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AI-GENERATED PERSONALIZED FEEDBACK IN EFL WRITING: EFFECTS ON REVISION QUALITY AND LEARNER ENGAGEMENT

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ABSTRACT

The integration of artificial intelligence (AI) into language education has created new opportunities to provide timely, individualized feedback in second-language writing instruction. This study investigates the impact of AI-generated personalized feedback on EFL students' writing development, revision behavior, and learner Engagement. Using a mixed-method quasi-experimental design, the study involved 120 undergraduate EFL students divided into an experimental group receiving AI-generated feedback and a control group receiving conventional teacher feedback. Data were collected through pre-test and post-test writing tasks, revision analysis, Engagement questionnaires, and semi-structured interviews. Quantitative analysis showed that students who received AI-generated feedback demonstrated greater improvement in writing performance, particularly in grammar accuracy and text organization. Students in the AI feedback group also performed more frequent and deeper revisions, including meaning-level revisions such as paragraph restructuring and argument development. Higher levels of cognitive Engagement and revision effort were also observed among students interacting with AI-generated feedback. Qualitative evidence further indicated that students perceived AI feedback as clear, immediate, and supportive for independent revision. These patterns indicate that AI-generated personalized feedback can serve as a pedagogical scaffold, encouraging reflective revision practices and greater learner Engagement in EFL writing classrooms. The study highlights the potential of AI-assisted feedback as a complementary tool that enhances both the process and outcomes of second language writing development.

Keyword: Artificial intelligence in language learning; AI-generated feedback; EFL writing development; learner Engagement.

I. INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly transformed educational practices, particularly within technology-enhanced language learning. In recent years, AI-driven systems have been increasingly integrated into second-language instruction to support learning processes, such as assessment, feedback, and learner interaction. In the field of second language writing, AI-assisted tools have attracted considerable attention for their ability to

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deliver immediate, individualized feedback during the writing process (X. Chen et al., 2022; Godwin-Jones, 2022; Zhai, 2022). The development of generative AI technologies has further expanded these possibilities by enabling automated systems to produce context-sensitive feedback that goes beyond simple error detection. Such systems can analyze learners' texts and provide suggestions on grammar, vocabulary, coherence, and argument development, thereby supporting more dynamic and iterative writing instruction (Dizon et al., 2025; Kohnke et al., 2023; Moorhouse & Kohnke, 2024).

Within second language writing pedagogy, feedback is widely recognized as a crucial factor in improving writing proficiency. Effective feedback allows learners to identify weaknesses in their texts and revise them to enhance both linguistic accuracy and rhetorical clarity. Traditionally, teacher feedback has played a central role in writing instruction; however, it often faces practical limitations such as delayed responses, heavy instructional workload, and restricted opportunities for iterative revision (Sato, 2024; Zhang & Hyland, 2025). In response to these limitations, researchers have increasingly explored technology-mediated feedback systems that enable learners to receive faster responses to their writing. Recent studies indicate that automated feedback tools can support writing accuracy and learner autonomy by encouraging students to revise their texts more frequently (H.-H. Feng & Chukharev-Hudilainen, 2022; Geng & Razali, 2022; Rong et al., 2025; Sun & Sun, 2025). Furthermore, AI-based writing technologies have been shown to foster more interactive learning environments in which learners actively engage with feedback during the revision process (Ma & Chen, 2025; Zou et al., 2025).

Despite the growing interest in AI-assisted writing feedback, important gaps remain in the literature. Much of the existing research on automated writing evaluation has focused primarily on surface-level linguistic corrections, particularly grammar and vocabulary errors. While these studies demonstrate the effectiveness of AI systems in identifying linguistic inaccuracies, fewer studies have examined how AI-generated feedback influences deeper dimensions of writing development, including text organization, argument development, and revision behavior (Yan & Zhang, 2024; Zhang & Hyland, 2023). Moreover, although previous research suggests that technology-mediated feedback may enhance learner Engagement, the mechanisms by which AI feedback influences cognitive engagement and revision effort remain underexplored (Bond et al., 2021; Halverson et al., 2023). This limitation is significant because Engagement determines whether learners actively interpret and apply feedback during the revision process.

