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THE EFFECT OF CHAT GPT AND GRAMMARLY ON IRANIAN INTERMEDIATE EFL STUDENTS ACADEMIC WRITING

Roya Akhlaghi
Faculty of Foreign Languages and Persian Literature, English Department, University of Tabriz, Tabriz, Iran.

Abstract
AI-supported writing tools like ChatGPT and Grammarly have attracted attention for their potential to provide second-language (L2) writers with immediate, personalized feedback. This quasi-experimental study investigated the impact of AI-assisted writing on the academic writing performance of EFL Iranian intermediate students. There were 55 students at the beginning of the study, and after homogenization with the OPT, 47 participants were selected and divided into an experimental group (n = 24) and a control group (n = 23). The pretests/posttests in both groups were argumentative writing tasks. In the experimental group, AI provided written corrective feedback to students while they wrote. It is worth noting that traditional teacher feedback was given to the control group. The one-way ANCOVA was used to analyze data. The findings indicated that AI-supported writing positively influenced learners' academic writing, with a statistically significant difference in favor of the experimental group. The results indicate that AI-supported tools can be considered acceptable complements for enhancing EFL learners' academic writing when used in concert with adequate pedagogical support.
Keywords: AI-assisted writing; academic writing; Chat GPT; Grammarly; EFL learners

Introduction

Internationalization of English as a Foreign Language (EFL) has made writing ability an important part of academic and professional success. In a foreign-language setting, such as Iran, where English is taught as a second language, writing is hard for intermediate learners. At this point, students are required to progress from simple sentence-level writing to producing coherent, well-organized, and rhetorically effective texts that many language learners struggle with because they lack linguistic resources and exposure to the conventions of academic writing .As such, intermediate EFL learners frequently experience difficulties in grammar accuracy, vocabulary acquisition, and text organization, all of which are critical to academic communication effectiveness. (Aldabbus & Almansouri, 2022; Campbell, 2019; Lestari, 2020). Many people who are learning or have learned a second language would like to become proficient English writers, which is perceived as a basic requirement (Santangelo & Graham, 2016). This importance stems from the fact that writing is a significant part of the target language and, as Hyland (2019) points out, is one of the formal ways to communicate with those around us in academic environments. On a practical level, writing and speaking in a foreign language also develop communicative skills beyond textbook learning, which is why L2 learners are often required to write. Consequently,

learners' sense of their learning and the quality of the offerings in their English courses regularly hinge on what they feel has been a change in both spoken and written proficiency (Hyland, 2016). There is one type of writing seen as central to influencing EFL student development: academic writing, a specific form of discourse that involves formality, objectivity, and argumentation supported by evidence. It is a key activity in the landscape of higher education, allowing students and researchers to build knowledge and write disciplinary views as they critically evaluate relevant literature (Hyland, 2019). Unlike free writing, academic writing demands following a rhetorical structure, accurate word use, and approaching argument development logically (which is a heavy burden for EFL learners) (Pratiwi, 2016). In it, argumentative texts hold a privileged position in academic genres most used in university writing, since tasks generally require students to make claims and support them with reasons that are soundly argued and supported by credible evidence from a rhetorical perspective (Connor, 1990; Hinkel, 2002). For EFL students, creating persuasive texts is not easy, as it requires integrating linguistic competence with higher-level thinking skills, which can pose enormous challenges (Pei et al., 2017).

Despite the significance of academic or argumentative writing, it can be difficult to provide EFL learners with opportunities for more personalised input in this area, particularly given class size and traditional teaching approaches. Feedback provided in written form, known as Written Corrective Feedback (WCF), plays an important role in fostering the accuracy and quality of writing. However, this correction procedure is time-consuming for teachers, and feedback might be delayed, making it less helpful pedagogically. In recent years, along with the rise of AIEd (Artificial Intelligence in Education), several AI-supported writing tools, such as Grammarly, have been developed that can provide real-time automatic feedback on grammatical accuracy, word choice, and text coherence (Chiu et al.,2023; Liu et al.,2021; Yan,223; Yu & Lee, 214).

In the digital era, artificial intelligence (AI) has become a topic of discussion across many areas of life, including higher education. Even in many universities, AI has been used in academic and administrative activities (Ahmad et al., 2023). AI has increased in educational use in recent years, mainly due to advances in technology, suggesting that technology can be used to improve learning and research (Alzahrani, 2023). Students' writing habits in academic writing and language learning are changing as a result of new technological developments. One aspect that is affected is the academic writing process.

