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The Role of Digital Literacy in Mediating ChatGPT's Impact on Writing Abilities and Perceptions of Iranian EAP Students

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Abstract

Academic writing has emerged as a central area of inquiry among researchers specializing in English as a Foreign Language (EFL) writing. Utilizing a mixed-methods research design, the current study aimed to explore the mediatory role of digital literacy in the writing improvement of EAP learners in a ChatGPT-supported writing course. Following the administration of the Oxford Placement Test (OPT) and digital literacy questionnaire, a cohort of 100 upper-intermediate learners from a non-profit university in Mazandaran, Iran was randomly selected. The participants were then split into two experimental groups (high vs. low digital literacy) and two control groups (high vs. low digital literacy), with each group consisting of 25 participants. The experimental groups received writing instruction that incorporated ChatGPT, while the control groups were taught implementing traditional pedagogical methods devoid of ChatGPT. Data were gathered through pre- and post-writing assessments along with semi-structured interviews. Results from the pre- and post-tests indicated that the experimental groups with either high or low digital literacy exhibited significantly superior academic writing outcomes compared to the control groups. However, no notable disparity was evidenced between the two experimental groups. Analysis of the interviews revealed that ChatGPT contributed greatly to their writing accuracy and fluency, while creating several challenges namely the generation of inappropriate responses and limited access. On implication side, suggestions are offered for prospective EAP students, teachers, teacher educators, and syllabus designers along with a sketch of possible avenues for further exploration.

Keywords: English for academic purposes (EAP), L2 writing, ChatGPT, digital literacy

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1. Introduction

A major drawback of product-based approaches to L2 writing is their adherence to copying and transforming models of correct language without considering the processes involved (Hasan & Akhand, 2010). The process-oriented methodologies, on the other hand, give primacy to student agency and active participation in writing. These approaches foster discovery-based learning and collaborative interactions, offering new avenues for improving writing skills (Hyland, 2006).

With the sky-rocketing developments in technology, scholars have commenced examining the effectiveness of Artificial Intelligence (AI) and generative chatbots like ChatGPT in L2 writing (Hong, 2023). Since its public unveiling in 2022, ChatGPT has been the subject of extensive research, not least because of its potential to offer personalized, contextualized, and interactive feedback (Lingard, 2023). By engaging in conversations with AI bots, students can enhance their speaking and writing skills within a low-pressure environment (Mohamed, 2023). Essentially, ChatGPT simulates real-life communication scenarios, enabling students to practice English in authentic contexts. Through conversations that mirror everyday interactions and engaging in an enjoyable learning environment, students can cultivate fluency, accuracy, and confidence in using the English language (Baskara, 2023). ChatGPT has been successfully tested as a writing companion or tutor to assist learners in editing their grammar, vocabulary, spelling, punctuation, and tone (Fitria, 2021).

These virtual assistants have the potential to create a feeling of closeness with students, offering support without criticizing their failures (Petrova & Mikheeva, 2021). The automated responses by chatbots provide real-time assessment of students' writing, directing their attention to the gaps in their transitional interlanguage and helping them redress specific areas for improvement (Durall & Kapros, 2020). An additional benefit of using AI tools is their role as an assistant to reduce the teacher's workload in managing feedback to crowded classes where one-to-one interactions become too demanding due to stringent time constraints (Nguyen, 2023). In EAP contexts, where the main motivation is to advance academic language proficiency (Du & Alm, 2024), ChatGPT is posited to have great potential to expedite crucial tasks such as planning, brainstorming, retrieving, and reviewing (Abdel Latif, 2013; Lingard, 2023).

Given the relentless progress of technology, digital literacy is now a fundamental skill crucial for excelling across various academic and professional contexts. EAP learners with higher digital literacy are better poised to acclimate to novel technologies, software applications, and digital platforms (Roche, 2017). Hence, the imperative is underscored for EAP students to cultivate proficiency in the effective utilization of digital technologies within their domain. Platforms such as ChatGPT, capable of delivering instantaneous feedback and assistance to learners, hold promise in mitigating some of the obstacles associated with dispensing individualized feedback in the realm of teaching academic writing (Guo & Wang, 2024). As such, this avenue merits exploration within the field of language education.

Academic writing remains a significant challenge for EAP learners, particularly in contexts where English is a foreign language, such as Iran. Despite extensive efforts to improve writing skills, Iranian EAP students often struggle with accuracy, fluency, and the effective use of academic language, which can hinder their academic success and professional development. National studies have highlighted that many Iranian students face difficulties in mastering academic writing conventions due to limited exposure to authentic writing practices and insufficient individualized feedback (Arianmanesh & Khani, 2019; Ndoricimpa & Nduwimana, 2023; Oskoui et al., 2024). Internationally, the rapid advancement of AI technologies, such as ChatGPT, has introduced new opportunities and challenges in language education. Research indicates that AI-powered tools can provide personalized, real-time feedback and foster learner autonomy, yet their integration into EAP writing instruction remains underexplored, especially regarding how learners' digital literacy influences their ability to benefit from such technologies (Guo & Wang, 2024; Lingard, 2023).