Another unresolved issue concerns the pedagogical integration of generative AI in EFL writing classrooms. While recent studies highlight the potential of generative AI tools in language learning, much of this research remains exploratory and focuses

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mainly on learners' perceptions rather than measurable learning outcomes (Kohnke et al., 2023; Moorhouse & Kohnke, 2024). As a result, empirical evidence explaining how AI-generated personalized feedback influences both writing development and revision practices remains limited, particularly within authentic classroom contexts where learners interact with feedback during iterative revision cycles.

Writing development depends not only on the accuracy of feedback but also on how learners engage with that feedback during the revision process. Feedback can serve as pedagogical scaffolding, supporting reflective learning and encouraging deeper revision practices rather than merely correcting surface-level linguistic errors. Understanding how learners interact with AI-generated feedback is therefore essential for determining whether such technologies operate simply as automated correction tools or as instructional resources that facilitate iterative writing development. This study examines the role of AI-generated personalized feedback in EFL writing classrooms by investigating its influence on writing development, revision behavior, and learner Engagement through three research questions.

1. How does AI-generated personalized feedback influence EFL students' writing development?
2. How does AI-generated feedback affect students' revision behavior during the writing process?
3. How does AI-generated feedback influence learner Engagement in EFL writing classrooms?

By addressing these questions, the study aims to provide a deeper understanding of how AI feedback can support writing development and learner Engagement in technology-enhanced language learning environments.

Table 1 – Text related to the table (inside table Times New Roman 11)

A. Figures

Graphics should be preferably black and white or in grey scale. Only photographs are allowed in colour. Avoid effects such as shading, outline letters, and so forth.

All figures are to be numbered using Arabic numerals. Figures should always be cited in text in consecutive numerical order, e.g. Fig. 1.

Keep lettering consistently sized throughout final-sized artwork, usually about 2–3 mm (8–12 pt).

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Figure 1 – Text related to the figure

II. REVIEW OF LITERATURE CAN BE MERGED INTO INTRODUCTION

subheading

III. METHOD

Research Design

This study employed a mixed-methods quasi-experimental design to examine the impact of AI-generated personalized feedback on revision quality and learner Engagement in EFL writing classrooms. This methodological approach was selected because the effectiveness of technology-enhanced feedback cannot be fully understood through quantitative measurement alone. While statistical analysis can identify improvements in writing performance, it often fails to explain how learners interpret and utilize feedback during the revision process. Integrating quantitative and qualitative data, therefore, enables a more comprehensive examination of how technological feedback influences both learning outcomes and learning processes (Clark & Creswell, 2017). The quasi-experimental design was adopted due to the practical limitations of random participant assignment in classroom-based research, a common constraint in applied linguistics studies (Dornyei, 2006). In this study, students receiving AI-generated feedback were compared with those receiving conventional teacher feedback to evaluate whether AI-supported feedback could produce more meaningful improvements in revision practices and Engagement. Previous research has shown that automated feedback systems can improve surface-level linguistic accuracy; however, their influence on deeper revision processes and learner Engagement remains insufficiently explored (Stevansion & Prakiti, 2019). By combining statistical comparison with qualitative insights from student reflections and interviews, this design allows the study to critically examine not only whether AI feedback improves writing outcomes but also how it reshapes learners' revision behavior and Engagement in the writing process.

Participants

Participants were 120 undergraduate students enrolled in an academic writing course in an English Education program at a university in Southeast Asia. All

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participants were EFL learners who had completed at least two semesters of academic English instruction, indicating basic writing competence but continued difficulty in organizing arguments, developing ideas, and revising texts. Participants were assigned to two intact classes within a quasi-experimental design due to administrative constraints. One group received AI-generated personalized feedback, while the other received conventional teacher feedback. A pre-test confirmed that both groups had comparable initial writing proficiency, allowing the study to examine the pedagogical effects of AI feedback on revision practices and learner Engagement.

