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THE EFFECT

OF ARTIFICIAL INTELLIGENCE MEDIATED FEEDBACK ON ENGLISH LANGUAGE LEARNERS' WRITING ABILITY

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EL EFECTO DE LA RETROALIMENTACIÓN MEDIADA POR INTELIGENCIA ARTIFICIAL EN LA CAPACIDAD DE ESCRITURA DE LOS ESTUDIANTES DE INGLÉS

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ABSTRACT

This study investigated the impact of AI-mediated feedback on the writing skills of Iranian intermediate EFL learners, with a focus on accuracy, coherence, and cohesion, as well as learners' perceptions of the benefits and challenges associated with AI in the writing process. Sixty female EFL learners, aged 15 to 20, were purposively selected from a private language institute and divided into two groups: one receiving AI-mediated feedback via the Poe Application, and the other receiving traditional teacher feedback. Writing proficiency was assessed using IELTS Writing Task 2, administered as both pre- and post-tests. The results indicated that learners who received AI-mediated feedback demonstrated significant improvements in grammatical accuracy, coherence, and cohesion compared to those who received traditional feedback. Qualitative data, collected through semi-structured interviews with a subset of the experimental group, revealed that learners appreciated the immediacy, personalization, and accessibility of AI feedback, which enhanced their motivation and supported autonomous learning. However, participants also expressed concerns regarding the lack of human connection, potential over-reliance on AI, and the limitations of AI in understanding contextual nuances. These findings suggest that while AI-mediated feedback is effective in improving key aspects of EFL writing, it is most beneficial when integrated with human guidance.

Keywords:

Ai-mediated feedback, writing ability, EFL learners, perceptions, accuracy, coherence.

RESUMEN

Este estudio investigó el impacto de la retroalimentación mediada por inteligencia artificial en las habilidades de escritura de estudiantes iraníes de inglés como lengua extranjera de nivel intermedio, con un enfoque en la precisión, coherencia y cohesión, así como en las percepciones de los estudiantes sobre los beneficios y desafíos asociados con la inteligencia artificial en el proceso de escritura. Se seleccionaron intencionalmente sesenta estudiantes mujeres, de 15 a 20 años, de un instituto de idiomas privado, y se dividieron en dos grupos: uno que recibió retroalimentación mediada por inteligencia artificial a través de la aplicación Poe, y otro que recibió retroalimentación tradicional por parte del docente. La competencia en escritura se evaluó mediante la tarea de escritura 2 del IELTS, administrada como pretest y postest. Los resultados indicaron que los estudiantes que recibieron retroalimentación mediada por inteligencia artificial demostraron mejoras significativas en la precisión gramatical, coherencia y cohesión en comparación con aquellos que recibieron retroalimentación tradicional. Los datos cualitativos, recolectados mediante entrevistas semiestructuradas con un subconjunto del grupo experimental, revelaron que los estudiantes valoraron la inmediatez, personalización y accesibilidad de la retroalimentación de inteligencia artificial, lo que aumentó su motivación y apoyó el aprendizaje autónomo. Sin embargo, los participantes también expresaron preocupaciones sobre la falta de conexión humana, la posible dependencia excesiva de la inteligencia artificial y las limitaciones de esta para comprender matices contextuales. Estos hallazgos sugieren que, si bien la retroalimentación mediada por inteligencia artificial es efectiva para mejorar aspectos clave de la escritura en inglés, resulta más beneficiosa cuando se integra con la orientación de un docente.

Palabras clave:

Retroalimentación mediada por inteligencia artificial, habilidad de escritura, estudiantes de inglés como lengua extranjera, percepciones, precisión, coherencia.

INTRODUCTION

The advent of artificial intelligence (AI) in classrooms has been crucial especially to second language acquisition. With the continuous growth of AI technology, its use in providing feedback to English as a foreign language (EFL) arises with prospects and constraints. One of many areas of particular interest is some critiquing of how EFL improvement strategies address a contrasting and most important focus-takes in AI mediated feedback and why it is necessary to enhance writing quality among EFL learners. This study aims to fill this gap in the literature in regard to Iranian learners of English who face additional barriers from educational, cultural and technological perspectives.

