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The impact of automated feedback using artificial intelligence on the development of writing skills in students of English as a foreign language

El impacto de la retroalimentación automatizada mediante inteligencia artificial en el desarrollo de las habilidades de escritura en estudiantes de inglés como lengua extranjera

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Abstract

The teaching of English as a Foreign Language (EFL) has increasingly incorporated artificial intelligence (AI), leading to significant transformations in writing instruction. This research analyzes the impact of AI-driven automated feedback on the development of writing skills in EFL learners, with particular attention to the types of technologies employed. Methodologically, a

mixed-methods systematic review was conducted following the PRISMA protocol, examining studies published between 2020 and 2025. The findings reveal that automated feedback tools can be broadly classified into two categories: traditional Natural Language Processing (NLP)-based systems (e.g., Grammarly, Criterion, Pigai), which focus primarily on grammatical accuracy, error detection, and surface-level textual features; and Large Language Models (LLMs) (e.g., ChatGPT), which generate more holistic feedback related to coherence, organization, and content development. Both categories demonstrate positive effects on writing accuracy and revision practices, largely due to the immediacy and personalization of feedback. However, the review also identifies challenges associated with technological dependence, uneven feedback depth, and ethical concerns when feedback is used without pedagogical mediation. The study concludes that AI-based automated feedback constitutes an innovative pedagogical resource for EFL writing development, provided it is integrated within structured instructional frameworks and complemented by active teacher mediation.

Keywords: artificial intelligence, automated feedback, academic writing, foreign language, EFL

Introduction

Globalization and English proficiency are essential for communication today, and can even be considered a path to academic and professional opportunities. In this context, automated feedback through artificial intelligence emerges as a strategic platform for improving academic writing skills in English as a Foreign Language (EFL) instruction. In this sense, developing proficiency in writing in English as a foreign language (EFL) is a challenge in training processes; this involves not only mastering foreign grammatical structures and vocabulary, but also constructing coherent and cohesive texts in academic and professional contexts.

It is important to note that since the emergence of artificial intelligence (AI), it has generated, among other aspects, the possibility of benefits regarding automated feedback in the teaching-learning process for students, transforming traditional pedagogical practices.

According to Liu (2024), automated feedback provides suggested responses generated by computerized systems in real time to improve written production. Furthermore, it is noted that artificial intelligence encompasses the set of technologies capable of simulating human cognitive processes, such as knowledge acquisition and decision-making (Lee & Moore, 2024). However, this is compounded by the limitations that arise in English language studies in foreign language contexts. In this sense, learning English in countries where it is neither an official language nor in everyday use presents barriers to real-world exposure (Sarıca & Deneme, 2025). Therefore, it would seem that academic writing in EFL is in a stage of pedagogical transition, in which its integration with artificial intelligence does not replace traditional teaching; on the contrary, it complements it, thus providing opportunities for students to strengthen their autonomy and achieve international standards in written production.

Despite the above, there are other conflicting opinions regarding the effectiveness of these tools. Authors such as Mekheimer (2025) and Alnemrat (2025) highlight the positive results in text quality, while others, such as Steiss (2024), warn that AI-generated feedback can be superficial or ambiguous. Therefore, the need to combine the potential of AI with pedagogical mediation is recognized. Currently, some research related to automated feedback systems, such as Grammarly, Criterion, and ChatGPT, has confirmed that these systems contribute to improving the accuracy and coherence of texts in EFL learners. In particular, Dizon (2024) and Shi and Aryadoust (2024) assert that these tools generate benefits by providing immediate and personalized feedback, although the quality of the suggestions depends on the learner's level of language proficiency.

Similarly, in the research of Fleckenstein et al. (2023), these confirm the positive effects on text revision, of course with the support of the teacher.

Similarly, in Latin America, studies have focused on understanding the influence of AI on language instruction. In this regard, research by Nunes et al. (2022) and Marzuki et al. (2023) has determined that the implementation of automated platforms leads to greater autonomy, although they highlight limitations related to technological access and the lack of educational policies that promote its use. Furthermore, recent research in Ecuador explores the benefits of automated feedback in university settings, identifying advantages in correcting recurring errors and in student motivation (Jaramillo, 2025).

