In *The Roles of Large Language Models in English Language Teaching*, Xu Jiajin and Zhao Chong (2024) note that for instructors, LLMs serve as efficient content generators, useful for developing teaching materials, designing writing tasks, and supplying pedagogical examples. For students, they act as sources of inspiration and tools for grammar correction, delivering real-time writing assistance and recommendations. This dual role establishes LLMs as a crucial link between teaching and learning, enhancing both instructional efficiency and educational outcomes. Research by Hartono et al. (2023) further supports that students view AI technology as highly adaptive, capable of addressing individual

learning needs and improving language proficiency through real-time guidance and instant feedback. Such adaptability enables LLMs to offer tailored support that aligns with diverse student needs and ability levels, facilitating individualized instruction.

Moreover, LLMs play a pivotal role in advancing personalized foreign language education, creating new technical opportunities for tailored instruction. In *Implementation Strategies for Personalized Foreign Language Education in the Context of Large Language Models*, Xu Jiajin (2025) suggests that LLMs can analyze learners' writing history based on individual differences such as proficiency and interests, thereby offering highly customized exercises, feedback, and suggestions suited to specific needs. This personalization extends beyond linguistic features to include areas such as content organization, argumentation strategies, and stylistic elements, holistically supporting the development of learners' writing skills. Research by Song and Song (2023) further affirms that students acknowledge the positive impact of AI on pedagogical innovation, including increased motivation and improved writing competence, particularly in areas such as organization, coherence, grammar, and vocabulary.

In terms of application pathways, LLMs are deeply incorporated into the three core stages of writing, pre-writing, drafting, and revision, forming an end-to-end support framework. In *Application Pathways of Large Language Models in College English Writing Instruction*, Chen Yijun (2024) details specific applications. During the pre-writing phase, LLMs can supply topical background knowledge and stimulate inspiration, aiding learners in expanding their ideas and gathering material. Throughout the drafting process, they provide immediate vocabulary and grammatical suggestions, supporting expression refinement and language development. In the revision stage, they deliver comprehensive evaluations and feedback, helping learners identify strengths and weaknesses and implement focused improvements. This end-to-end support system not only increases writing efficiency but also fosters learners' metacognitive abilities, empowering them to better monitor and manage their own writing processes.

Having established the multi-faceted support LLMs provide throughout the writing process, it is crucial to evaluate their actual efficacy and the challenges that emerge when these tools are deployed in authentic educational settings.

4. Efficacy and Challenges in LLM-assisted Writing

Writing assessment constitutes a fundamental aspect of pedagogy, wherein Large Language Models (LLMs) offer considerable benefits while simultaneously introducing new complexities, resulting in a nuanced interplay of opportunities and challenges. A comprehensive examination of the capabilities and constraints of LLMs in writing assessment is vital for maximizing their potential and addressing associated risks.

Regarding efficacy, LLMs demonstrate strong performance in automated scoring and feedback generation, delivering exceptional efficiency and evaluative quality. In their 2024 study, *The Application of Large Language Models in Process Evaluation: Scoring and Feedback in English*

Writing, Huang Xiaoting and Guo Liting show that LLMs are capable of swiftly and accurately assessing English compositions while supplying elaborate feedback, which encompasses grammatical corrections, recommendations for lexical diversity, and assessments of logical coherence. This not only alleviates the grading workload for educators but also affords learners prompt and detailed feedback, thereby supporting the refinement of their writing techniques and overall competence. In contrast to conventional human evaluation, feedback produced by LLMs tends to be more immediate, consistent, and exhaustive, encompassing a broader array of evaluative aspects and finer details, which in turn furnishes learners with more substantive and targeted recommendations for improvement.