Given these challenges and the emerging potential of AI tools, there is a pressing need to investigate how digital literacy mediates the impact of ChatGPT on the writing abilities and perceptions of Iranian EAP students. Addressing this gap will contribute to more effective pedagogical strategies and support the development of digital competencies essential for academic success in the 21st century. Thus, this study sought to unravel the impacts of employing ChatGPT on the writing proficiency of EAP students with respect to their digital literacy. Guided by the study's objectives, the following queries were constructed:

RQ3. Do Iranian EAP students with higher or lower digital literacy benefit differentially from ChatGPT in the course of their L2 academic writing?

RQ4. What are the Iranian EAP students' perceptions about their writing development through using ChatGPT?

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2. Theoretical Framework: Social Learning Theory

According to psychologist Albert Bandura's social learning theory, learning occurs as individuals observe and replicate the behaviors demonstrated by others in their environment. This theory emphasizes the importance of social interactions, observational learning, and reinforcement as a mechanism for altering human behavior. According to social learning theory, individuals attain abilities and insights by observing, replicating, and receiving reinforcement for their actions. The theory also highlights the role of cognitive processes in learning, suggesting that individuals actively engage in mental processes such as attention, retention, reproduction, and motivation when acquiring new behaviors (Bandura, 1997).

In the context of language education and academic writing instruction, Social learning theory creates a structure for understanding how writing skills are learned and cultivated. By modeling and communicating with others, students can acquire writing strategies, techniques, and conventions through modeling and imitation. Social learning theory stresses the value of peer collaboration, feedback, and support in the learning process (Nabavi, 2012). Through social interactions with peers, teachers, and online tools like ChatGPT, students can uplift their writing proficiency by observing and imitating effective writing practices. Incorporating ChatGPT into writing classes is consistent with social learning principles as it grants the students a virtual platform for interaction, feedback, and modeling. ChatGPT can serve as a virtual writing partner that offers real-time assistance, suggestions, and feedback to students as they engage in the writing process (Baskara, 2023). By interacting with ChatGPT, students can observe and learn from the model responses generated by the AI tool, thereby enhancing their writing skills through imitation and practice. ChatGPT supplies students with custom feedback and direction, adapting to their unique learning profiles, promoting active engagement in the writing process, and nurturing a conducive educational milieu that mirrors the principles of social learning theory (Baskara, 2023).

2.1 The Role of Digital Literacy in Language Learning

In today's tech-driven world, digital literacy is now a critical competency in numerous disciplines, including education. Roche (2017, p. 73) depicts digital literacy as "the ability to access, critically assess, use and create information through digital media in engagement with individuals and communities". Embedding technology into language pedagogy not only eases access to a wealth of resources but also enables more interactive and personalized learning environments (Danilov et al., 2020; Lingard, 2023). It is argued that digital literacy facilitates the utilization of adaptive learning technologies, which customize learning experiences to address individual student requirements. For example, AI-driven platforms like Grammarly offer real-time feedback on writing, guiding learners to detect and amend grammatical inaccuracies while harnessing their writing skills (Şengel et al., 2014). Another critical aspect of digital literacy in language teaching is the facilitation of collaborative learning. Digital tools such as Google Docs, Padlet, and collaborative annotation platforms empower learners to team up on tasks, brainstorm collectively, and give real-time feedback to peers (Oz et al., 2015).

Research indicates that a higher level of computer literacy correlates with better engagement and outcomes when using AI tools in language learning. For instance, students who are adept at using digital platforms tend to show increased autonomy in their learning processes, particularly when leveraging AI for feedback and writing prompts (Little et al., 2024). This autonomy fosters a proactive approach to writing, allowing learners to take advantage of immediate corrections and personalized suggestions provided by tools like ChatGPT (Zhang, 2024). Moreover, computer literacy facilitates the development of feedback literacy, which is the competence to understand, interpret, and effectively utilize feedback for improvement. Studies have highlighted that learners with strong feedback literacy can better utilize the immediate and contextualized feedback from AI systems, leading to enhancements in writing quality and complexity. Conversely, students with limited computer skills may struggle to fully engage with AI-generated resources, thus missing out on potential learning benefits (Karunarathne et al., 2023). Previous studies show that digital literacy and ability to use Web 2.0 tools, such as wikis, blogs, and podcasts, positively affect individuals' levels of performance (Mohammadyari & Singh, 2015). Others (Ahmed & Roche, 2021; Roche, 2017) documented the link between digital literacy and general academic performance in EAP learners.