Table 1. Participant Distribution.

Group	Number of Students	Academic Level	Mean Age	English Proficiency
AI Feedback Group	60	Undergraduate Semester 3–4	20.4	Intermediate
Teacher Feedback Group	60	Undergraduate Semester 3–4	20.1	Intermediate
Total	120	Undergraduate	20.3	Intermediate

Research Instruments

This study employed multiple research instruments to collect both quantitative and qualitative data to critically examine the impact of AI-generated personalized feedback on revision quality and learner Engagement in EFL writing. The use of multiple instruments was intended to strengthen the validity of the findings through data triangulation, particularly important in technology-mediated language learning research, where learning outcomes are shaped by complex interactions among learners, tools, and instructional contexts (Clark & Creswell, 2017). Writing tests were administered before and after the intervention to measure changes in students' writing performance, with argumentative essays evaluated by two independent raters using an academic writing rubric to ensure inter-rater reliability (Hyland, 2021). To capture how feedback influenced the revision process rather than merely the final writing product, a revision quality rubric was used to analyze changes between initial and revised drafts across linguistic, structural, and argumentative dimensions (Ferris, 2010). Learner engagement was measured through a Likert-scale questionnaire assessing cognitive, behavioral, and emotional Engagement during the revision process (Fredricks et al., 2004). In addition, semi-structured interviews were conducted with selected participants to explore how students interpreted and utilized AI-generated feedback in their revision strategies, an approach commonly used to reveal learners' experiences with technology-enhanced language learning

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environments (Reinders & Hubbard, 2013). By integrating evidence from these instruments, the study aimed not only to measure improvements in writing outcomes but also to critically explain the learning processes through which AI-supported feedback shapes students' revision behavior and Engagement.

Procedure

The procedure examined how AI-generated personalized feedback influenced students' revision practices and Engagement in EFL writing. The study began with a pre-test writing task to establish baseline proficiency and ensure comparability between the experimental and control groups. Students then produced an argumentative essay as their initial draft. The experimental group received AI-generated feedback addressing grammar, vocabulary, coherence, and argument development, while the control group received conventional teacher feedback. Students subsequently revised their essays based on the feedback provided, allowing analysis of revision quality. Finally, a post-test writing task was administered to evaluate changes in writing performance and determine the impact of AI-supported feedback on revision practices and Engagement.

Data Analysis

Data analysis integrated quantitative statistical procedures and qualitative interpretation to evaluate the effects of AI-generated personalized feedback on students' writing development and Engagement. Quantitative analysis used paired-sample t-tests to examine pre–post improvements within groups and independent-sample t-tests to compare gains between the experimental and control groups. Analysis of variance (ANOVA) was applied to assess differences across writing dimensions, including grammatical accuracy, lexical choice, coherence, and argument structure. Regression analysis explored the relationship between learner Engagement and revision quality. Qualitative data from semi-structured interviews and reflective responses were analyzed using thematic analysis to understand how students interpreted and applied AI-generated feedback during the revision process.

IV. RESULTS AND DISCUSSION

RESULT

Writing Performance Improvement (Pre–Post Analysis)

The analysis examined whether AI-generated personalized feedback improved students' writing performance. Pre-test scores showed that the experimental and

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control groups had comparable writing proficiency, confirming baseline equivalence within the quasi-experimental design. After the intervention, students who received AI-generated feedback demonstrated greater improvement than those who received conventional teacher feedback. The AI feedback group increased from a mean score of 68.4 in the pre-test to 82.3 in the post-test, representing a gain of 13.9 points, while the teacher feedback group improved from 69.1 to 74.6, with a gain of 5.5 points. This pattern suggests that AI feedback provides more targeted guidance that supports more systematic writing revisions.