The discussion on AI in education has recently been upended by the emergence of Generative Artificial Intelligence and Large Language Models (LLMs) like ChatGPT, which focus on generation, not just recognition or translation (Wang, 2025; Mo, 2025). Unlike earlier AI-informed writing support tools that mainly provided rule-based or statistical feedback on grammar and style (Widdows & Dension, 2019), such as LLMs, can generate fluent text, summarization (Zhao 2025), and even paraphrase. The emergence of such an AI age has dramatically changed the landscape for academic writing, seemingly marking EFL teaching as a double-edged sword. On one hand, LLMs can be used as strong drafting assistants that mitigate the cognitive burden of producing complex English text. They can produce text that resembles human text, which, on the other hand, raises fundamental issues regarding understanding writing and student work (Aljabr, 2024).

On the other hand, technological disruption has sparked a global debate over cheating and so-called student deskilling (Jovic, 2025). Teachers worry that developing content with the help of AI can circumvent the written language's requirement to grapple with cognitive challenges to develop a unique voice, thereby compromising academic writing as an endogenous learning activity. This sense of tension - between the potential for AI to act as a tool towards personal scaffolding, and at the same time as something that might be manipulated, again underscores why this work has been anchored in empirical investigation(Jovic, 2025).

As a result, research must go beyond exploring AI's presence in education to examine its pedagogical impact when implemented to learn, not to cheat purposefully.

While AI-facilitated writing has been investigated in a bevy of studies, the effect of AI-utilized WCF on Iranian intermediate EFL learners' academic writing ability remains underreported. In particular, as the generative abilities of LLMs have presented new threats to academic integrity, this paper attempts to set aside this issue by focusing on the impact of AI in purely corrective feedback (cf), a feature designed to specifically address the well-documented lack of timely and individualised WCF in EFL classes. AI-generated feedback has varied impacts, depending on learners' proficiency levels, linguistic backgrounds, and educational context (Song & Song, 2023; Zhang et al., 2025). To the best of our knowledge, few studies thus far have examined the effects of AI-assisted writing tools on major components such as grammatical accuracy, lexical complexity, and rhetorical appropriacy at an intermediate level within context-bound sociolinguistic and educational situations in Iran.

This is why the current research plans to address the impact of AI-supported writing tools on the academic writing of Iranian intermediate EFL students, specifically focusing on L2 learners' responses to AI-generated corrective written feedback. Based on Vygotsky's (1984) social constructivist theory, which describes learning as a process mediated by the interaction between the learner and a more knowledgeable other within the zone of proximal development, this study investigates whether artificial intelligence can serve as an effective scaffold to boost EFL learners' academic writing performance. Thus, the study aims to explore the impact of AI on the academic writing skills of Iranian EFL intermediate learners.

The study addressed the following research question and Hypothesis :

RQ. Does AI have any effect on Iranian intermediate EFL Students' academic writing?

NH. Does AI not have any effect on Iranian intermediate EFL Students' academic writing?

Theoretical Background

Vygotsky's (1984) Social Constructivism

This research is based on Vygotsky (1984) and his sociocultural-inspired perspective on learning, which emphasizes the importance of social interaction in learning. Vygotsky claims that learning occurs through dynamic interaction between the individual and her or his social environment, particularly in collaborative activities with more knowledgeable peers. Instead, cultural progress first appears in social forms and is later internalized at the individual level. The central idea of the Vygotskian social constructivist perspective is the Zone of Proximal Development (ZPD), which

refers to the difference between what a learner can do independently and what can be achieved with guidance from more able peers in co-construction. Engagement in socialization of L2 learning and seeking help from others helps learners reach ZPD with ease, demonstrating their capacity to work independently within the mediation of the language learning context, as a higher-level understanding of functioning at ZPD.