From a social perspective, this research responds to the growing demand for communicative competence in English as a foundation for global academic and professional integration. From a practical standpoint, it offers teachers and students innovative strategies to optimize writing instruction. Methodologically, this research adopts a systematic review approach based on the PRISMA protocol, ensuring rigor and transparency. Academically, it provides recent evidence on the effectiveness of automated feedback in the Latin American and Ecuadorian context.

In this context, the purpose of this article is to analyze the impact of automated feedback using artificial intelligence on the development of writing skills in students of English as a foreign language.

One of the most enduring problems in language instruction is the development of writing proficiency in English as a Foreign Language (EFL), especially in situations where English is not a common language of communication. In addition to grammatical and lexical correctness, academic writing demands the capacity to create arguments, arrange ideas logically, and adhere to global standards for academic communication. Written feedback is essential in this approach because it helps students improve their writing and fosters their progressive growth as independent authors.

However, time constraints, big class sizes, and teachers' overwhelming workloads frequently limit the ability to provide fast and customized feedback through traditional teacher-provided methods. Artificial intelligence (AI) advancements have reshaped pedagogical approaches in EFL writing education by creating automated feedback systems that can instantly and individually respond to students' written work in response to these problems.

The necessity to thoroughly and critically investigate the real effects of AI-driven automated feedback on the growth of academic writing abilities in EFL learners makes this study pertinent. Recent studies show gains in literary coherence, grammatical accuracy, and student motivation, but they also raise issues with technology dependence, the sporadic shallowness of automated recommendations, and the need for pedagogical mediation. Therefore, it is crucial to synthesize the most recent scientific findings in order to comprehend not only the advantages but also the constraints and situational circumstances that can make automated feedback a useful teaching tool. By organizing contemporary research published between 2020 and 2025 and employing the PRISMA methodology to guarantee methodological rigor and openness in the selection and analysis of studies, this study advances the field of EFL teaching and learning from an academic standpoint. By doing this, it highlights current discussions, gaps, and trends surrounding the application of AI to written feedback, especially in EFL contexts.

Practically speaking, the results give teachers, teacher educators, and curriculum designers important information by offering evidence-based recommendations on how to include automated feedback systems as an addition to, rather than a substitute for, teacher input. This method preserves the growth of critical and metacognitive writing abilities while promoting informed pedagogical decision-making that increases learner autonomy.

Lastly, from a social and educational standpoint, this study is particularly pertinent in Ecuadorian and Latin American contexts, where issues with technology access and English language training continue to exist. Analyzing how AI-based automated feedback affects academic writing helps create more inclusive educational policies and creative teaching methods that enhance educational quality and facilitate students' academic and professional integration in a world growing more interconnected by the day.

1.1 Artificial Intelligence, Feedback, and Writing Development from an Information Processing and Self-Regulated Learning Perspective

Both the Self-Regulated Learning (SRL) framework and information processing theory provide theoretical justification for the efficacy of AI-driven automated feedback in EFL writing teaching. Learning is defined as the active encoding, storing, and retrieval of information through cognitive systems with constrained processing power from the standpoint of information processing. Because it lessens cognitive strain and stops the consolidation of faulty language forms, immediate feedback is essential to this process. AI-based feedback enables learners to make real-time linguistic adjustments by giving prompt answers during the writing process, which promotes more effective encoding of lexical and grammatical knowledge (Atkinson & Shiffrin, 1968; Mayer, 2020).

Additionally, a supplementary explanation for the noted advantages of automated feedback is provided by the Self-Regulated Learning framework. This viewpoint holds that the capacity of students to organize, track, and assess their own performance is a necessary component of effective learning (Liu, 2024; Shi & Aryadoust, 2024). With AI-driven feedback, students can autonomously see mistakes, edit texts, and gauge their progress without continual teacher assistance, supporting the monitoring and evaluation stages. Learner autonomy and continued involvement in the writing process are fostered by the accessibility and immediateness of AI feedback, which promotes iterative revision cycles.

Both theoretical frameworks stress, therefore, that meaningful learning is not ensured by feedback alone. Immediate feedback may result in superficial adjustment rather than in-depth cognitive processing if reflective engagement is not maintained. In order to ensure that learners actively evaluate and use input rather than passively accepting automated suggestions, AI-based feedback must be incorporated into instructional designs that foster metacognitive awareness (Zimmerman, 2002; Panadero, 2017).