Table 2. Writing Performance Results

Group	N	Pre-test Mean	Post-test Mean	Mean Gain	SD	t-value	p-value
AI Feedback Group	60	68.4	82.3	13.9	5.42	11.27	< .001
Teacher Feedback Group	60	69.1	74.6	5.5	4.96	6.18	< .001

The results suggest that integrating AI-generated personalized feedback may significantly enhance students' writing development in EFL contexts.

Writing Dimension Improvement

Beyond overall writing scores, the analysis also examined improvements across several key dimensions of writing quality, including grammar accuracy, vocabulary use, text organization, and coherence, to provide a more detailed understanding of how AI-generated feedback influences writing development. Students who received AI-generated, personalized feedback achieved higher scores across all dimensions than those who received teacher feedback, with the most notable improvements in text organization and coherence. This pattern suggests that AI-generated feedback supports higher-level revision processes rather than merely correcting surface-level linguistic errors. In contrast, improvements in the teacher feedback group were more limited, largely focused on grammatical accuracy and vocabulary use. These patterns indicate that AI-generated feedback can serve as a pedagogical scaffold, encouraging students to reconsider the structure and clarity of their ideas as they revise their texts and promoting deeper Engagement with the revision process.

Table 3. Improvement in Writing Dimensions (Post-test)

Writing Dimension	AI Feedback Mean	SD	Teacher Feedback Mean	SD
Grammar Accuracy	4.25	0.48	3.52	0.54
Vocabulary Use	4.18	0.51	3.46	0.57
Text Organization	4.30	0.45	3.61	0.50

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Coherence	4.21	0.49	3.40	0.56

Scale based on a 1–5 writing assessment rubric.

Overall, the results demonstrate that AI-generated personalized feedback not only improves overall writing performance but also contributes to the development of structural and rhetorical aspects of academic writing. This finding highlights the potential of AI-supported feedback to enhance revision practices and promote more meaningful writing development in EFL learning contexts.

Revision Behaviour Analysis (Surface vs Meaning-Level Revision)

The analysis also examined students' revision behavior to understand how AI-generated personalized feedback influenced the revision process. Revision behavior reflects the cognitive processes involved in improving written texts and was categorized into surface-level revisions, such as correcting grammatical or lexical errors, and meaning-level revisions, including reorganizing ideas, expanding arguments, and restructuring paragraphs. Students who received AI-generated feedback performed more revisions overall and demonstrated a stronger tendency toward meaning-level revisions that improved coherence and clarity. In contrast, students who received teacher feedback made fewer revisions and focused mainly on surface-level corrections. This pattern indicates that AI-generated feedback encourages deeper Engagement with revision by guiding learners to reconsider both linguistic accuracy and the organization of ideas.

Table 4. Frequency of Revision Types.

Revision Type	AI Feedback Group	Teacher Feedback Group
Grammar Corrections	185	142
Vocabulary Changes	126	97
Sentence Restructuring	104	63
Paragraph Reorganization	82	41
Argument Development	76	33
Content Expansion	69	28

The results show that while both groups made revisions during the writing process, the AI feedback group made substantially more meaning-level revisions, particularly in paragraph organization and argument development. This finding indicates that AI-generated personalized feedback may support deeper cognitive Engagement with writing tasks, encouraging students to refine not only the linguistic form of their texts but also the clarity and strength of their ideas. Such patterns highlight the potential pedagogical value of AI-assisted feedback in fostering more reflective, substantive revision practices in EFL writing classrooms.

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Learner Engagement Analysis (Behavioral, Cognitive, and Emotional Engagement)

The analysis also examined learner Engagement during the revision process across three dimensions: behavioral, cognitive, and emotional Engagement. Students who received AI-generated, personalized feedback demonstrated higher engagement across all dimensions than those who received conventional teacher feedback. Behavioral Engagement was evident in more active participation in revision activities, including reviewing feedback, editing drafts, and conducting multiple rounds of revision. Cognitive Engagement emerged as the most prominent dimension, indicating that AI feedback encouraged students to invest greater effort in interpreting feedback and evaluating the clarity and structure of their arguments. Emotional Engagement was also higher in the AI group, as students reported increased motivation and confidence during revision.