2.2 Related Empirical Studies

Barrot (2023) studied the merits and drawbacks of ChatGPT application in L2 writing tasks. He found that ChatGPT offered several advantages, including providing language input, generating coherent text, and assisting with writing tasks. It could help address challenges such as timely feedback and organizational difficulties. However, it struggled with nuanced writing elements like emotional depth and rhetorical flexibility. Concerns included over-reliance undermining critical thinking and creativity, and potential plagiarism issues. The study recommended a balanced approach where students write original content and then refine it with ChatGPT.

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Research by Su et al. (2023) disclosed that ChatGPT aids learners in generating content and streamlining the writing process by assisting with outlining, revision, proofreading, and reflection. This is particularly significant for L2 writers who often struggle with higher-order components of writing, including organization and argumentation, compared to their native-speaking peers. Harunasari's study (2023) demonstrated that integrating ChatGPT into EFL writing classrooms can be effective when implemented with strategic approaches. Key strategies included: timing integration, peer feedback, monitoring usage, promoting critical thinking, and fact-checking. Most students found ChatGPT helpful for idea formation and grammar assistance. However, concerns about over-reliance and technical issues were noted. The study concluded that ChatGPT can support EFL writing when used responsibly and strategically.

In a more recent study, Bibi and Atta (2024) found that students generally viewed ChatGPT positively and reported satisfying experiences when using it as an English writing assistant, appreciating its helpfulness in various aspects of writing tasks. The majority of participants found ChatGPT easy to use, effective, accessible, and more convenient than other AI tools. Many students frequently used ChatGPT for writing tasks and believed it could improve their overall writing skills. Interviews further supported these findings, highlighting ChatGPT's ability to generate creative, well-structured content and enhance writing productivity.

In a scoping review, Azadnia (2024) analyzed 28 peer-reviewed articles on integrating ChatGPT into language learning for non-native speakers. The review found that most studies focused on EFL contexts, particularly in China, and examined the outcomes of integrating ChatGPT on the writing performance of language students. The studies employed various research designs, with descriptive surveys being common in non-intervention studies. The review highlighted several positive outcomes of using ChatGPT, including progress in grammar, vocabulary, reading, and writing as well as its potential to enhance teaching practices and foster critical thinking and motivation. However, it also identified significant concerns such as academic integrity issues, privacy violations, cultural biases, and over-reliance on the tool. The review highlighted the need to recognize ChatGPT's capabilities and constraints for effective integration into language learning.

Mahapatra's study (2024) found that leveraging ChatGPT as a means of formative assessment markedly boosted the academic writing proficiency of undergraduate ESL students within the experimental group. The data indicated a statistically significant boost in writing performance from pre-test to post-test and delayed post-test relative to the control group. Students of the experimental group demonstrated improvements in content generation, idea organization, and grammatical accuracy. Insights gathered from focus group discussions reinforced these outcomes, with students noting that ChatGPT assisted them to stay focused, come up with relevant ideas, improve sentence structure, and understand grammar concepts through explanatory feedback.

Fathi and Rahimi's study (2024) employed Vygotskian social constructivism to investigate how AI-supported writing mediation affects EFL learners' academic writing skills. Fourteen students preparing for the IELTS exam used ChatGPT for interactive writing tasks, receiving implicit and explicit support to refine their writing. The study monitored learners' progress, observed their interactions with ChatGPT, and maintained reflective journals. Results showed that AI-mediated support significantly improved academic writing competencies. Think-aloud interviews revealed positive attitudes towards AI-supported writing mediation, highlighting its effectiveness in enhancing academic writing skills.

Du and Alm's (2024) qualitative study explored English language students' perception towards ChatGPT acting as an academic support platform for EAP learners. It used self-determination theory to examine how ChatGPT influenced students' needs for competence, relatedness in language learning, and autonomy. The experiment found that ChatGPT supported autonomy and competence by enabling flexible learning, delivering personalized responses, and creating a safe space for practice. However, its effect on relatedness was mixed, with some students feeling companionship and others concerned about less human interaction. Despite the substantial body of research examining ChatGPT's role in writing instruction over the past few years, little is known about its influence on the academic writing progress of EFL learners, particularly in regions like Iran where digital literacy levels may vary. This study seeks to investigate how integrating ChatGPT into the writing practices of EAP students affects their writing abilities in relation to their digital literacy.

3. Methodology

3.1 Design of the Study

This project implemented a mixed-methods research model to comprehensively investigate the research inquiries through both qualitative and quantitative lenses. The quantitative component focused on assessing the extent to which ChatGPT advances the academic writing competence of Iranian EAP subjects with varying levels of digital literacy. Conversely, the qualitative aspect delved into the perceptions of Iranian EAP students regarding their writing progress

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facilitated by the utilization of ChatGPT. The quantitative phase was executed in a quasi-experimental manner by analyzing students' writing assessments before and after the intervention. In contrast, semi-structured interviews were employed to qualitatively delve into the EAP students' perspectives on the interventions.