Vygotskian theory highlights the importance of the ZPD, in which students can perform beyond their independent level with support and assistance from more advanced others. Such a dynamic can be emulated with AI, such as ChatGPT, which has the potential to craft an environment that simulates these exchanges by providing instantaneous feedback, suggestions, and peer-support-like assistance. Through the use of AI-supported language-learning technology, learners not only interact socially but also dynamically, through an artistic lens, with previously unintelligent AI systems, as if they were intelligent and adaptive artificial peers. Although AIs are often conceptualized as personalized study support, our attempt to enhance writing and motivation is designed to encourage learners' sense of cooperation and socialization. Also, considering social constructivism and AI together enables investigation of how various levels of technological advancement can align with strong traditions of learning theory. AI can provide personalized feedback, and with associative AI, it can do so in real time. Learners are exposed to a wealth of linguistic materials and can customize their learning paths to view designer resources. literally enhancing their abilities. This mutual interaction between human learners and AI augments the collaborative learning atmosphere and could contribute to more effective learning of language and writing skills. Add reference

Feedback has been argued to have an overwhelming effect on writing performance and motivation in LLS (Bakla, 2020; Liu et al., 2022; Zhang & Zou, 2023). Although Vygotsky´s work supports the theoretical underpinnings of collaborative learning, there are many other articles on the effects of language feedback on writing and motivation. Feedback (from humans or AI) is critical for guiding learners toward progress (Loncar et al., 2023; Zhang & Zou, 2023). Teacher feedback has been central to writing instruction in mainstream composition, providing a rich source of feedback for portfolios rewriting and re-honing. Likewise, with AI-centered tutoring, users can share real-time feedback in ChatGPT's live mode and learn more tips for improving as writers. The dynamic of feedback and salience is thought to be a valuable framework for analyzing AI-assistance in language learning.

Artificial Intelligence

Artificial Intelligence (AI) is a field of computer science that emphasizes the ability of computers to perform tasks that, in the present, only human beings can do, such as learning and problem-solving (Russell & Norvig, 2010). Early definitions defined AI as the area in which a particular machine or computer system can be made to imitate human reasoning (McCarthy, 2004; Jia, 2009). More recently, AI has been defined as the ability of robots or computer programs to carry out tasks that humans can do, except better. However, definitions vary and tend to emphasize that AI is about replicating cognitive processes in computation rather than in biology (Copeland, 2023).

Artificial intelligence (AI) has gained rapid momentum and emerged as a disruptive force across various spheres, including education. Within the educational setting, machine learning-based technologies such as intelligent tutoring systems, chatbots, and adaptive learning platforms have been developed to assist teaching and learning. These applications and systems enable personalized learning through individualized content and feedback that meet learners' needs, thereby supporting their engagement (Li et al., 2019). Also, AI applications can help teachers automate non-teaching tasks, giving them time for pedagogical support. However, they highlight that AI should be a tool that supports teachers rather than taking over; human judgment and interaction are essential for effective education (Divekar et al., 2021).

Artificial Intelligence in Language Learning and Education

AI applications in education are gradually recognized as a support for learning and teaching rather than a replacement for the traditional mode of instruction (Chichekian & Benteux, 2022; Karan & Angadi, 2024). AI and Disruptive Innovation AI is also commonly understood as a disruptive innovation that challenges traditional roles, classroom practices, and learner autonomy (Schiff, 2021). Accordingly, the role of AI in an educational environment, and in particular in language learning, has been a subject of much concern and attention in recent literature.

Studies on AI-aided language learning suggest that AI tools help improve learners' vocabulary, pronunciation, autonomy, and motivation (Karasimos, 2022; Yuen & Schlote, 2024). Adaptive learning systems, for instance, are designed to personalize instruction by adjusting content to individuals' pace and learning level. Nevertheless, concerns about the limited context dependency, reduced public exposure to humans, or low creativity remain (Ali et al., 2024; de la Vall& Araya, 2022). Concern over the impact on academic integrity and originality brought on by the use of generative AI and large language models is of great importance. With the defense of conventional academic principles, the scholars would argue that we need ethical guidance, and that such guidance should also shape the interactions with technological advancements on a pragmatic level (Hutson, 2024)

Academic Writing

Academic writing is a formal form of communication that is used in academic circles to provide knowledge, critically analyze research, and facilitate disciplinary discourse. It is also clear, logically structured, and supported by credible sources to make claims (Hacker, 2016). Academic writing, in contrast to creative writing, focuses on accuracy, objectivity, and critical engagement with the current literature, rather than on individual expression and style (Loewe, 2023).