Materials and methods

With the aim of providing relevant evidence in the field of language teaching, this research was structured as a systematic review, which facilitates the analysis and comparison of contributions from different studies related to academic writing in English as a foreign language. Therefore, this study adopted a mixed-methods approach, combining qualitative and quantitative systematic review, based on the PRISMA protocol. This protocol combines interpretive analysis of findings

(qualitative) with the use of synthesis techniques and numerical categorization of studies (quantitative), allowing for a deeper understanding of the phenomena under investigation, as well as the identification of patterns, trends, and gaps in the literature. As a result, it allows for the organization and transparency of the process of searching, selecting, and analyzing the literature (Page et al., 2021; Moher et al., 2020). Snyder (2022) indicates that systematic review guarantees academic rigor by synthesizing the available evidence around a research problem; on the other hand, Kitchenham and Charters (2021) point out that this approach is ideal for identifying trends and gaps in emerging areas such as AI-driven automated feedback.

This investigation was carried out in accordance with the PRISMA protocol and used a mixed-methods systematic review methodology, integrating qualitative and quantitative synthesis. Database searching, screening according to inclusion and exclusion criteria, and narrative-comparative synthesis of the chosen papers were the three steps in the review process.

250 records from Scopus, Web of Science, ERIC, Scielo, and Redalyc were found in the first search. 60 articles were examined in full text after duplicates were eliminated and relevance and quality standards were applied. A final sample of 25 peer-reviewed studies (n = 25) published between 2020 and 2025 was included in the study after this screening procedure. The findings' legitimacy and dependability are increased by this clear specification of the final corpus, which also guarantees scientific transparency.

Consequently, a descriptive-analytical study was developed with an exploratory scope, as it investigated and identified the contributions, limitations, and perspectives of automated feedback in English as a foreign language instruction. In this sense, this design was pertinent because it allowed for the comparison of international, regional, and national evidence under previously established criteria (Creswell & Creswell, 2021).

Therefore, the analysis was developed in three phases: (1) a search based on specific expressions in English and Spanish—including terms such as artificial intelligence , automated feedback, EFL writing , and automated feedback (Table 1)—to ensure a broad and relevant retrieval of published articles, as well as indexed metadata (Scopus, Web of Science, ERIC, Scielo, and Redalyc); (2) the provision of inclusion and exclusion criteria; and (3) a narrative and comparative synthesis of the selected studies, all to guarantee reliability. Additionally, source triangulation and cross-validation techniques were employed (Gough et al., 2021; Booth et al., 2021). Another aspect of

the applied method is the population, which consisted of academic articles published between 2020 and 2025 that address AI-powered automated feedback in English language teaching.

Table 1.

Search strings used

Database	Search string
Scopus	("Artificial Intelligence" OR "AI") AND ("Automated Feedback" OR "Automated Writing Evaluation") AND ("EFL" OR "English as a Foreign Language") AND (2020–2025)
Web of Science	("AI feedback" AND "EFL writing" AND "academic writing" AND "2020–2025")
ERIC	("Automated feedback" OR "AI writing tools") AND ("foreign language learning" OR "English writing")
Scielo / Redalyc	("automated feedback" AND "artificial intelligence" AND "academic writing" AND "2020–2025")

Source: Own elaboration

Similarly, reference is made to the PRISMA diagram, which reflects the screening process. Of the initial 250 articles, only 25 met the established inclusion criteria (year, language, thematic relevance, and methodological rigor), Figure 1. The selection of studies using the Inclusion and Exclusion Criteria is also shown in Table 2, in the search and organization of the databases, ensuring the relevance, currency, and scientific validity of the selected studies, Table 3.

Fig. 1. *PRISMA diagram of the selection process*

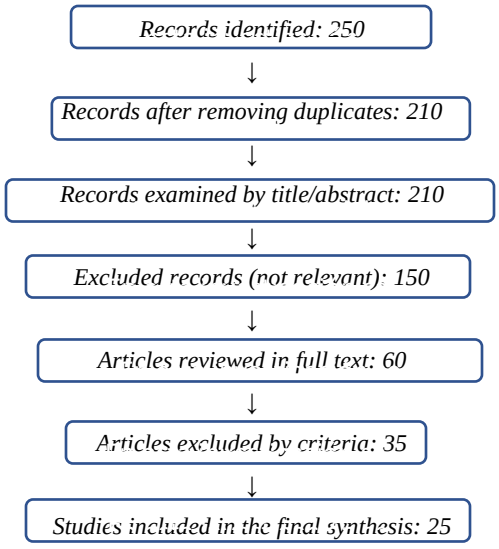

Table 2.

Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Articles between 2020 and 2025	Publications before 2020
Studies on AI and written feedback	Documents on AI in other skills (reading, speaking, listening)
EFL/ESL Context	Exclusively native context
Full access to the text	Abstracts or papers without full text
Systematic reviews and empirical studies	Opinions, blogs, or essays without scientific backing

Source: Own elaboration

Table 3.

Summary of selected articles

Author (year)	Country	AI tool / approach	Main results
Alnemrat (2025)	Jordan	ChatGPT	Automated feedback improved coherence and organization in EFL argumentative essays.
Asadi et al. (2025)	Iran	ChatGPT + teacher feedback	The AI-teacher combination increased grammatical accuracy and reduced recurring errors.
Baz (2025)	Saudi Arabia	Various AI tools	Automated feedback generated improvements in informative texts, although with limitations in style.
Dizon (2024)	Japan	Grammarly	AWE reduced grammatical errors, but students relied too heavily on the proofreader.
Ding and Zou (2024)	China	Systematic review (Grammarly, Pigai , Criterion)	Positive evidence in writing accuracy, but longitudinal research is lacking.
Engeness (2025)	Norway	Theoretical perspective on AI	Automated feedback is understood as a cultural tool, but it can limit metacognition.
Fleckenstein et al. (2023)	Germany	Meta-analysis	AWE systems show moderate positive effects on writing quality.
He (2024)	China	Pigai	Frequent use motivated students to write more, albeit with technological dependence.
Jaramillo (2025)	Ecuador	Grammarly	The frequency of spelling and grammar errors among university students decreased.
Lee and Moore (2024)	USA	Systematic review	ChatGPT offers fast feedback, but requires teacher validation to avoid superficial responses.
Liu (2024)	China	Pigai	Immediate feedback strengthened autonomy and self-publishing in EFL students.

Mahapatra (2024)	India	ChatGPT	Students perceived greater motivation and confidence in their academic writing.
Mekheimer (2025)	Egypt	ChatGPT	AI feedback increased the frequency of revisions and improved text quality.
Marzuki et al. (2023)	Indonesia	AI (Grammarly, Quillbot)	Improvements in text structure, although with unequal technological access.
Nunes et al. (2022)	Brazil	Criterion	Advances in narrative writing among schoolchildren; positive evidence in EFL contexts.
Sarica and Deneme Gençoğlu (2025)	Türkiye	Hybrid review on AI	Students value the immediacy of the feedback, but doubt its reliability.
Sadigzade (2025)	Azerbaijan	ChatGPT	Pedagogical opportunities, although it raises ethical concerns in EFL writing.
Setiawan (2025)	Indonesia	Grammarly, Quillbot , Ginger	Useful tools for vocabulary and grammar, but limited in style and creativity.
Shi and Aryadoust (2024)	Singapore	Systematic review	AI feedback shows a positive impact on text accuracy and length.
Steiss (2024)	Germany	Human vs AI comparison	Human feedback is still more in-depth; AI is useful in initial feedback.
Wilson and Roscoe (2020)	USA	Automatic evaluation	AWE is effective in linguistic accuracy, but has criticisms regarding contextualization.
Woo et al. (2023)	South Korea	ChatGPT	Students experienced contradictions: trust in AI, but a need for teacher guidance.
Ya et al. (2025)	China	Review of LLMs	They identify the ethical benefits and risks of using language models in education.
Yan et al. (2025)	China	AIAS Framework	AI applied to English teaching improves formative feedback, still under experimental development.
Zhang et al. (2025)	China	ChatGPT	Controlled trial showed improvements in critical writing with AI support.

Source: Own elaboration

Results and discussion

Two main categories clearly dominate the sorts of artificial intelligence technologies that were studied in the chosen studies, according to the findings. First, the most often examined systems are the conventional automated writing evaluation tools based on Natural Language Processing (NLP), such as Grammarly, Criterion, Pigai, QuillBot, and Ginger. This is especially true of research done before 2023. These methods mainly concentrate on surface-level textual aspects, lexical choice, and grammatical accuracy.