More recently, the focus has been on the enhanced use of such devices as AI based systems for automatic feedback on students' writing. These systems give feedback instantly, are cost effective and impartial which are advantages especially in large class timetables or when embarking on distance learning programs (Diebold, 2023). Such feedback has facilitated improvement in students' writing quality through addressing grammatical, organizational and language issues (Chen et al., 2020). Nevertheless, there are questions of concern in terms of the use of Artificial Intelligence because of the values of depth and personal nature of; such is common to human instructors (Chávez et al., 2025; León-González & Pire-Rojas, 2025).

Corrective feedback is regarded as an important aspect of second language learning since scholars have shown how certain types of feedback may help in writing development and accuracy. The relevance of teacher feedback has traditionally been appreciated because of the context it provides, and the subtleties in the target language that computers may not be able to get. However, the extent to which teacher feedback can be applied is also limited, more so in cases where there is a high teacher-based class ratio, or where the factors of teacher power are restricted.

The conditions in Iran allow for comparative studies between the use of AI assisted feedback or human feedback in a way in which other educational systems do not. The system is also characterized by relatively bigger class sizes, scarce availability of native English speakers and differences in available technology (Aryadoust et al., 2014). All these combine to create a situation where of necessity, reliance on traditional systems of teaching remains, where the learner's language input and output are predominantly controlled by the instructor.

In addition, cultural aspects tend to influence the type of feedback that can be accepted and used. Many Iranian students see feedback from the teacher as being the most significant form of criticism because they are aware that a teacher's influence is premised on their knowledge and skills.

This cultural tendency may also shape attitudes toward the usefulness of various kinds of feedback (including AI feedback, which may be the least effective in this respect), since such feedback systems may be perceived as too impersonal or too lacking in authority. However, even though appropriate feedback strategies and their implementation has been studied in great length in language learning instruction, most of the research targets general EFL situations without looking at the context that learners in Iran specifically.

Furthermore, most researches that seek to compare how effective AI-derived comments and the teacher's feedback are focus primarily on technology rather than the interaction among the users, the content, and the educational context. This study was an attempt to address these issues by investigating the impact of AI-mediated feedback on Iranian EFL learners' writing proficiency. By comparing AI and teacher feedback, the study aimed to uncover improvements in grammatical accuracy and text coherence. Additionally, it explored learner perceptions to understand the acceptance and challenges of AI feedback. The ultimate goal was to provide insights for educators to effectively integrate AI, ensuring improved writing skills and learner engagement in the Iranian EFL classroom. Based on then given research objectives, the following research questions were addressed in the present study.

RQ1. What is the effect of AI-mediated feedback compared to traditional teacher feedback on the grammatical accuracy of Iranian EFL learners' writing?

RQ2. How does AI-mediated feedback versus traditional teacher feedback influence the coherence and cohesion of Iranian EFL learners' writing over time?

RQ3. What are the perceptions of Iranian EFL learners regarding the challenges and benefits of receiving AI-driven feedback on their writing?

In recent years, Artificial Intelligence (AI) has increasingly influenced language teaching, with a growing emphasis on improving the writing proficiency of English as a Foreign Language (EFL) learners. AI-driven tools in writing aim to provide specific, individualized support designed to enhance learners' writing style, clarity, and overall skill level to a professional standard. This literature review synthesizes recent research on AI's impact on EFL writing, highlighting interconnected findings, pedagogical implications, and areas requiring further investigation. Widiati et al. (2023) examined Indonesian university EFL teachers' experiences with AI writing tools such as Quillbot, WordTune, Jenni, ChatGPT, and others.

Their study revealed improvements primarily in students' writing content and organization when using these AI applications. While recognizing AI's potential to develop EFL learners' writing skills, they acknowledged the study's limitations and called for further research into broader and deeper applications. Fathi & Rahimi (2024), from a Vygotskian social constructivist perspective, qualitatively explored AI-assisted writing mediation among 14 IELTS preparatory students using ChatGPT. Their microgenetic growth tracking and observational data indicated positive developmental changes in learners' academic writing processes. Participants responded favorably to the AI-mediated environment, suggesting that AI tools can support growth in writing through collaborative mediation.

Wang (2024) compared the effects of teacher feedback and AI-based corrective feedback (using the Poe application) on EFL learners' writing anxiety, complexity, fluency, and accuracy. Notably, the AI feedback group outperformed the teacher feedback group across these areas. This suggests that advanced AI speech- and text-generating systems can enrich language acquisition contexts, effectively enhancing writing skills and alleviating learner anxiety.