3.2 Participants

The participants consisted of Iranian EFL students from a non-profit university in Mazandaran, Iran. The sample comprised 100 students selected from a total population of 150 individuals attending a non-profit university in Mazandaran, Iran. The participants were categorized by gender, with 63 males and 37 females, aged between 23 and 30. Notably, the participants were BA and MA students taking an academic writing course at the university, with Farsi as their native language. Prior to data collection, their proficiency was determined by administering the Oxford Quick Placement Test (OQPT), confirming an upper-intermediate proficiency level based on scores ranging from 40 to 47 (Geranpayeh, 2003). Furthermore, the participants displayed a similar level of proficiency, as indicated by their pre-test writing assessments categorizing them as low-graded writers on a rating scale (Jalilifar & Hemmati, 2013). The mean values of the participants varied from 60 to 62 among the four groups, reinforcing their classification as low-graded writers (Jalilifar & Hemmati, 2013). For the study's purpose, the students were divided into two experimental groups (differing in digital literacy levels) and two control groups (also varying in digital literacy levels), each comprising 25 students. The four groups are as follows:

Experimental group 1: ChatGpt with higher digital literacy

Experimental group 2: ChatGpt with lower digital literacy

Control group 1: Conventional instruction with higher digital literacy

Control group 2: Conventional instruction with lower digital literacy

In terms of participant selection, the study employed purposeful convenience sampling to identify suitable candidates. This approach, as advocated by Dornyei (2007), involves selecting participants readily available at the time of the study and intentionally targeting specific individuals. Given the researcher's teaching role at the university and the logistical challenges of conducting EAP writing instruction at universities, participants were chosen from BA and MA programs in diverse disciplines such as Chemistry, Mathematics, Management, Electrical Engineering, Computer Science, and Architecture Engineering within the university. It is noteworthy that ethical considerations and confidentiality of all students were carefully observed, with their voluntary participation in the study being emphasized.

3.3. Instrumentation

3.3.1 Oxford Quick Placement Test (OQPT)

The OQPT was employed to ascertain the proficiency levels of the participants and to ensure their homogeneity as upper-intermediate students. This assessment instrument comprises three sections encompassing grammar, reading, and vocabulary. Participants were required to respond to multiple-choice, matching, and cloze exercises within a designated time frame of 60 minutes. The scoring system of the test categorizes candidates into 6 levels of English proficiency: beginner (0-17), elementary (18-29), lower-intermediate (30-39), upper intermediate (40-47), advanced (48-54), and advanced (55-60). This widely recognized test is known for its validity, with its reliability supported by various studies, including Geranpayeh (2003). Specifically, the test's reliability was verified using the Kuder-Richardson 21 formula, which resulted in a high reliability coefficient of 0.86.

3.3.2 Writing Pre- and Post-Test

To assess the participants' initial writing proficiency and investigate the impact of treatment sessions on their EAP writing accuracy, pre- and post-tests in writing were given to the subjects. Each participant was tasked with composing an essay comprising a minimum of 250 words within a 40-minute timeframe. The prompt for the essay was drawn from an IELTS exam (IELTS 5) question titled *"Learning about the past has no value for those of us living in the present. Do you agree or disagree?"* Participants were instructed to articulate their stance on the topic using specific reasons and examples to substantiate their argument. They were expected to clearly articulate their thesis and subsequently bolster their assertions with logical reasoning supported by evidence or illustrative instances.

The written responses from the pre- and post-tests were evaluated by three raters, all possessing an MA in TEFL, to assess the students' performance in academic writing. The inter-rater reliability for both the pre- and post-tests was computed using Cronbach's Alpha, yielding coefficients of .83 and .86, respectively. These values indicate a satisfactory level of internal consistency throughout the assessment (Farhady et al., 1994).

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3.3.3 Rating Scale

The evaluation of the students' writing performance in the pre- and post-tests was conducted utilizing Jalilifar and Hemmati's (2013) assessment rubric. This rubric encompassed multiple criteria, including organization, vocabulary, content, language proficiency, and mechanical accuracy. The grading scale delineated four proficiency levels: ranging from excellent to very poor. Jalilifar and Hemmati (2013) stipulated a definitive threshold score of 63, designating scores falling below this range (between 34 and 62) as indicative of lower proficiency levels, while scores surpassing 63 were indicative of higher proficiency levels. Noteworthy is the composition of three raters with a minimum of six years' experience in teaching IELTS, ensuring consistency in the rating process through the resolution of any potential ambiguities.

3.3.4 Semi-Structured Interview

In order to investigate the learners' perspectives on the enhancement of their writing accuracy facilitated by the utilization of ChatGpt, a cohort of ten participants from the experimental groups was randomly picked to participate in a semi-structured interview subsequent to the intervention. The interview inquiries were modified from the work of Bibi and Atta (2024), which addressed both the merits and drawbacks of using ChatGPT. It is pertinent to highlight that the semi-structured interview sessions were audio documented. The validity of the interview queries was meticulously assessed by three MA graduates in TEFL to ascertain their relevance and alignment with the research objectives.