Table 5. Learner Engagement Scores by Dimension

Engagement Dimension	AI Feedback Group Mean	SD	Teacher Feedback Group Mean	SD
Behavioral Engagement	4.35	0.50	3.52	0.55
Cognitive Engagement	4.28	0.48	3.34	0.53
Emotional Engagement	4.33	0.54	3.38	0.57

Scale based on a five-point Likert Engagement questionnaire.

The results demonstrate that AI-generated personalized feedback not only improves students' writing outcomes but also enhances their Engagement in the learning process. The particularly strong effect observed in cognitive Engagement suggests that AI-supported feedback may encourage students to process actively and interpret feedback during revision, thereby fostering deeper learning. These findings highlight the pedagogical potential of AI-assisted feedback systems to support not only performance improvement but also sustained learner involvement in EFL writing activities.

Regression Analysis (Engagement Predicting Revision Quality)

A multiple regression analysis examined whether different dimensions of learner Engagement predicted revision quality. Behavioral, cognitive, and emotional Engagement were treated as independent variables, while revision quality served as the dependent variable. The regression model was statistically significant and

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explained 52% of the variance in revision quality ($R^2 = 0.52$, $p < .001$), indicating that Engagement strongly influences the effectiveness of students' revisions. Among the predictors, cognitive Engagement was the strongest predictor of higher revision quality, suggesting that deeper mental effort in interpreting feedback leads to more meaningful revisions. Behavioral Engagement also showed a positive relationship with revision quality, while emotional Engagement demonstrated a weaker but significant association with revision outcomes.

Table 6. Multiple Regression Analysis Predicting Revision Quality

Predictor	Beta (β)	SE	t	p
Behavioral Engagement	0.31	0.07	4.21	< .001
Cognitive Engagement	0.44	0.06	6.38	< .001
Emotional Engagement	0.18	0.08	2.54	.012

Model Statistics

$R^2 = 0.52$

$F = 41.67$

$p < .001$

The results indicate that students' Engagement during the revision process significantly contributes to the quality of their revisions. The strong influence of cognitive Engagement suggests that students who actively analyze and interpret feedback are more capable of implementing meaningful changes to their texts. These findings highlight that the effectiveness of AI-generated personalized feedback may depend not only on the availability of the feedback itself but also on the extent to which students cognitively engage with it during the revision process. Consequently, AI-supported feedback systems may enhance writing development when they encourage learners to actively reflect on and apply feedback rather than passively receiving corrective suggestions.

Student Perspectives on AI Feedback

To complement the quantitative analysis, semi-structured interviews were conducted with selected participants from the AI feedback group to explore how students perceived AI-generated personalized feedback and how it influenced their revision practices. The interview transcripts were analyzed using thematic analysis, which identified three recurring themes: clarity of feedback, support for revision strategies, and increased learner autonomy. Students described AI-generated feedback as clear and immediate, which helped them understand weaknesses in their texts and apply more effective revision strategies. In addition, the accessibility

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of AI feedback encouraged students to revise their writing more independently, suggesting that AI-assisted feedback serves not only as a corrective tool but also as pedagogical guidance that supports learners' decision-making during the revision process.

Table 7. Themes Emerging from Student Interviews

Theme	Description	Representative Student Comment
Clarity of Feedback	AI feedback was perceived as clear and easy to understand	"The AI feedback clearly showed what part of my sentence was wrong and how I could improve it."
Support for Revision Strategies	AI suggestions encouraged deeper revision beyond grammar correction	"Sometimes it suggested reorganizing my paragraph, which helped me make my argument clearer."
Increased Learner Autonomy	Students felt more independent during the writing process	"I did not have to wait for the teacher. I could revise my writing immediately using the AI suggestions."