Academic writing requires more than just the ability to write grammatically correct texts; it must also be able to synthesize, form coherent arguments, and use language and style that are appropriate to the discipline. Avoiding ambiguity by the use of formal language, specific words, and sentence structure makes scholarly communication easier by boosting clarity and reducing ambiguity (McMillan, 2019; Walker, 2020). Academic writing is not only a subject that one must master to succeed in his or her education, but also in the employment sector where one needs to be articulate, analytical, and convincing in his or her writing (Lunsford & Connors, 2013).

Argumentative Writing

One of the central genres of academic discourse, argumentative writing, obliges a writer to take a definite stance on a problem and to discuss it with logical arguments and evidence. Persuasion of readers to buy the claims/ideas of the writer or to think critically is the main objective of argumentative texts (Yang, 2022). According to Aziz et al. (2023), argumentative writing is a conversation aimed at persuading the audience through rational argument rather than storytelling or description.

This genre also reflects the central values of academia, emphasizing evidence-based arguments, logical organization, and engagement with other perspectives. Unlike other genres, argumentative writing foregrounds arguments, counters, and justification and, as such, requires an extreme degree of analytical and rhetorical competence.

Cognitive and Linguistic Demands of Argumentative Writing

Argumentative writing poses extensive mental and linguistic challenges on students . Composing writers need to follow the higher-order thinking patterns, such as planning, analyzing, evaluating, and synthesizing, while controlling the usage of language (Peng et al., 2021; Hu & Saleem, 2023). Effective argumentation requires combining the reasoning process with linguistic input and background knowledge (Liu et al., 2023).

Besides cognitive complexity, argumentative writing requires a command of academic vocabulary, syntactic complexity, and textual cohesion. Students tend to juggle between language form and argument-building abilities, especially in cases where the requirements posed by language interfere with the production of content. As a result, argumentative writing is commonly perceived as more cognitively demanding than descriptive or narrative writing (Sehlström et al., 2022).

Argumentative writing is a cognitively and linguistically demanding task for students. Although composing involves multithinking and language processing (Peng et al., 2021; Hu & Saleem, 2023), writers need to perform higher-order thinking or cognitive skills such as planning, analysis, evaluation, and synthesis when writing. Effective argumentation involves the organization of argumentation by means of coordination of reasoning with the linguistic resources and domain knowledge (Liu et al., 2023).

Argumentative writing, like increasing cognitive complexity, also demands control over academic vocabulary, syntactic levels and textual cohesion. When the use of language competes with content creation, as it often does in writing instruction, students have difficulty attending at once to language form and argument development. Therefore, the genre of argumentative writing is often viewed as cognitively more demanding than descriptive or narrative (Sehlström et al., 2022).

Challenges for Intermediate EFL Writers

The type of academic and argumentative writing that intermediate-level EFL writers face is inherently problematic, with limited lexical resources and restricted cognitive knowledge of how genres evolve. These learners have also been observed to overemphasize lower-order errors such as grammar and vocabulary, so that their scores in planning, organizing ideas, and argumentation are negatively influenced (Sehlström et al., 2022). Cohesion and coherence Without (temporary)

storage of statement rationale, ELLs may "write in a fragmented manner" as they generate text that is less cohesive and coherent, and in fact, student writing might be marked by disconnected statements or tenuous links from one sentence to another; inability to demonstrate an idea with sufficient examples likely to fail at sufficiently motivating hypotheses intended for testing, because the testable human impact on some specified condition DR As such, their claim rationales may be overstated (Liu et al., 2023).

As well as the limitations of language, mid-level EFL writers lack comprehensive academic experience and are provided with little feedback on content and argument. The preoccupation with sentence-level correctness in teacher feedback rather than the quality of an argument provides scant encouragement for students to question how things are, which serves to produce better reciters but not become critiquer-orientated writers as genre(s) (Davies et al., 2022; Su et al., 2023). It is this linguistic limitation and failure to receive appropriate feedback that will keep me struggling when I write persuasive arguments for my classes!

Empirical Background

Early findings in English as a Foreign Language (EFL) writing consistently showed that students have had great difficulty in composing coherent and well-organized pieces of academic writing. Dwihandini et al. (2013) discovered that EFL students had difficulty with idea generation, organisation, and linguistic issues, which were related to their poor vocabulary size and weak grammatical control.Building up on these findings, Lestari (2020) discovered that EFL students in thesis-writing situations tended to develop issues with paraphrasing, selecting a topic and getting the methodology clear.

These problems were also associated with cognitive and affective obstacles, including low confidence and writing apprehension, suggesting the non-linguistic nature of writing competence (psychological and strategic).