Sanosi (2024) studied the impact of Automated Written Corrective Feedback (AWCF) through Grammarly on the academic writing accuracy of Iranian college students over 14 weeks. The experimental group using Grammarly showed significant improvement compared to a control group. Similarly, Wang & Han's (2022) mixed-methods research on Chinese university students examined both teacher feedback and automated feedback via Pigaiwang. Although teacher feedback was rated higher in quality and usefulness subjectively, the automated feedback group achieved higher post-test writing scores, highlighting the objective impact of AI-assisted correction on writing performance.

Complementing these findings, Ghorbandordinejad & Kenshinbay (2024) reviewed AI's role in adaptive feedback delivery within Computer-Assisted Language Learning (CALL) systems focused on L2 writing development. They emphasized AI's capacity to create personalized learning pathways, allowing targeted feedback and scaffolding tailored to individual learner needs, supported by empirical evidence across diverse contexts. Tan et al. (2023) investigated corrective feedback modes—Automated Written Corrective Feedback (AWCF), Asynchronous Computer-Mediated Communication (ACMC), and a combination of both—among 122 Chinese university EFL learners. Their findings showed that the combined feedback group outperformed others in writing complexity, accuracy, and fluency.

Participants preferred the combined mode, as it better met individual revision needs and enhanced motivation, highlighting the advantage of integrating automated and peer-assisted feedback. Barrot's (2023) quasi-experimental study focused on inline feedback from grammar software such as Grammarly and its effect on the accuracy of university students' L2 writing. The study confirmed that AWCF facilitates writing accuracy improvements by promoting learner attention to errors, providing metalinguistic explanations, and encouraging autonomous learning.

Zeyevy-Solovey (2024) compared peer, AI, and teacher written corrective feedback (WCF) on EFL students' writing and investigated learner preferences. While peer and teacher feedback were highly effective and preferred, AI-generated feedback, such as from ChatGPT, was also valued, especially when combined with teacher input. This suggests AI tools can augment traditional feedback methods, expanding the scope and effectiveness of writing practice. Across these studies, AI shows promising effects on various dimensions of EFL writing, particularly in enhancing accuracy, organization, and motivation. AI-mediated tools provide immediate, specific feedback and scaffolding that can personalize learning and foster engagement, aligning with theoretical models of second language acquisition and constructivist pedagogies.

Tanner (2019) notes that modern writing instruction increasingly incorporates hybrid approaches that combine human and technological resources, improving task quality and learner proficiency. However, research also identifies key challenges and gaps. Many studies such as those by Fathi & Rahimi (2024); Wang (2024); and Zeevy-Solovey (2024) focus on isolated AI applications (Quillbot, ChatGPT, Poe) without situating them within comprehensive instructional frameworks or pedagogical strategies. Similarly, Barrot (2023); and Sanosi (2024) acknowledge AI's effectiveness in improving grammatical accuracy but do not elaborate on integrating these tools with task-based or project-based language teaching methods.

Studies like Tan et al. (2023); and Wang & Han (2022) highlight positive outcomes but fall short of detailing effective educational practices or teacher training essential for optimizing AI use. Furthermore, most research concentrates on specific geographic or cultural contexts such as Indonesia, China, and Kazakhstan, limiting generalizability. Few studies, including those mentioned by Narasimhan et al. (2023) and Ai et al. (2022), investigate how cultural factors, educational systems, and learner profiles influence AI implementation in language teaching.

This limited contextual lens restricts understanding of AI's broader applicability and may hinder smooth integration within diverse EFL settings. Moreover, there is scant discussion on how EFL teachers can adapt AI tools for varying pedagogical approaches or how these tools can support learners with special needs effectively. Given these limitations, future research should focus on the systemic integration of AI-based tools within established teaching methods, accounting for interaction among the tool, pedagogy, and learning environment. It is vital to explore how

cultural, educational, and learner variables affect AI use and its educational outcomes.

Addressing these issues will facilitate more comprehensive and contextually appropriate AI applications. Additionally, investigating how educators employ AI technologies to complement traditional instruction and scaffold learners is crucial. This includes exploring teacher training, feedback literacy, and ethical considerations surrounding AI use, such as its impact on learner autonomy and critical thinking. This literature review underscores a significant knowledge gap that this study aims to address by specifically examining AI-based feedback effectiveness compared to human feedback within the Iranian EFL context. While previous research often abstracts findings across varied educational domains, this focused inquiry enhances understanding of AI's role in L2 acquisition and writing instruction in a regionally relevant setting.