Second, more recent research demonstrates an increasing focus on Large Language Models (LLMs), particularly ChatGPT, which are intended to produce context-aware feedback concerning coherence, organization, and content development in addition to linguistic accuracy. A move away from rule-based feedback systems and toward generative models that can generate comprehensive

and flexible responses to student writing is reflected in the growing number of LLMs in the literature.

According to comparative analysis, LLM-based systems dominate qualitatively in terms of research interest and pedagogical discussion, but NLP-based tools dominate statistically across the literature. LLMs are more commonly linked to higher-order writing processes like idea formation and argumentation coherence, whereas NLP tools are regularly linked to gains in grammatical precision and error reduction. However, research also indicates that LLMs raise more pedagogical and ethical issues, such as the possibility of over-reliance and accidental plagiarism, which emphasizes the necessity of planned instructional mediation.

Consolidated evidence about the effect of AI-driven automated feedback on the development of writing abilities in English as a Foreign Language (EFL) is provided by the analysis of the 25-research chosen using the PRISMA protocol. Based on the linguistic focus of the feedback, learner engagement, the presence of pedagogical mediation, and the contextual conditions in which these technologies are implemented, the results show that automated feedback's effectiveness is multifaceted rather than uniform.

A dominant pattern across the reviewed studies is the positive effect of automated feedback on linguistic accuracy, particularly in grammar, spelling, and sentence-level structure. Studies carried out in Ecuador (Jaramillo, 2025), China (Liu, 2024), Brazil (Nunes et al., 2022), and Japan (Dizon, 2024) consistently show that students' writing has improved in formal accuracy and decreased in recurrent errors. The promptness and regularity of feedback, which enable students to spot and fix mistakes during iterative revision processes, are directly related to these gains. This implies that surface-level language growth, a fundamental aspect of EFL academic writing, is particularly well-supported by automated feedback.

Numerous research demostrate enhancements in textual coherence and organization beyond grammatical accuracy, especially when generative AI tools like ChatGPT are used (Alnemrat, 2025; Mekheimer, 2025). According to these studies, learners can benefit from automated feedback by using it to better organize arguments and construct paragraphs. This conclusion, though, is not always true. While automated systems offer helpful recommendations at the lexical and syntactic levels, other research (Baz, 2025; Setiawan, 2025) notes that they are limited in their ability to handle discourse-level characteristics including academic voice, stylistic nuance, and rhetorical appropriateness. This discrepancy suggests that when writing demands shift from micro-

linguistic precision to higher-order cognitive and rhetorical skills, the influence of automated feedback diminishes.

Learner autonomy and revision behavior are the subject of another noteworthy finding. According to a number of studies (Liu, 2024; Mekheimer, 2025; Mahapatra, 2024), students are more inclined to make autonomous, repetitive revisions to their writings when automated feedback is used. Constant feedback seems to encourage self-regulation and learner accountability by moving writing practices toward a more process-oriented approach. In this way, by allowing students to actively interact with their own writings, automated feedback serves as a stimulant for independent learning.

However, there are significant risks associated with this autonomy. Engeness (2025) and Steiss (2024) caution that if students accept ideas without critically analyzing them, an over-reliance on automated feedback may result in shallow editing practices. This conflict highlights a paradox found in the literature review: automated feedback raises the number of revisions but does not always ensure greater metacognitive participation. Therefore, rather than simply applying feedback mechanically, students must be able to analyze, assess, and justify it in order to build critical writing skills.

The results show that students generally have a positive perception of automated feedback in terms of motivation and affective variables. According to research from South Korea, India, and Turkey (Mahapatra, 2024; Sarıca & Deneme Gençoğlu, 2025; Woo et al., 2023), students appreciate AI-generated feedback's instantaneity, accessibility, and lack of judgment. Particularly for EFL learners who frequently feel nervous when composing academic texts, these traits help to lessen writing anxiety and boost confidence. Students do, however, also voice concerns about the accuracy and comprehensiveness of automated feedback, underscoring the necessity for instruction in evaluating recommendations produced by AI.

The crucial function that teacher mediation plays is among the most important conclusions to come out of this analysis. When human supervision is added to automated systems, studies comparing automated feedback alone with combined AI–teacher feedback models (Asadi et al., 2025; Fleckenstein et al., 2023) consistently show better learning outcomes. In these hybrid approaches, teachers concentrate on higher-order skills like argumentation quality, coherence, and critical thinking, while AI tools mainly assist with initial error identification and revision. This

demonstrates that rather than taking the place of instructor competence, automated feedback should be viewed as an additional instructional tool.