3.3.5 Computer Literacy Questionnaire

To examine the comparative levels of digital literacy among EAP students, a validated questionnaire devised by Son et al. (2011) was administered prior to the treatment. The questionnaire encompassed five distinct sections: Section I (background information); Section II (utilization of computer applications); Section III (queries pertaining to computer proficiency - "Do you & Can you?"); Section IV (assessment of computer knowledge through a set of ten questions); and Section V (factors influencing the utilization of computers). To gauge the reliability of the questionnaire, Cronbach's alpha was run and calculated as .89.

3.4 Procedure

The study's objectives were addressed through purposeful convenience sampling to select participants from a non-profit university. The researchers conducted the necessary administrative procedures to obtain legal permission, ensuring that participants were thoroughly briefed on the objectives of the study and providing informed consent to uphold ethical standards and ensure participant anonymity. Taking part was optional, and individuals were free to withdraw. The four study groups received foundational information on academic essays and were provided with ten essays sourced from Bailey (2003) and Bill (2011) as study materials, with additional sources added at the discretion of the instructor, who also served as the researcher, attended ten academic writing sessions, each two hours long utilizing ChatGpt. Notably, there were two experimental groups categorized by varying levels of digital literacy among EAP students, each matched with a control group. Prior to the intervention sessions, a digital literacy questionnaire was administered.

EAP students with varying levels of digital literacy participated in writing instruction in a technologically advanced classroom setting, equipped with desktop computers and internet access. A ChatGPT account was established for each participant, with the instructor offering introductory guidance on integrating ChatGPT into language learning practices. To enhance the academic writing skills of EAP learners, ChatGPT was used to strengthen students' comprehension of a range of connectors and paragraph structures in academic writing. This approach recognized the significance of metadiscourse markers and text structures in scholarly writing, aiming to help learners better grasp how these elements contribute to coherent and effective writing. Regarding the instruction on metadiscourse markers, the educator tasked ChatGPT with presenting the prevalent types of markers and their respective applications in writing, engaging in discussions with the learners to facilitate internalization. Following this, students were given a blank essay, which required them to work in pairs and groups to choose suitable markers and discuss their functions collaboratively. As a final activity designed to refine academic writing skills, students worked in groups with ChatGPT to select their own topics and focus on using the most appropriate metadiscourse markers within the essay's context. The instructor provided feedback throughout the process to persuade students to thoughtfully incorporate these markers into their writing.

In relation to the instruction on text structure, students were presented with detailed guidance concerning the organization of written compositions and the structuring of paragraphs. The teacher utilized ChatGPT to inquire about the content and alignment of each paragraph with the standards of essay composition. Students engaged in exercises

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within the ChatGPT platform to practice writing introductory, supporting, and concluding statements, with any uncertainties being clarified by the teacher. Additionally, students were tasked with selecting their own topics and focusing on creating graphic organizers and exploring various essay structures. Subsequently, group discussions were held to evaluate each composition, with the instructor facilitating essential feedback.

In contrast to the experimental groups subjected to the intervention involving the utilization of ChatGPT, the control group underwent traditional language training. Notably, participants in the control cohort received conventional writing instruction devoid of exposure to the ChatGPT platform. The control group engaged in customary academic writing instruction based on the principles delineated in Hinkel's textbook (2004). The instructor's objective was to acquaint the learners with the conventions of academic writing and elucidate the requisite standards for scholarly composition. Emphasis was placed on elucidating linguistic norms by the instructor, who demonstrated the crafting of essay segments to exemplify paragraph construction and the nuanced development of various components. The instructor emphasized clarifying linguistic norms by demonstrating how to construct essay segments, illustrating paragraph structure and the detailed development of various components. The primary goal was to assist learners to grasp the structural framework of paragraphs and the importance of supporting thesis statements with evidence in academic writing. After the instructor briefed about structure topic sentences, central ideas, and supporting arguments, students were asked to choose individual topics and develop them into written compositions.

Finally, it is crucial to mention that students took pre- and post-writing tests to trace changes in academic writing proficiency across the groups. Furthermore, semi-structured online interviews were completed with ten participants from the experimental groups.

3.5 Data Collection

Data for the study were collected using a mixed-methods approach that incorporated both quantitative and qualitative research techniques. Initially, all participants completed the Oxford Quick Placement Test (OQPT) to confirm their upper-intermediate English proficiency and ensure group homogeneity. Subsequently, participants filled out a digital literacy questionnaire to categorize them into high and low digital literacy groups. Before the intervention, a writing pre-test was administered, requiring students to write an essay on an IELTS prompt within 40 minutes. This pre-test established baseline writing proficiency. Following the intervention—ten two-hour academic writing sessions using ChatGPT for the experimental groups and traditional instruction for the control groups—a writing post-test was conducted with the same essay prompt. The pre- and post-test essays were independently rated by three experienced TEFL raters using Jalilifar and Hemmati's (2013) rubric, ensuring reliability through inter-rater agreement statistics.