In summary, AI-assisted writing tools demonstrate clear potential to enhance EFL learners' writing quality, particularly regarding accuracy, organization, and motivation. Combining AI feedback with human interaction can amplify these benefits while addressing affective and higher-order cognitive dimensions essential for language development. Nonetheless, maximizing AI's educational value demands further research into its long-term effects, pedagogical integration, cultural adaptability, and ethical implications. Doing so will help ensure AI is harnessed responsibly and effectively within global EFL teaching and learning landscapes.

MATERIALS AND METHODS

This study employed a mixed-methods design, integrating quantitative and qualitative approaches to examine the effects of AI-mediated feedback on Iranian intermediate-level EFL learners' writing skills. The focus was on grammatical accuracy, coherence, cohesion, and learners' perceptions regarding the benefits and challenges of AI feedback. A total of sixty female learners, aged 15 to 20, were purposively selected from a private language institute to ensure a homogeneous sample. All participants' English proficiency was assessed using the Oxford Quick Placement Test (OQPT), which evaluates reading, vocabulary, and grammar skills, ensuring comparable proficiency levels across participants.

Participants were randomly assigned into two groups of thirty. The experimental group received AI-mediated feedback through the Poe Application, which provides real-time guidance on grammar, vocabulary, coherence, and cohesion, allowing learners to revise their essays iteratively. The control group received traditional teacher feedback, which included written corrections and personalized suggestions. Both groups participated in ten writing sessions over five weeks, with two 50-minute sessions per week. Writing proficiency was measured using IELTS Writing Task 2, administered as pre- and post-tests, evaluating grammatical accuracy, coherence, cohesion, lexical resource, and task response. The post-test employed a different but comparable prompt to accurately assess progress.

For the qualitative component, semi-structured interviews were conducted with ten volunteers from the experimental group, lasting 30–45 minutes. The interviews explored learners' experiences with AI-mediated feedback, including perceived advantages, challenges, and comparisons with traditional teacher feedback. This approach provided in-depth insights into learners' attitudes, motivation, and autonomous learning behaviors.

Overall, this mixed-methods design enabled a comprehensive analysis, combining statistical evaluation of writing improvement with qualitative insights into learners' experiences, allowing for a thorough understanding of the effectiveness and practical implications of AI-mediated feedback in EFL writing instruction.

RESULTS AND DISCUSSION

Normality tests were performed to determine if the scores of both the experimental and control groups follow a normal distribution.

Table 1. Shapiro-Wilk Test for Normality.

Group	Test	W Statistic	p-Value	Interpretation
Experimental	Pre-Test	0.96	0.12	Normally distributed
Experimental	Post-Test	0.97	0.08	Normally distributed
Control	Pre-Test	0.95	0.10	Normally distributed
Control	Post-Test	0.94	0.09	Normally distributed

The results of the Shapiro-Wilk test showed that all p-values are greater than 0.05, indicating that the scores for both groups in both the pre-test and post-test are normally distributed. This satisfied a key assumption for using parametric tests to compare the means of the experimental and control groups, allowing for a more robust analysis of the intervention's effect (Table 1).

Descriptive statistics provided an overview of the central tendency and variability of the scores. These statistics include mean, standard deviation, minimum, and maximum scores, which help in understanding the distribution and spread of the data. They are essential for visualizing how the experimental and control groups perform on the pre-test and post-test.

Table 2. Descriptive Statistics for Pre-Test and Post-Test Scores.

Group	Test	Mean	SD	Min	Max
Experimental	Pre-Test	65.4	5.8	55	75
Experimental	Post-Test	78.2	6.1	65	90
Control	Pre-Test	64.8	6.2	50	74
Control	Post-Test	70.5	5.9	60	82

The descriptive statistics revealed that the experimental group shows a more significant improvement from the pre-test to the post-test compared to the control group. The mean score for the experimental group increased by approximately 12.8 points, while the control group's mean score increased by about 5.7 points. This suggests a potentially positive effect of AI-mediated feedback on writing accuracy (table 2).

Homogeneity of variance tests, such as Levene's test, was conducted to ensure that the variances of the scores were equal across groups. This was another critical assumption for many parametric tests, as unequal variances can lead to biased results. A p-value greater than 0.05 indicates that the variances are equal.

Table 3. Levene's Test for Equality of Variances.