Qualitative analysis identified three key themes regarding students' experiences with AI-generated personalized feedback. First, students emphasized the clarity and immediacy of feedback, noting that AI-enabled responses allowed them to quickly identify weaknesses in their writing and apply revisions without waiting for instructor comments. Second, AI feedback supported revision strategies by highlighting issues in paragraph organization, sentence clarity, and argument development, encouraging students to perform more meaning-level revisions consistent with the patterns observed in the quantitative revision analysis. Third, participants reported increased learner autonomy, as the availability of AI feedback enabled them to revise their writing more independently and develop greater confidence in managing their revision process. Together, these qualitative insights reinforce the broader analysis by indicating that AI-generated feedback functions not only as a corrective tool but also as a learning resource that supports clearer feedback interpretation, deeper revision practices, and greater autonomy in the writing process.

DISCUSSION

AI Feedback and Writing Development

The use of AI-generated personalized feedback contributes significantly to the improvement of EFL students' writing quality, particularly in two key aspects, namely grammar accuracy and text organization. The analysis demonstrates that students

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who received AI-based feedback not only improved their overall writing scores but also showed clearer development in both linguistic and structural dimensions of their writing. Improvements in grammar accuracy suggest that AI-based feedback helps students identify and correct grammatical errors more systematically. At the same time, improvements in text organization indicate that AI feedback serves not only as a linguistic correction tool but also as a mechanism that assists students in structuring their ideas more logically and coherently. These patterns suggest that the use of AI in writing instruction can support a more comprehensive revision process, encouraging learners not only to correct language errors but also to reconsider the organization of their ideas.

These patterns are consistent with a growing body of research suggesting that AI-assisted feedback technologies have considerable potential to support second-language writing development. Recent studies indicate that AI-based feedback systems can provide rapid, consistent linguistic corrections, helping learners improve grammatical accuracy in their writing (H. Feng et al., 2025; Jamshed et al., 2025). In addition, several studies report that generative AI tools increasingly provide suggestions on sentence structure, paragraph development, and argument clarity in academic texts (Kim et al., 2022; Stofiana et al., 2025; Zhao, 2025). This development indicates that the role of automated feedback technologies has gradually shifted from simple automated error correction to more sophisticated pedagogical support systems that assist learners in understanding how to structure ideas effectively in academic writing.

At the same time, the present study provides a critical perspective on the evolving capabilities of automated feedback systems in writing instruction. Earlier research on automated writing evaluation suggested that such systems were generally more effective in correcting surface-level linguistic errors than in supporting higher-level rhetorical development (Wei et al., 2023). The current analysis indicates that AI-generated feedback can also contribute to improvements in text organization. This shift may be associated with the rapid development of large language model technologies, which possess stronger capabilities for analyzing textual context and discourse-level structures compared with earlier automated feedback systems. Consequently, the pedagogical potential of AI-assisted feedback systems appears to be expanding beyond linguistic accuracy to include broader aspects of writing development, such as coherence, organization, and argument clarity.

Several pedagogical implications emerge from this analysis for EFL writing classrooms. The integration of AI-generated feedback in writing instruction may help reduce teachers' workload in correcting basic linguistic errors, allowing instructors to focus more on higher-level aspects of writing, such as argument

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development, rhetorical effectiveness, and critical thinking. AI feedback can also serve as a scaffolding tool during the revision process, particularly in the early stages, when students need immediate, specific feedback on weaknesses in their texts. The availability of instant feedback may further encourage students to engage in more independent revision practices, as they can evaluate and improve their writing without waiting for teacher feedback. The integration of AI tools in writing instruction should therefore be understood not as a replacement for teacher feedback but as part of a broader pedagogical strategy that combines technological support, instructional guidance, and reflective Engagement with the writing process.

AI Feedback and Engagement

The use of AI-generated personalized feedback significantly increases student engagement during the writing revision process, particularly in cognitive Engagement and revision effort. Students who received AI-based feedback demonstrated higher cognitive involvement than those who received conventional teacher feedback. Greater cognitive Engagement was reflected in how students actively processed the feedback, evaluated their writing weaknesses, and made deeper revisions to the structure of their ideas and arguments. In addition, students in the AI feedback group exhibited stronger revision effort, as evidenced by a higher frequency of revisions and a tendency to perform meaning-level revisions rather than merely correcting linguistic errors. This pattern indicates that AI feedback influences not only the quality of written texts but also the degree to which students engage cognitively in the revision process.