To gain deeper insight into students' experiences and perceptions of using ChatGPT, semi-structured interviews were conducted with ten randomly selected participants from the experimental groups after the intervention. The interview questions, adapted from Bibi and Atta (2024), focused on the benefits and challenges of ChatGPT in improving academic writing. Interviews were audio-recorded with participants' consent and later transcribed for thematic analysis. All data collection procedures were conducted in a controlled classroom environment equipped with computers and internet access. Ethical considerations, including informed consent, voluntary participation, and confidentiality, were strictly observed throughout the study.

3.6 Data Analysis

Pre- and post-tests were utilized to assess the writing proficiency of the participants, while semi-structured interviews were employed to delve into their perspectives on the intervention sessions. Data analysis encompassed both quantitative and qualitative techniques tailored to respond to each research question. Quantitative research questions (RQs 1–3) underwent statistical analysis using descriptive and inferential approaches, incorporating paired samples t-tests and one-way ANOVA conducted using SPSS software (version 24). The learners' viewpoints on the intervention sessions were scrutinized through qualitative content analysis following Dornyei's (2007) framework, which involves categorizing data based on emerging themes from interview transcripts. The researcher identified meaningful units within the text, such as words, phrases, or sentences, and allocated them to distinct categories. Subsequently, upon categorizing all transcripts, the data were analyzed to unveil patterns, connections, and themes within the interviews.

4. Results

4.1 Addressing Research Question One

Examining whether there was any statistically marked disparity between the effects of using ChatGPT on Iranian EAP students' academic writing development with higher and lower digital literacy was the first objective of the study. To respond to this research question, the writing proficiency assessments administered before and after the intervention were subjected to descriptive and inferential analyses utilizing SPSS software. Prior to conducting these analyses, it

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was essential to assess the normal distribution of data, as depicted in Table 1, in order to ensure the appropriateness of subsequent statistical procedures.

Table 1. Kolmogorov-Smirnov normality distribution for the four groups

	Statistic	df	Sig.
Ex-higher-pre	0.152	25	0.200
Ex-higher-post	0.095	25	0.200
Ex-lower-pre	0.125	25	0.200
Ex-lower-post	0.125	25	0.200
Control higher -pre	0.149	25	0.160
Control higher-post	0.161	25	0.082
Control lower -pre	0.159	25	0.170
Control lower -post	0.167	25	0.062

Table 1 presents the significance values (*Sig* = .200) for the pre- and post-tests of writing conducted on the experimental groups categorized by higher and lower literacy levels. Furthermore, the corresponding significance values for the pre- and post-tests of the control group, distinguished by higher literacy (*Sig* = .160; .082) and lower literacy (*Sig* = .170; .062), are displayed. Notably, all p values for the four groups exceeded the threshold of .05, indicating adherence to the data normality. This normality facilitated the application of parametric statistical analyses such as paired samples t-tests and one-way ANOVA. Table 2 illustrates the results of descriptive statistics for the pre- and post-test tests of four groups.

Table 2. Descriptive statistics for the writing pre- and post-tests of the four groups

						95% Confidence Interval for Mean	
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
Pre	Ex-higher	25	60.00	6.339	1.188	58.86	64.38
	Ex-lower	25	61.00	6.593	1.239	57.52	62.84
	Control-higher	25	60.50	5.443	1.089	58.47	62.97
	Control-lower	25	60.60	5.303	1.002	58.59	62.19
Post	Ex-higher	25	64.00	6.546	1.229	62.43	67.77
	Ex-lower	25	65.00	6.361	1.192	60.86	66.34
	Control-higher	25	61.00	5.431	1.086	58.56	63.04
	Control-lower	25	61.20	5.233	1.080	58.46	62.83

Table 2 illustrates the progression observed in two experimental groups from pre-test to post-test assessments. The instructional approach of utilizing ChatGPT significantly affected the academic writing advancement of Iranian EAP students, as evidenced by the descriptive statistics reflecting mean scores and standard deviations at the pre-tests (*M* = 60.00, *SD* = 6.33; *M* = 61.00, *SD* = 6.59) and post-tests (*M* = 64.00, *SD* = 6.54; *M* = 65.00, *SD* = 6.36). In contrast, the control group exhibited minimal improvements descriptively in their pre-test (*M* = 60.50, *SD* = 5.44; *M* = 60.60, *SD* = 5.20) and post-test (*M* = 61.00, *SD* = 5.43; *M* = 61.20, *SD* = 5.23) performances. The data suggests that prior to intervention, learners demonstrated comparable levels of proficiency based on descriptive metrics, yet notable disparities emerged in their post-test outcomes. Subsequently, Inferential analysis was applied to evaluate mean

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differences across the four groups, requiring that the variance among groups be homogeneous as determined by Levene's test for the subsequent implementation of one-way ANOVA, as delineated in Table 3.