Nonetheless, the deployment of LLMs is not without challenges, especially in advanced academic writing contexts, where questions of relevance and efficacy emerge. As Li and Flowerdew (2020) observe, although AI-mediated language refinement is frequently applicable in general academic settings, "publication-oriented academic English writing" demands a more specialized, discipline-aware use of language, distinct from generic academic discourse. This implies that LLMs might be limited in their capacity to perform deep, discipline-sensitive language optimization, thus struggling to address the nuanced requirements of domain-specific writing. You et al. (2025), in their work *Opportunities, Challenges, and Strategies for Generative AI-Assisted Research Writing in Social Science Graduate Students: A Case Study of DeepSeek*, also investigate the role of generative AI in supporting research writing among social science graduate students. They conclude that although LLMs can enhance certain aspects of academic English, such as standardizing citation formats and strengthening argumentative structure, their ability to process deeply specialized subject matter remains inadequate.

Another challenge is how students engage with the feedback they receive, as this critically shapes the effectiveness of LLM-supported learning. Xu et al. (2024), in *A Study on Learner Cognition and Behavior in AI-Assisted Academic English Writing*, examine the influence of AI on learners' cognitive and behavioral patterns during academic writing tasks. Their findings highlight considerable diversity in how learners perceive and utilize AI-generated support. Further underscoring this point, research by Lu et al. (2021) identifies a pivotal concern: a prevalent behavior among students involves the uncritical adoption of AI-modified text, specifically, "copying and pasting" without further intellectual engagement. This approach inhibits deeper cognitive activities, such as comparing, analyzing, and critically assessing machine-generated language, which ultimately obstructs language acquisition and the growth of linguistic ability. Such behavior points to a potential overreliance on technological aids and a deficiency in active cognition and knowledge assimilation, possibly stunting the long-term advancement of writing skills.

In a complementary vein, Huang Jianhong (2024), in *A Study on the Impact and Process of Generative AI-Assisted Writing Revision on English Writing Performance*, analyzes the outcomes and mechanisms of generative AI-facilitated revision. The research affirms that generative AI, including LLMs, can supply instructive recommendations during the revision phase, thereby contributing to the enhancement

of learners' writing proficiency. At the same time, the author stresses the importance of guiding students toward judicious use of these technologies, eschewing overdependence and mindless reproduction, and instead leveraging AI-produced suggestions as catalysts for critical reflection and learning. By actively processing and internalizing these inputs, learners can achieve authentic and sustainable improvements in their writing capabilities.

Beyond the technical and cognitive dimensions, the interaction with LLM also significantly influences learners' psychological states. The next section, therefore, turns to the affective factors and psychological effects associated with LLM-assisted writing.

5. Affective Factors and Psychological Effects: The Humanistic Dimension

In addition to technical efficacy and linguistic development, recent research has increasingly examined the affective dimensions and psychological implications of LLM-assisted writing. This evolution marks a shift from a purely technical focus toward a more humanistic perspective, thereby broadening the scope of research on LLM-supported writing practices.

In *A Study on the Application of AI Technology in Alleviating English Writing Anxiety Among Middle School Students*, Pei Yanlin (2024) highlights the role of artificial intelligence in reducing writing anxiety. The research demonstrates that AI technology can alleviate English writing anxiety among junior high school students by offering a non-judgmental practice space, instant positive feedback, and tailored support. Writing anxiety is a key factor impacting writing performance, especially among adolescents and lower-proficiency learners, where fear and discomfort often impede skill development. The low-stakes practice environments and supportive feedback facilitated by LLMs help learners build confidence and progressively overcome psychological obstacles. This study emphasizes the need to consider not only technological effectiveness but also learners' emotional experiences and psychological well-being, promoting a human-centered approach that fosters holistic growth.

Apart from anxiety reduction, studies also indicate that LLMs can positively affect learners' motivation, self-confidence, and self-efficacy. Students perceive AI technology as highly adaptable and responsive to individual learning needs. This sense of support boosts learners' autonomy and intrinsic motivation. When students feel that digital tools understand and cater to their personal requirements, they are more inclined to participate actively in learning and persevere through difficulties, resulting in better outcomes. This psychological process aligns with self-determination theory, which suggests that intrinsic motivation is enhanced when learning environments fulfill students' needs for autonomy, competence, and relatedness.