Lastly, regional and contextual factors have a big impact on how effective automated feedback is. The degree to which AI tools can be successfully incorporated into EFL instruction is influenced by institutional infrastructure, teacher training conditions, and technological access, according to research done in Latin American and developing contexts (Nunes et al., 2022; Marzuki et al., 2023; Jaramillo, 2025). The benefits of automated feedback are not uniform in settings with poor connectivity or inadequate pedagogical support, which supports the notion that pedagogical development is not guaranteed by technology innovation alone.

Overall, this systematic review's findings show that AI-powered automated feedback improves EFL writing growth in quantifiable ways, especially in terms of grammatical accuracy, revision techniques, and learner motivation. However, contextual preparedness, teacher mediation, and critical integration are necessary for its pedagogical efficacy. In order to promote both linguistic correctness and higher-order writing skills, automated feedback should be viewed as a component of a well-rounded teaching strategy that incorporates both human direction and technological assistance.

Teacher mediation is crucial in minimizing the misuse of AI-based feedback, especially when it comes to accidental plagiarism and mechanical text substitution, according to a key result from the analyzed studies. Students may rely too much on automated recommendations in the absence of clear instructional guidance, utilizing AI-generated language without critically analyzing the material or comprehending the underlying linguistic principles.

Thus, three crucial areas should be the focus of effective teacher mediation. Instructors must first clearly explain the limitations and goal of AI feedback, emphasizing that these technologies are meant to assist with editing rather than produce original content. Second, educators should provide writing assignments that challenge students to defend changes, consider their feedback selections, or turn in annotated versions that detail how they understood and used the automated ideas. This approach discourages passive acceptance of AI outcomes and encourages metacognitive interaction. Third, by incorporating conversations about ethical AI use, authorship, and originality into writing training, instructors may highlight academic integrity.

Teacher mediation guarantees that automated systems improve learning without taking the place of cognitive effort by presenting AI feedback as a formative support tool within a guided

instructional procedure. By doing this, educational intervention protects against the dangers of reliance and accidental plagiarism while simultaneously optimizing the advantages of immediacy and personalization.

Conclusions

The results of this systematic review show that automated feedback powered by artificial intelligence (AI) improves writing abilities in English as a Foreign Language (EFL) in a positive and quantifiable way. This is especially true when considering the kinds of AI technologies that are most commonly discussed in the literature. Traditional Natural Language Processing (NLP)-based tools, like Grammarly, Criterion, Pigai, QuillBot, and Ginger, clearly outnumber the examined research. These tools are regularly linked to gains in spelling, grammar, and sentence-level correctness. Because of their accessibility and emphasis on surface-level linguistic traits, these tools continue to be the most extensively used systems in a variety of educational contexts.

The ability of Large Language Models (LLMs), in particular ChatGPT, to produce comprehensive, context-aware feedback that addresses coherence, organization, and content growth, on the other hand, is the focus of more recent research. The results suggests that the instructional effectiveness of LLM-based tools is more variable and context-dependent, despite their encouraging potential to enhance higher-order writing processes. According to studies, when used without clear instructional supervision, LLMs pose more issues about overreliance, decreased critical engagement, and the possibility of inadvertent plagiarism than typical NLP tools.

Overall, the findings from the literature study show that the kind of technology used has a significant impact on how successful AI-based feedback is. While LLMs give more pedagogical options but necessitate more formal integration, NLP-based automated writing evaluation techniques consistently and reliably improve linguistic accuracy. In order to guarantee that automated feedback promotes meaningful learning as opposed to mechanical text correction or substitution, instructor mediation stands out as a critical component in both categories.

These results imply that AI-driven feedback should be viewed as a differentiated educational resource rather than a one-size-fits-all solution from a pedagogical standpoint. To ensure that students interact critically with feedback and uphold authorship and academic integrity, educators are urged to strategically integrate LLM-based systems for content and organization support with NLP-based tools for accuracy-focused feedback. Longitudinal impacts, comparative instructional

approaches, and ethical frameworks guiding the use of generative AI in EFL writing teaching should all be further explored in future studies.

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