Table 3. Levene's test of homogeneity of variances

		Levene Statistic	df1	df2	Sig.
pre	Based on Mean	1.160	3	96	0.331
post	Based on Mean	0.738	3	96	0.530

As to Table 3, homogeneity assumption for the variances of the study groups was met since all the *sig.* values are more than .05. Table 4 provides the results of one-way ANOVA.

Table 4. One-way ANOVA for the writing pre- and post-tests of the four groups

		Sum of Squares	df	Mean Square	F	Sig.
pre	Between Groups	31.310	3	10.433	0.243	0.869
	Within Groups	3965.280	96	41.311		
	Total	3996.590	99			
post	Between Groups	812.680	3	270.883	7.290	0.000
	Within Groups	3577.360	96	37.259		
	Total	4390.040	99			

Table 4 reveals that the pre-test scores did not differ significantly across the four groups ($F_{3,96} = .243$, $p = .86$) because the significance level is more than .05. Nonetheless, the post-test results demonstrated significant differences ($F_{3,96} = 7.29$, $p = .00$) as the level of significance is less than .05. Table 5 illustrates several comparisons between the four groups in terms of writing accuracy.

Table 5. Post-Hoc Scheffe test for the writing post-tests of the four groups

		Mean Difference			95% Confidence Interval	
(I) CODE2	(J) CODE2	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Ex-higher	Ex-lower	-1.000	1.727	.809	-2.83	4.03
	control-higher	3.000*	1.713	.001	.97	7.83
	control-lower	2.800*	1.699	.002	.88	7.23
Ex-lower	Ex-higher	1.000	1.727	.809	4.03	2.83
	control-lower	3.800*	1.700	.001	.37	7.13
	control-higher	4.000*	1.623	.001	.29	6.98

Table 5 indicates a marked disparity between the experimental and control groups with higher digital literacy ($p = .001<.05$), and the experimental and control groups with lower digital literacy ($p = .001<.05$) regarding EAP students' academic writing development. Finally, the two experimental groups showed no notable disparity ($p = .80>.05$). According to inferential results, the third null hypothesis of the study was confirmed since no marked disparity was detected in the effects of ChatGPT on the academic writing ability of Iranian EAP students with higher and lower digital literacy.

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4.2 Addressing Research Question Two

The second RQ gained insights into the students' views on how the using ChatGPT contributed to the improvement of their writing skills. The analysis of the students' views was conducted through Dornyei's (2007) content analysis framework. Their viewpoints were classified into two main categories namely benefits and challenges. Each category was further elaborated upon to highlight the nuances of the students' perceptions. Additionally, excerpts from interviews were incorporated to provide a more thorough understanding of the participants' perspectives. The benefits accruing from using ChatgPT were summed up into two main themes: 1) improved writing accuracy; and 2) enhanced writing fluency as follows:

4.2.1 Benefits

Improved Writing Accuracy

Students of the experimental groups unanimously stated that working with ChatGPT helped them improve their writing skills. They noted that various aspects of their written work, such as sentence structure, grammar, vocabulary usage, and overall coherence were positively affected. They affirmed that by interacting with ChatGPT they had the opportunity to get immediate feedback on their writing, enabling them to unsurface and remedy errors more effectively. As a result, they became more conscious of their language choices and developed a better understanding of how to express their ideas clearly and accurately in written form.

Furthermore, they stated that a key benefit of using ChatGPT was its ability to provide real-time suggestions and corrections as students write. This immediate feedback allowed students to address mistakes as they occurred, helping them internalize proper grammar rules and sentence structures. They reported that ChatGPT's capacity to suggest alternative vocabulary choices could expand students' word banks and encouraged them to use more varied and sophisticated language in their writing. By exploring different synonyms and expressions recommended by ChatGPT, students could enhance the depth and richness of their writing, rendering their work more engaging and compelling. Additionally, ChatGPT's analysis of sentence structure could guide students in crafting well-structured and coherent paragraphs.

In conclusion, the interactive nature of ChatGPT provided students with a valuable tool for honing their writing skills and achieving greater accuracy in their written work. By benefiting from ChatGPT's feedback and suggestions, students could refine their grammar, expand their vocabulary, improve their sentence structure, and upgrade the entire coherence of their writing. This holistic approach to writing practice could lead to significant growth in students' proficiency and confidence as writers. Based on the students' interviews, all (n = 10) concurred that they could improve their writing accuracy through using ChatGpt. Examples of students' responses testifying the positive effects of ChatGPT are given below. It is worth mentioning that interviews were conducted in Persian and English equivalents were provided below:

Extract 1:

"As a student, I have found that integrating ChatGPT into my writing practice has significantly improved my grammar skills. The real-time suggestions provided by ChatGPT have helped me correct common grammatical errors and refine my sentence structures. I believe that this interactive feedback mechanism has been crucial in sharpening my writing accuracy".