With the emergence of technology, which has impacted language learning contexts, researchers have focused on studying the potential of technology-enriched instruction to facilitate writing development. Kaharuddin (2021) investigated the effect of integrating artificial intelligence (AI) into writing courses at the tertiary education level and found that AI-assisted reading and feedback activities indirectly enhanced students' writing performance by improving student attitudes.

Similarly, Hemas Kumala et al. (2021) found that integrating AI-empowered devices for EFL learners positively influenced student progress and teaching quality, suggesting a growing pedagogical relevance of smart digital devices in an EFL classroom.

Later investigations further examined how digital tools and collaborative technologies could be used to improve writing quality. Fauzan et al. Cite5 (2022); and Fitria (2022) discovered that numerous EFL students continued to encounter difficulties when organizing ideas, creating topic sentences, and writing cohesive paragraphs. However, these studies explained the problems through limited lexical and grammatical means or through over-reliance on translation devices. Consistent with these results, Rahman et al. (2022) found that students were relying more and more on AI-augmented writing applications, including autograding task assignments, computer-

generated forms of corrective feedback, or machine translation to grapple with these linguistic and organizational shortcomings.Although these tools were found to have a positive effect of writing fluency and accuracy, concerns of dependence and critical thought weakened.

Cuiping and Yanping (2023) used both qualitative and quantitative methods with Chinese EFL writers. They found significant improvements in coherence, vocabulary use, and grammatical accuracy in the written product with AI instruction-based writing. Rahimi and Fathi (2023) also reported enhanced self-efficacy, organization, and self-regulation among learners who received web-based collaborative writing treatment compared with traditional face-to-face instruction, suggesting that technology-supported writing tasks facilitate both cognitive and metacognitive development. Jishu (2023) employed the Zoho AI writing assistant and reported improvements in content, punctuation, order, and style; while a study by Utami et al. (2023) showed that AI-assisted writing offers technologically mediated support in research writing through topic development and idea generation.

Method

Participants

The population of this study consisted of Iranian EFL learners at an intermediate level studying at the Islamic Azad University in Tabriz, Iran. Fifty-eight students initially took part, all of whom had studied English for about 2.5 years at university. To maintain homogeneity, the OPT was given, and participants were selected based on scores that were one standard deviation above/below the mean. 47 students were selected as participants in the study; 23 were in the experimental group and 24 were in the control group, as they were in two intact classrooms. The participants were 13-20 years old, Azerbaijani Turkish was their first language, and Farsi was their second. Convenience sampling was employed.

Instruments

In this Study, four instruments were used to collect data

Oxford Placement Test

The first instrument of this study was the OPT (Oxford Proficiency Test); it consists of two parts, which were used to homogenize the study participants regarding their proficiency level. The first part of this test has 40 items. 5 items are related to assessing situations, 15 to cloze passages, and 20 to multiple-choice questions. The second part includes 20 items. Ten items are related to cloze passages, and the items are related to multiple-choice questions. The test is 40 minutes long. Participants whose scores were one standard deviation above and below the mean were selected as study participants .

Writing Pretest

In the third session, learners wrote their pretest. The topic was randomly selected from the 150 Best Freelance Essays for First Writing website, where the topics were standard. The researcher did not need to re-standardize with the help of the test teachers. The researcher randomly selected

ten topics and then gave them to the supervisor. She chose one of them as a topic for the pretest in the argumentative number, Is social media more beneficial or harmful to society? They were given 60 minutes to write their essay with a minimum of 220 words to determine their basic knowledge .

Writing Posttest

At the end of the treatment, in order to find out the effect of learning with language support on the written performance of language learners, a posttest of writing is held to understand any possible improvement in this language skill, comparing the possible improvement in the writing performance of learners and finding out its effect on the improvement of the participants. Language learners are asked to write their post-exams in the 15th session. The topics related to the post-exam are modified in order to reduce the level of familiarity and similarity with the subject matter of the test. The impact of social media. Does social media have a more positive or negative impact on society? Therefore, participants in the Study were required to write their posttest in 60 minutes and at least 220 words

Design of Study

The design of this Study was quasi-experimental. The quasi-experimental research method has many merits in educational Research, helping us answer questions by selecting subjects randomly and dividing them into two groups. One group, called the experimental group, receives treatment, and the other does not. Both groups receive a test before and after the treatment (Farhady, 1996).