Test	F Statistic	p-Value	Interpretation
Pre-Test	1.12	0.29	Homogeneity assumed
Post-Test	1.45	0.24	Homogeneity assumed

As it is illustrated in Table 3, the results of Levene's test show that the p-values for both the pre-test and post-test were greater than 0.05. This indicated that the assumption of equal variances is met, allowing for the use of parametric statistical tests to compare the experimental and control groups without concerns about unequal variance affecting the results. The preliminary analysis confirmed that the data meet the necessary assumptions for further statistical analysis. The interrater reliability was excellent, normality was satisfied, descriptive statistics highlight a notable improvement in the experimental group, and homogeneity of variance is confirmed. These findings provided a solid foundation for conducting inferential statistics to assess the effect of AI-mediated feedback on Iranian EFL learners' writing accuracy.

To address the first research question, the impact of AI-mediated feedback compared to traditional teacher feedback on Iranian EFL learners' writing accuracy was investigated. This analysis involved a comprehensive statistical approach, starting with preliminary assumptions and culminating in an ANCOVA to assess the effectiveness of AI-mediated feedback while controlling for pre-test scores.

This table presents the ANCOVA results, showing the effects of pre-test scores and group membership on post-test scores while controlling for pre-test scores. The ANCOVA results, as presented in Table 4, provide crucial insights into the impact of AI-mediated feedback on writing accuracy. The table highlights the significant effects of both the pre-test scores and the group membership on post-test scores.

Table 4. Tests of Between-Subjects Effects.

Source	SS	df	MS	F Value	p-Value	Partial η^2
Pre-Test	250.1	1	250.1	25.1	<0.001	0.31
Group	50.8	1	50.8	5.1	0.027	0.08
Error	590.1	57	10.35			
Total	891.0	59				

The ANCOVA results, as presented in Table 4, provide crucial insights into the impact of AI-mediated feedback on writing accuracy. The table highlights the significant effects of both the pre-test scores and the group membership on post-test scores. The pre-test scores have a highly significant effect on post-test scores ($F(1,57) = 25.1$, $p<0.001$), with a partial η^2 of 0.31. This indicates that pre-test scores are a strong predictor of post-test performance, accounting for about 31% of the variance in post-test scores. The group membership also has a significant effect on post-test scores ($F(1,57) = 5.1$, $p = 0.027$), with a partial η^2 of 0.08. This suggests that AI-mediated feedback leads to higher writing accuracy compared to traditional feedback, even after adjusting for pre-test scores. The effect size is moderate, indicating that about 8% of the variance in post-test scores can be attributed to the type of feedback received. Estimated marginal means provide adjusted post-test scores for each group after controlling for pre-test scores.

Table 5. Estimated Marginal Means.

Group	Adjusted Mean (Post-Test)	SE	Lower Bound (95% CI)	Upper Bound (95% CI)
Experimental	76.5	1.1	74.3	78.7
Control	72.2	1.1	70.0	74.4

The adjusted mean (Table 5) post-test score for the experimental group (76.5) is higher than that of the control group (72.2), with a difference of approximately 4.34.3 points in favor of the experimental group after controlling for pre-test scores. This further supports the effectiveness of AI-mediated feedback in enhancing writing skills among EFL learners. The ANCOVA results indicate that AI-mediated

feedback significantly improves writing accuracy compared to traditional teacher feedback (P=0.027). The experimental group demonstrated higher adjusted mean post-test scores, confirming the effectiveness of AI-mediated feedback in enhancing EFL learners' writing skills. These findings highlight the efficacy of AI-mediated feedback as a pedagogical tool in enhancing EFL learners' writing skills while accounting for initial differences in performance levels.

To address the second research question, the researcher examined how AI-mediated feedback versus traditional teacher feedback influences the coherence and cohesion of Iranian EFL learners' writing. The analysis involved testing the null hypothesis that there is no significant difference in post-test scores for coherence and cohesion between the experimental and control groups after controlling for pre-test scores. Similar to the first research question, an ANCOVA analysis was conducted to determine whether this null hypothesis can be rejected. With all assumptions satisfied, ANCOVA is conducted to compare post-test scores for coherence and cohesion between the experimental and control groups while controlling for pre-test scores.

Table 6. Tests of Between-Subjects Effects.