It aligns with recent studies indicating that AI-assisted feedback technologies can enhance learner Engagement in technology-mediated learning environments. Previous research suggests that immediate, personalized, and easily accessible feedback encourages students to interact more actively with learning materials and reflect on their learning processes (Bond et al., 2021; Maier & Klotz, 2022; Yaseen et al., 2025). In second language writing instruction, AI-generated feedback has been shown to increase cognitive engagement by encouraging learners to understand the reasons behind their writing errors and to independently identify strategies for improvement (Engeness, 2025; Luo & Yusuf, 2025; Mekheimer, 2025). In this sense, AI feedback functions not only as a corrective tool but also as a mechanism that supports metacognitive reflection, prompting learners to think more critically about the quality and organization of their writing.

Beyond cognitive Engagement, AI feedback also plays an important role in strengthening students' revision efforts during the writing process. Students who received AI-generated feedback tended to revise their texts more frequently and more systematically than those in the control group. The defining characteristics of AI feedback can explain this tendency: it is immediate and responsive to learners'

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texts. The availability of instant feedback allows students to implement suggested improvements without waiting for instructor comments. Prior research indicates that the speed and accessibility of feedback strongly influence the intensity and frequency of revisions in writing instruction (Gao & Ma, 2022; Link et al., 2022). From this perspective, AI technology catalyzes revision, encouraging learners to engage more actively in improving their writing.

These patterns also contribute to theoretical discussions concerning the relationship between educational technology and learner Engagement. Within the framework of learner Engagement theory, cognitive Engagement is a critical component that influences the quality of learning processes because it involves sustained mental effort in understanding and applying new knowledge (Alam & Mohanty, 2024; Li & Lajoie, 2022; Lin et al., 2022). AI-generated feedback facilitates this process by providing information that helps learners evaluate and improve their writing in a reflective, iterative manner. The effectiveness of AI technologies in language learning, therefore, depends not only on their ability to generate feedback but also on their capacity to encourage learners to engage in the revision process actively.

Several pedagogical implications emerge from this analysis. Integrating AI into writing instruction can strengthen student Engagement during the revision stage by enabling learners to revise their texts more independently and repeatedly, thereby promoting a more active and reflective learning process. At the same time, the use of AI in writing classrooms requires the continued involvement of teachers as facilitators who guide students in interpreting AI-generated feedback and developing critical perspectives toward technological suggestions. The integration of AI in writing instruction should therefore be understood as part of a human–AI collaborative learning approach, in which technology serves as a supportive tool that enriches the learning process without replacing the pedagogical role of the teacher.

Implications for EFL Teaching

The integration of AI-generated personalized feedback in EFL writing instruction carries important implications for pedagogical practice in writing classrooms. The use of AI not only supports improvements in students' writing performance but also promotes higher levels of cognitive Engagement and enhances the quality of revision practices. Within this context, AI can be utilized by teachers as a supportive tool to provide draft feedback during the early stages of the writing process. By delivering initial feedback on grammatical errors, sentence structure, and paragraph organization, AI allows students to receive rapid responses to their texts and begin revising earlier in the writing cycle. Such an approach encourages a more iterative writing process, as learners can revise their drafts multiple times before receiving more detailed feedback from instructors.

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It aligns with recent research suggesting that AI-assisted feedback technologies can expand feedback practices in language learning environments. AI-based feedback systems can deliver rapid, consistent, and personalized corrections, enabling learners to recognize and address weaknesses in their writing more effectively (Nazli et al., 2025; Youn et al., 2025). In addition, generative AI tools increasingly offer suggestions on sentence structure, paragraph development, and argument clarity in academic texts (Mo & Crosthwaite, 2025; Sanz-Tejeda et al., 2026; Shabir, 2025). In writing pedagogy, the availability of AI-generated feedback enables teachers to devote more attention to higher-level aspects of writing, such as idea development, argument quality, and rhetorical effectiveness. In this sense, AI functions as a technological resource that facilitates a more balanced distribution of responsibilities between automated feedback systems and instructor guidance.