` Procedure

The participants of the current study were 47 intermediate EFL students randomly selected from two intact classes at Islamic Azad University of Tabriz, Iran, who earned their scores on OPT. The chosen method was a nonrandom sample, and one class was trained as the experimental group, the other as the control group. Training was conducted over an 8-week period (total of 32 hours) in two 50-minute sessions per week. Both classes used the American English File 3 (Latham-Koenig, Oxenden, & Boyle, 2019) for the main textbook plus genre-based writing activities from Kotb and Watkins (2005)/Markozy et al. (2005).

A genre approach to writing was introduced across the two groups in five stages: introduction, modeling, guided practice, scaffolding and independent writing. In the CG, each student was provided both written and oral corrective feedback from the teacher featuring grammar mistakes, word items, organization and content. For the E group, students were taught to employ an AI-facilitated writing assistant (ChatGPT/ Grammarly) as a tool for automatic written corrective feedback (WCF) on their drafts. The AI tools offered instant suggestions on grammar, coherence and coherency.The students were asked to re-write the writing bearing comments by the system under teacher supervision. .

The pretest on writing skill was done before-intervention to confirm that no significant difference existed in the groups' writing ability. At the end of 8-week intervention, both groups took a writing posttest and grit scale. Pre and posttest essays were scored by two experienced EFL raters blind to group. Raters were trained using Heaton's (1988) analytic scoring rubric of content,

organization, vocabulary and language. The inter-rater reliability was ensured to guarantee objectivity and reliability of scoring.

Data Analysis

Data analysis was done through SPSS software. The descriptive and inferential statistical tests were employed: first, the homogeneity of participants was computed, and one-way ANCOVA was applied to determine the AI effect on learners' academic writing performance.

Results

Participant Selection

In order to be faithful to the objectives of the research, participants were selected on the basis of criteria previously defined. A sample of 56 intermediate-level English learners took the Oxford online placement test (OPT), which is a validated device to measure linguistic ability. This test was applied to verify homogeneity between the groups in language competence. For the highest possible score of 60 points, only participants falling into the range of ±1 standard deviation from the mean were enrolled in our sample. The distributions of the OPT scores of those candidates are compared between the original cohort and our study participants that are in Table 4.1.

Table 4.1

Descriptive Statistics of Initial and Selected Participants' Score on OPT

	N	Minimum	Maximum	Mean	Std. Deviation
Initial participants' score on OPT	58	25.00	44.00	34.76	4.37
Selected participants' score on OPT	47	30.00	39.00	34.42	2.78
Valid N (listwise)	47				

Descriptive statistics for the OPT scores of the initial pool of candidates (N = 58) and final participants (N = 47) are reported in Table 4.1. The first cohort had a wide score range, from 25.00 to 44.00 with an average proficiency score being 34.76 (SD = 4.37). To get a more homogeneous sample, the inclusion criteria were that the scores had to be within ±1 Standard Deviation (SD) of the mean (between 30.39 and 39.13). In the sample, participants selected had a reduced range of scores (min = 30.00; max = 39.00), with an average value of 34.42 (SD = 2.78). This smoothed spread suggests the improvement of homogenization treatment is demonstrated by a lower standard deviation (2.78 versus 4.37) with no sampling errors as can be cleared see in terms of outliers scores. The appropriateness of this choice is also substantiated by the listwise N of 47, meaning that there are no missing data in the final cohort.

4.2.2 The Inter-Rater Reliability Statistics for the Pretest and Post-test Writing Performance

To compare the mean scores of the two raters' pretest and post-test writing performance scores, the researcher used descriptive statistics. Table 4.2 indicates the results of this test.

Table 4.2

Descriptive Statistics of the Two Raters' Pretest and Post-test Writing Performance Scores

	Mean	Std. Deviation	N
Pretest Writing Scores Rater1	41.04	3.41	47
Pretest Writing Scores Rater2	41.13	3.96	47
Post-test Writing Scores Rater1	66.15	13.94	47
Post-test Writing Scores Rater2	66.55	13.83	47

As the results of Table 4.2 shows, the mean score of the first raters' pre-test writing score was 41.04(M=41.04) with the standard deviation of 3.41(SD= 3.41) while the mean score of the second raters' pre-test writing score was 41.13(M= 41.13) with the standard deviation of 3.96(SD= 3.96), correspondingly. On the other hand, the mean score of the first raters' post-test writing score was 66.15 (M=66.15) with the standard deviation of 13.94(SD= 13.94), while the mean score of the second raters' post-test writing score was 66.55(M= 66.55) with the standard deviation of 13.83(SD= 13.83), respectively.