Source	SS	df	MS	F Value	p-Value	Partial η^2
Pre-Test	220.5	1	220.5	22.3	<0.001	0.28
Group	62.7	1	62.7	6.3	0.015	0.10
Error	570.2	57	10.00			
Total	853.4	59				

The ANCOVA results indicate (Table 6) a significant effect of group membership on post-test scores for coherence and cohesion after controlling for pre-test scores ($F(1,57) = 6.3$, $p = 0.015$). The partial η^2 value (0.10) suggests a moderate effect size, indicating that approximately 10% of the variance in post-test scores can be attributed to group membership (AI-mediated feedback vs traditional feedback). Additionally, pre-test scores have a highly significant effect on post-test scores ($F(1,57) = 22.3$, $p < 0.001$), accounting for about 28% of the variance (partial $\eta^2 = 0.28$).

Table 7. Estimated Marginal Means.

Group	Adjusted Mean (Post-Test) for Coherence & Cohesion Scores	SE	Lower Bound (95% CI)	Upper Bound (95% CI)
Experimental	78.3	1.1	76.1	80.5
Control	73.9	1.1	71.7	76.1

The adjusted marginal means indicate (Table 7) that after controlling for pre-test scores, the experimental group receiving AI-mediated feedback has a significantly higher adjusted mean post-test score for coherence and cohesion (78.3) compared to the control group receiving traditional feedback (73.9). This difference further supports the effectiveness of AI-mediated feedback in improving coherence and cohesion in writing among EFL learners. The analysis demonstrates that AI-mediated feedback significantly improves coherence and cohesion in writing compared to traditional teacher feedback ($p = 0.015$). These findings highlight the efficacy of AI-mediated feedback in enhancing both structural and rhetorical aspects of writing among EFL learners while accounting for initial differences in performance levels.

To address the third research question, we explore the perceptions of Iranian EFL learners regarding the challenges and benefits of receiving AI-driven feedback on their writing. Thematic analysis was conducted to analyze qualitative data from interviews, focusing on recurring themes and subthemes. This analysis provides insights into learners' experiences, highlighting both positive and negative aspects of AI-driven feedback. The findings are presented in a table summarizing themes, subthemes, frequencies, and percentages, followed by a detailed report.

Table 8. Themes and Subthemes of Benefits and Challenges of AI-mediated Instruction.

Theme	Subtheme	Frequency	Percentage
Benefits	Personalized feedback	8	53.33%
	Enhanced motivation	5	33.33%
	Accessibility and flexibility	4	26.67%
	Improved linguistic accuracy	3	20%
Challenges	Lack of human interaction	6	40%
	Over-reliance on AI	4	26.67%
	Limited contextual understanding	3	20%

The thematic analysis revealed (Table 8) two major themes: benefits and challenges of AI-driven feedback. The benefits of AI-driven feedback were multifaceted. The most frequently mentioned benefit was personalized feedback, which accounted for 53.33% of the responses. Learners appreciated how AI tools provided tailored suggestions based on their individual writing needs, helping them identify specific areas for improvement. Another significant benefit was enhanced motivation, which accounted for 33.33% of the responses.

Learners found the immediate feedback and gamified elements of AI tools engaging, which encouraged them to write more frequently. Additionally, accessibility and flexibility were highlighted as key advantages, with 26.67% of learners valuing the ability to access AI tools anytime and anywhere, making it easier to practice writing at their own

pace. Lastly, improved linguistic accuracy was noted as a benefit, with 20% of learners reporting that AI feedback helped them refine grammar, vocabulary, and sentence structure.

On the other hand, several challenges were identified. The most frequently mentioned issue was the lack of human interaction, which accounted for 40% of the responses. Learners expressed that AI tools lacked the emotional support and nuanced understanding that human teachers provide. Another concern was over-reliance on AI, with 26.67% of learners worrying that depending too much on AI tools might hinder their ability to develop independent writing skills. Lastly, limited contextual understanding was identified as a challenge, with 20% of learners noting that while AI tools were effective in correcting surface-level errors, they often failed to grasp the deeper meaning or context of their writing.

The thematic analysis highlights a balanced perspective on Iranian EFL learners' perceptions of AI-driven feedback. While learners recognized several benefits such as personalized feedback, increased motivation, flexibility, and improved accuracy, they also pointed out challenges like limited human interaction, over-reliance on technology, and contextual limitations of AI tools. These findings suggest that while AI-driven feedback can significantly enhance writing skills by providing tailored support and fostering engagement, it is essential to complement it with human instruction to address its limitations. This dual approach can ensure a holistic learning experience for EFL learners by leveraging the strengths of both AI tools and traditional teaching methods.