Nevertheless, it is important to be mindful of potential adverse psychological effects resulting from technology use. Excessive reliance on AI tools, for example, may undermine self-efficacy or foster "technology dependence." If learners delegate all writing-related decisions to AI, they may increasingly doubt their own capabilities and believe they cannot write effectively without technological aid. Thus, a key challenge lies in balancing technological benefits with the promotion of learner autonomy and

self-confidence. Educators should develop thoughtful instructional strategies to help learners use AI tools appropriately, as supplements to, rather than substitutes for, their own critical thinking and creativity.

6. Research Gaps and Future Prospects

In summary, existing research has laid a solid foundation for the use of LLMs in assisting English writing across technological foundations, pedagogical applications, efficacy and challenges, and affective factors, forming a multi-angle, multi-layered research landscape. However, significant research gaps and unresolved issues remain, requiring further in-depth exploration in future studies.

6.1 The Child and Adolescent Research Gap

The most notable gap is the insufficient research focused on children and adolescents. Learners at different age stages exhibit significant differences in cognitive characteristics, learning needs, and psychological traits. This necessitates that the application of LLMs in writing assistance consider developmental factors, providing age-appropriate support and guidance. Application strategies for large language models should vary for different age groups. Although Zhu Xiaona (2018), in her study *Research on the Application of English Education Apps in Children's Learning*, explored the use of English education apps in children's English learning processes, there is limited discussion on how large language models can enhance the English writing skills of children and adolescents. Children and adolescents differ considerably from adults in aspects such as cognitive levels, learning styles, and interest characteristics. Children's cognitive tendencies are in a transitional phase from concrete to abstract thinking, while adolescents place greater emphasis on self-expression and social interaction. Directly applying models designed for adult learners may yield limited results or even prove counterproductive. Future research needs to draw on theories from developmental psychology and pedagogy to deeply investigate suitable LLM application strategies for learners at different developmental stages.

It is worth noting that data privacy and ethical issues for different age groups also require special attention. Data protection for children and adolescents is particularly important. The application of LLMs must strictly comply with relevant laws and regulations to ensure data security and privacy protection. Additionally, the long-term impact of technology use on child development must be considered, avoiding potential negative effects caused by premature or excessive use of technological tools.

6.2 The Need for Cross-cultural Perspectives

Second, cross-cultural perspectives and attentiveness to learner diversity remain underdeveloped in the current literature. The majority of existing studies are conducted within specific cultural and educational settings, which constrains the generalizability of their findings. Learners from varied cultural backgrounds differ significantly in writing conventions, rhetorical practices, and learning behaviors. Thus, LLM-powered writing supports must be culturally aware and adaptable. Future

research should incorporate cross-cultural comparative designs to evaluate the efficacy and relevance of LLMs across contexts, and to advance the development of culturally responsive writing assistance systems.

6.3 Long-term Effects and Sustainable Integration

Moreover, the long-term effects and sustainable integration of LLMs constitute another crucial avenue for future inquiry. Current scholarship focuses largely on short-term gains, leaving the longitudinal implications of LLM-assisted writing inadequately explored. Key questions remain, such as how extended use of LLMs influences learners' writing proficiency, cognitive patterns, and creative capacities, and how educators can mitigate over-reliance and foster intellectual agency. Addressing these issues will require longitudinal designs and extended observational studies to guide ethically and pedagogically sustainable implementation.

In light of these gaps, scholars should delve into developing LLMs application strategies tailored to the characteristics of different learner groups. This includes creating personalized solutions that effectively stimulate writing interest, foster critical thinking, and enhance expressive capabilities. Furthermore, it is essential to expand cross-cultural perspectives and conduct long-term effect studies to promote the sustainable development of the technology. Such efforts will advance English writing pedagogy and research towards greater precision, human-centricity, and scientific rigor, ultimately meeting the diverse needs of all learners and promoting educational equity and quality.

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