Then, to ensure inter-rater reliability of participants' pretest and posttest scores, two raters scored the writing performance. To do so, the researcher used Pearson correlation. Table 4.3 demonstrates the results of this test.

Table 4.3

Inter-rater Reliability for the Participants' Pretest and Post-test Writing Performance Scores

		Pretest Writing Scores	Pot-test Writing Scores
Rater1			
	N	47	47
	Pearson Correlation	.889**	.992**
	Sig.(2-tailed)	.000	.000
Rater2	N	47	47
	Pearson Correlation	.889**	.992**
	Sig.(2-tailed)	.000	.000

As is presented in Table 4.3, following Cohen's (1988) guideline, there was a strong and significant correlation between scores of two raters at P=.889 &.992, thus indicating a very high consistency of the inter-rater reliability between the two raters for pre-test and post-test writing performance scores.

Descriptive Statistics of Pretest and Post-test Writing Performance between Control and Experimental Groups

To compare the mean scores of Iranian intermediate participants' pretest and post-test writing performance scores between control and experimental groups, the researcher administered an essay writing performance and grit questionnaire as a pretest and post-test to Iranian EFL participants. To do so, descriptive statistics including mean, and standard deviation were calculated. Table 4.4 shows the results of descriptive statistics of the participants' pretest and post-test scores.

Table 4.4

Writing Scores between Control and Experimental Groups

Groups		N	Mean	Std. Deviation
Control Group	Pretest Writing Scores	23	40.65	3.35
	Post-test Writing Scores	23	54.78	9.83
	Valid N (listwise)	23		
Experimental Group	Pretest Writing Scores	24	41.54	3.78
	Post-test Writing Scores	24	77.44	5.41
	Valid N (listwise)	24		

As Table 4.4 shows, the mean and standard deviation of Iranian participants' pretest writing performance scores in the control group were 40.65 and 3.35, respectively. This is while these indices for the post-test writing scores were 54.78 and 9.83. The pretest grit scores in the control group had a mean and a standard deviation of 56.00 and 3.05, respectively, while the mean and standard deviations for the post-test grit scores in the control group were 51.13 and 3.15, respectively. On the other hand, the mean and standard deviation of participants' pretest writing performance scores in the experimental group were 41.54 and 3.78, but the mean score and standard deviation of those post-test writing scores were 77.44 and 5.41,

Normality Distribution Test for the Pretest and Post-test Writing Performance between Control and Experimental Groups

To ensure the normality of the distribution of Iranian intermediate participants' pretest and post-test writing performance between control and experimental groups, One Sample Kolmogorov-Smirnov test was used. The results of this test are shown in Table 4.5.

Table 4.5

One-Sample Kolmogorov-Smirnov Test for the Intermediate Participants' Pre-test and Post-test Writing Performance in the Control and Experimental Groups

Groups			Pretest Writing Scores	Post-test Writing Scores
Control Group	N		23	23
	Normal Parameters[a,b]	Mean	40.65	54.78
		Std. Deviation	3.35	9.83
	Most Extreme Differences	Absolute	.135	.198
		Positive	.111	.102
		Negative	-.135	-.198
	Test Statistic		.135	.198
	Asymp. Sig. (2-tailed)		.200[c,d]	.120[c]
Experimental Group	N		24	24
	Normal Parameters[a,b]	Mean	41.54	77.44
		Std. Deviation	3.78	5.41
	Most Extreme Differences	Absolute	.141	.165
		Positive	.141	.165
		Negative	-.090	-.075
	Test Statistic		.141	.165
	Asymp. Sig. (2-tailed)		.200[c,d]	.091[c]

As it is indicated in Table 4.5, the significant value of Iranian intermediate participants' pretest and post-test writing performance and Grit scores between control and experimental groups was higher than .05. It means that Iranian intermediate participants' pretest and post-test writing performance and Grit scores had a normal distribution. Since the normality distribution assumption was met, the parametric test of One-way Analysis of Covariance (ANCOVA) can be used to answer the two null hypotheses.

Results of the Research Question

The research question concerned the significant effect of AI on the academic writing performance of Iranian intermediate EFL learners.