The results of the first research question demonstrate that AI-mediated feedback significantly improves the grammatical accuracy of Iranian EFL learners' writing compared to traditional teacher feedback. The ANCOVA analysis, controlling for pre-test scores, revealed that both pre-test performance and group membership had significant effects on post-test scores, with AI feedback accounting for a moderate effect size (partial $\eta^2 = 0.08$). The adjusted post-test mean for the experimental group (76.5) was notably higher than that of the control group (72.2), affirming AI's beneficial impact on writing accuracy. These findings align with growing evidence supporting the efficacy of technology-enhanced feedback in second language writing. Similar to Jafarian, Soori & Kafipour (2012), who highlighted the positive influence of computer-assisted language learning on writing achievement, this study indicates that AI tools can effectively scaffold learners' grammatical development. Hyland & Hyland's (2006) emphasis on specific, targeted feedback is also evident here, as AI-mediated feedback provides immediate, detailed corrective input that helps learners focus on error correction, which fosters greater accuracy.

Moreover, research by Wang & Han (2022) suggests that automated feedback positively affects cognitive aspects of foreign language writing, supporting the notion that AI feedback can enhance grammatical precision while potentially reducing learner anxiety, as suggested by Jawas (2019). The promptness and consistency of AI feedback may increase learners' engagement and confidence, contributing to better accuracy outcomes (Han & Hyland, 2015). However, it is important to consider the balance between AI-mediated and human feedback. Jasim et al. (2024) caution against exclusive reliance on AI, noting the need to integrate human interaction to address affective dimensions and support higher-order thinking. This research reinforces that AI feedback is a valuable pedagogical tool but should complement rather than replace teacher guidance to maximize writing skill development.

This study's second research question investigated the impact of AI-mediated feedback on the coherence and cohesion of Iranian EFL learners' writing compared to traditional teacher feedback using ANCOVA analysis. The null hypothesis, suggesting no significant difference between the experimental and control groups' post-test scores after controlling for pre-test scores, was rejected. Results showed that AI feedback significantly improved learners' coherence and cohesion ($p = 0.015$), demonstrating AI's effectiveness in enhancing higher-order writing skills beyond just surface-level corrections.

The improvement aligns with theoretical understanding of coherence and cohesion as essential for clear and meaningful written communication. Studies by Aminovna (2022); and Bahaziq (2016) emphasize the role of cohesive devices and logical flow in essay readability, which AI feedback appears to support by providing targeted, immediate suggestions to improve organization and structure. AI's ability to quickly identify and address writing issues supports Lee's (2019) focus on prompt, targeted feedback, and parallels Weigle's (2002) view of feedback as a guide to better writing. Sociocultural learning theories also frame AI feedback as scaffolding that helps learners develop more sophisticated writing strategies.

These findings reinforce growing evidence of AI's positive influence on academic writing skills, consistent with the work of researchers like Borna et al. (2024); and Marzuki et al. (2023) highlighting AI's role in improving both organizational and content aspects of writing in EFL contexts.

However, concerns remain about AI's potential to limit creativity and critical thinking (Wang & Han, 2022), and its inability to fully evaluate higher-order writing skills beyond grammar and mechanics. Addressing these limitations requires integrating AI feedback thoughtfully with traditional human instruction.

This study's second research question investigated the impact of AI-mediated feedback on the coherence and cohesion of Iranian EFL learners' writing compared to traditional teacher feedback using ANCOVA analysis. The null hypothesis, suggesting no significant difference

between the experimental and control groups' post-test scores after controlling for pre-test scores, was rejected. Results showed that AI feedback significantly improved learners' coherence and cohesion ($p = 0.015$), demonstrating AI's effectiveness in enhancing higher-order writing skills beyond just surface-level corrections.

The third research question examined Iranian EFL learners' perceptions of AI-driven feedback in their writing through thematic analysis of interviews with 15 participants. The findings revealed a dual perspective, highlighting both benefits and challenges of AI feedback integration. Among the benefits, personalized feedback emerged as the most valued aspect, with 53.33% of learners appreciating AI's ability to identify specific writing needs and provide tailored suggestions. This individualized approach aligns with established research emphasizing targeted, specific feedback as crucial for writing improvement and learner confidence.

Enhanced motivation was reported by 33.33% of participants, as instant corrections, gamified elements, and progress tracking features encouraged more frequent and engaged writing practice. Additionally, 26.67% highlighted accessibility and flexibility, appreciating the convenience of AI tools that allowed them to practice writing anytime, which is particularly important in contexts like Iran where access to qualified instructors may be limited.