From a pedagogical perspective, the use of AI in providing draft feedback also contributes to improving the depth and quality of revision practices. Students who interacted with AI-generated feedback tended to perform more substantial revisions, including paragraph reorganization and argument development. Such patterns indicate that AI feedback can serve as a scaffolding mechanism, helping learners understand the relationship between linguistic structure and the organization of ideas in their texts. Previous studies also indicate that immediate, specific feedback encourages more active and reflective revision practices (O. Chen & Bergner, 2021; Chung et al., 2021). Within this context, AI feedback increases both the frequency and depth of revisions, encouraging learners to revise at the level of meaning rather than focusing solely on linguistic corrections.

At the same time, integrating AI into writing instruction requires a critical pedagogical perspective. Although AI systems can provide rapid and detailed feedback, they do not always fully capture rhetorical context or communicative intent. The role of the teacher, therefore, remains essential in guiding students to interpret and critically evaluate the suggestions generated by AI systems. Research suggests that the pedagogical effectiveness of AI in language learning increases when technological tools are combined with instructional guidance that encourages critical reflection on feedback (AbuSahyon et al., 2023; Kristiawan et al., 2024; Liu & Wang, 2024). Consequently, AI should not be viewed as a replacement for teacher feedback but rather as part of a human–AI collaborative pedagogy, in which technology functions as a supportive resource that enriches the learning process.

The integration of AI-generated feedback in EFL writing instruction also has important implications for the design of writing pedagogy. Incorporating AI into the revision stage supports a process-based writing approach, where learners engage in iterative cycles of drafting, feedback, revising, and editing. Because AI-generated feedback is immediate and interactive, students can receive responses while

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composing their texts, enabling more frequent and efficient revisions. This environment encourages learners to experiment with different revision strategies and actively monitor the development of their writing. Such practices suggest that AI technologies can enrich EFL writing instruction by enabling more responsive feedback processes while promoting greater learner participation in revision. Consequently, the use of AI in writing classrooms should be understood as part of a broader pedagogical strategy that integrates digital technologies, reflective learning, and sustained instructional guidance.

V. CONCLUSION

This study examined the role of AI-generated personalized feedback in supporting EFL students' writing development, focusing on revision quality and learner Engagement during the writing process. The findings indicate that AI-assisted feedback significantly improves writing performance, particularly in grammar accuracy and text organization, suggesting that AI feedback can support both linguistic precision and structural clarity in students' academic writing. Students who interacted with AI-generated feedback also demonstrated more meaning-level revisions, including paragraph restructuring and argument development, which indicates deeper Engagement with the writing process rather than mere correction of surface-level errors. In addition, the results reveal that AI feedback enhances cognitive Engagement and revision effort, as students actively interpret and apply feedback while revising their texts, thereby increasing their involvement in the learning process. These findings contribute to current discussions in AI-assisted language learning by demonstrating that generative AI systems can extend the pedagogical role of automated feedback beyond error detection toward supporting reflective revision practices and learner autonomy. From a pedagogical perspective, integrating AI-generated feedback into EFL writing classrooms can enable teachers to use AI as an initial-draft feedback tool, allowing students to revise their texts more intensively before receiving instructor feedback and enabling teachers to focus on higher-level aspects of writing, such as argument development and rhetorical coherence. The study was conducted within a single institutional context with a limited number of participants and a relatively short intervention period, which may limit the generalizability of the findings and the ability to observe long-term writing development. Future research should therefore investigate the long-term effects of AI-generated feedback across different learning contexts, proficiency levels, and instructional settings, and explore pedagogical models that integrate AI feedback with teacher guidance to promote critical Engagement and responsible use of AI technologies in language learning.

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