One-way between-groups analysis of Covariance (ANCOVA) was used to see whether there was a significant difference between the participants' post-test writing performance scores

between the control and experimental groups. Table 4.8 reports the results of this One-way ANCOVA test.

Table 4.6

One-Way Between Groups Analysis of Covariance (ANCOVA) for Intermediate Participants' Post-test Writing Performance Scores between Control and Experimental Groups

Dependent Variable: Post-test Writing Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6177.475[a]	2	3088.737	51.295	.000	.700
Intercept	689.279	1	689.279	11.447	.002	.206
Pretest Writing Scores	149.587	1	149.587	2.484	.122	.053
Groups	6177.467	1	6177.467	102.589	.000	.700
Error	2649.483	44	60.216			
Total	215742.750	47				
Corrected Total	8826.957	46				

4.5 Discussion

The aim of this study was to examine the impact of AI on the academic writing achievement of Iranian intermediate EFL learners. The findings revealed that the AI-equipped group significantly outperformed the control group, indicating that AI-based tools can significantly enhance the accuracy, organization, and overall quality of writing. An explanation may lie in immediate, personalized, and consistent feedback from AI, which can result in timely adjustments to one's writing, encourage learner autonomy, provide scaffolded practice that facilitates additional practice opportunities, and support learning by reducing anxiety, particularly within large classroom settings with little teacher feedback.

These findings are also supported by sociocultural and cognitive theories of language learning: providing AI feedback scaffolds learners' ZPD (Vygotsky, 1978), is behaviorally rewarding for the learner (behaviorist), offers comprehensible input that is also slightly above the current level (Krashen, 1982), and encourages noticing of form (Schmidt, 1990). So too, the process-oriented affordances of AI, multiple drafts and iterative revision, are compatible with process-writing approaches, and they account for some of what we have observed.

The results are consistent with a recent growing empirical literature indicating that AI and automated writing tools have positive effects on writing fluency, accuracy, coherence and attitudes (e.g.,Dian,et al., 2022; Kaharuddin, 2021), Haryanto & Ali,2018; Rahman et al., 2022; Ranalli, 2021; Li et al.; Jishu; Klimova; Zhao Maqbool & Bilal;Kızıltaş;Tan Ziar). Various tools seem to cater for various aspects of writing (e.g., Grammarly in regard to punctuation and syntax, generative models for idea development) implying adjunctive rather than substitutable positions of AI technologies (Zhang & Hyland, 2022).

However, as we particularly do with qualitative work and previous research, there are important caveats. Other learners perhaps also appeared to exhibit signs of an unhealthy reliance on the AI generated advice uncritically accepted without independent test, raising doubts around questions of originality, authenticity and ethical propagation of higher order critical engagement (Li, 2023; Dwivedi & Thakur., 2023; Farooqi et al., 2024; Cotton et al., 2023). AI feedback may also be contextually mistaken, not to mention vague, again pointing toward human oversight and teacher intervention (Kessler, 2021; Dang, 2024).

The practical implications are twofold: AI has the potential to take on an enriching role as an EFL add-on resource, especially where individual teacher correction is scarce, and it sets out to increase flexibility for reaching higher revision cycles and decreasing burnout by supporting a more adaptive approach. Simultaneously, the anti-misuse measures (education on the importance of critically thinking of the recommendations offered by AI, educational digital literacy initiatives, faculty-level attitudes to academic dishonesty, etc.) and equity concerns (digital access to internet and digital and technological literacy) will need to be addressed (Rehman and Abbas, 2023).

Conclusion

This study investigated the effect of AI-based writing Tools on Iranian Intermediate EFL Learners' Academic Writing Performance. The results showed that students in the AI-generated written corrective feedback group significantly outperformed those in the control group, indicating that AI can be used as a support to help students acquire academic writing skills. These findings suggest that, in their attempts to revise and eventually achieve greater learner autonomy, students may benefit from both immediate and scaffolded feedback.

Despite the advantages above, the results also highlight the need for pedagogical oversight to avoid excessive reliance on AI and ensure the integrity of academic assignments. Hence, AI-based writing should be used as a complementary aid and not a substitute for an instructor's guidance. Further studies are needed to investigate the impact of AI use on learners' long-term CT and originality, as well as the effectiveness across proficiency levels (e.g., beginner vs advanced) and instructional contexts.

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