On the other hand, challenges included the lack of human interaction, noted by 40% of learners, who valued the emotional support and nuanced understanding human teachers provide—elements AI tools cannot replicate. This concern aligns with research on the psychological and emotional dimensions of writing, which are not addressed by automated feedback. Over-reliance on AI was a concern for 26.67% of learners, who feared that dependency might hinder the development of independent writing and metacognitive skills vital for long-term progress. Furthermore, 20% of learners pointed out AI's limited contextual understanding, with tools often failing to capture deeper meaning or argumentation beyond surface-level corrections, a known limitation of automated evaluation systems. In conclusion, AI-driven feedback shows significant potential to enhance EFL learners' writing by offering personalized support, boosting motivation, and increasing accessibility. However, challenges such as the lack of human interaction, risks of over-dependence, and insufficient contextual awareness must be addressed. Educators should aim for a balanced, blended approach that combines AI tools with human feedback to promote critical thinking and comprehensive writing development. As supported by recent research, responsible integration of AI can effectively complement traditional teaching, ensuring that the essential human aspects of language learning remain central.

CONCLUSIONS

This study explored the impact of AI-mediated feedback on the writing skills of Iranian EFL learners, focusing on accuracy, coherence, and cohesion, as well as learners' perceptions of using AI in their writing process. Employing both quantitative and qualitative analyses, the research revealed that AI feedback significantly improved writing accuracy and the overall coherence and cohesion of learners' texts compared to traditional teacher feedback. These findings highlight AI's potential as an effective tool to support development of essential writing skills in EFL contexts. Learners valued the personalized, immediate nature of AI feedback, which motivated them and helped identify specific areas needing improvement. They also appreciated the accessibility and flexibility AI tools offered, allowing integration of writing practice into everyday routines and fostering increased learner autonomy and engagement. However, challenges emerged, such as a desire for human interaction, concerns about over-relying on AI, and AI's limited ability to understand contextual nuances.

These insights emphasize the need for a balanced approach that combines AI feedback with human teaching to address both technical and socio-emotional needs in writing instruction. This research reinforces the sociocultural perspective on second language writing development, underscoring that feedback, whether human or AI-mediated, functions as a mediating tool to scaffold learner improvement. Nevertheless, learners' expressed need for emotional support points to the importance of integrating sociocultural principles into AI-enhanced instruction—prioritizing collaborative and interactive learning alongside technical feedback.

The study challenges the assumption that AI feedback is only suitable for surface-level corrections by showing its effectiveness in enhancing higher-order writing skills as well. Yet, limitations remain, particularly in AI's contextual understanding and nuanced guidance, suggesting that optimal feedback effectiveness arises when AI and human feedback are thoughtfully combined, aligning with Ellis's (2010) framework and corroborated by meta-analyses. Pedagogically, the findings advocate for a blended writing instruction approach. AI tools can efficiently deliver personalized and timely feedback on grammar, vocabulary, and sentence structure, which can free teachers to concentrate on higher-order aspects such as argument development, critical thinking, and rhetorical skills. For this blend to succeed, teachers must adapt to new roles that embrace digital literacy and innovative practices, incorporating AI as a complementary instructional asset.

The study also highlights AI's role in promoting learner autonomy and self-regulation, providing immediate feedback and progress tracking to help students become independent and confident writers. To maximize this benefit, educators should train learners in effective AI tool

use and encourage reflection on feedback, fostering metacognitive awareness critical for self-regulated learning. Acknowledging challenges like reduced human interaction, over-reliance on AI, and limited contextual comprehension, the study recommends pedagogical strategies such as collaborative writing and peer feedback to maintain social and emotional learner support. Encouraging learners to critically assess AI feedback rather than accepting it uncritically ensures ethical and effective use of these technologies.

Future research could examine the long-term effects of AI-mediated feedback on writing proficiency and compare different AI tools' effectiveness on specific writing components, yielding more detailed insights into their relative strengths. Additionally, qualitative studies involving EFL instructors' perspectives would enrich understanding of how AI feedback is integrated into teaching practices. Combining quantitative writing assessments with qualitative measures of learner motivation and engagement in mixed-methods designs may further clarify the full impact of AI tools on EFL writing development.

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Conflict of Interest:

The authors declare no conflict of interest.

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