Extract 2:

"I can attest to the fact that using ChatGPT has broadened my vocabulary repertoire and enhanced my overall writing coherence. Through consistent interactions with ChatGPT, I have acquired new words and phrases that have enriched my writing style. Additionally, the platform's ability to analyze and suggest improvements in my sentence structure has contributed to a more polished and cohesive writing output. I credit ChatGPT for playing a pivotal role in elevating my writing accuracy to a higher level".

Enhanced Writing Fluency

Further exploration revealed that ChatGPT enhanced the students' writing fluency. By engaging with ChatGPT's real-time feedback and suggestions, learners found that they were able to express their ideas more easily in English. The interactive nature of ChatGPT prompted them to consider alternative vocabulary choices, refine their sentence structures, and improve the overall flow of their writing. Subsequently, participants reported feeling more comfortable and proficient in articulating their thoughts in written form, leading to a greater fluency and ease in writing.

In addition to boosting their confidence, students noted that using ChatGPT helped them develop a more natural and fluid writing style. By incorporating the feedback and suggestions provided by ChatGPT, learners found that they

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could craft sentences and paragraphs with greater clarity and coherence. This enhanced language fluency not only improved the quality of their writing but also allowed them to communicate their ideas more effectively. Overall, students appreciated how ChatGPT contributed to their growth as writers, enabling them to express themselves with greater fluency and precision. As to students' interviews, almost all (n = 9) believed that through ChatGpt they could enhance their writing potential in terms of writing fluency, as shown in the following extracts:

Extract 3:

"I've noticed a significant improvement in my writing fluency since I started using ChatGPT. The real-time feedback and suggestions have helped me refine my language choices and sentence structures, allowing me to express my ideas more confidently and cohesively. I feel like I can now write with greater ease and fluency, which has positively impacted the quality of my work".

Extract 4:

"ChatGPT has been instrumental in enhancing my language fluency. By incorporating its suggestions and corrections into my writing, I've been able to develop a more natural and fluid writing style. I now feel more comfortable expressing my thoughts in English, as ChatGPT has helped me improve the clarity and coherence of my writing. This newfound fluency has not only boosted my confidence but has also made my writing more engaging and effective".

4.2.2. Challenges

The themes related to the challenges facing the students using ChatGPT were categorized into two primary types: inappropriate responses and limited access. These categories are elaborated upon below.

Inappropriate Responses

Upon further exploration, it transpired that a primary challenge with ChatGPT was its sensitivity to the nature of prompts. The success of ChatGPT in delivering useful feedback was closely tied to how well-crafted the prompts were, with clear specifications regarding the type of feedback required. Students noted that when prompts were vague or poorly constructed, ChatGPT often failed to provide relevant or accurate feedback. However, they recognized that only after iterative prompting could they obtain more detailed and satisfactory information.

Moreover, students expressed frustration when they encountered limitations due to poorly constructed prompts. They noted instances where they received responses that were either off-topic or lacked depth because the initial prompt did not provide enough context or detail. This led to a trial-and-error process that consumed time and hindered their writing progress.

Extract 5:

I spent a lot of time trying different ways to ask my question before I finally got a useful response. Sometimes I feel lost trying to figure out what information to include.

Extract 6:

When I asked ChatGPT for help with my essay, writing very general prompts, the response was completely off-topic. I spent a lot of time trying different ways to ask my question before I finally got a useful response.

Limited Access

Another concern highlighted by the students was related to their limited access to ChatGPT due to internet censorship and unavailability of platforms like Google Play. As a result, they were left seeking alternative methods, such as using virtual private networks (VPNs), to bypass these restrictions. Apart from access to the app, they also complained about the content filtering of ChatGPT, which prohibited their access to their intended information. Many learners reported that the filters often prevented them from receiving relevant responses, especially when they sought assistance on sensitive or complex topics. This left them feeling disappointed in their learning process, as they were unable to obtain the information they needed to enhance their understanding of the topic.

Extract 7:

I encountered challenges in downloading the application due to restrictions imposed by Google Play. Each time I intended to utilize ChatGPT, it was necessary for me to activate my VPN. Complicating matters further, not all VPN services were capable of providing reliable access to ChatGPT, which limited my ability to fully utilize its features.

Extract 8:

Whenever I try to ask about specific historical events or controversial issues, I get blocked responses. It feels like I'm hitting a wall every time.

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5. Discussion

The research findings revealed that using ChatGPT markedly enhanced academic writing skills of Iranian EAP students, regardless of their digital literacy levels. This finding suggests that the positive effects of ChatGPT outweighed its shortcomings and learners were affected more by its affordances than limitations. Although low digital literacy resulted in missed learning opportunities, it did not substantially hinder learners' progress in mastering L2 writing skills. This observation can be attributed to ChatGPT's multiple functions, which include its user-friendliness and promptness, making it versatile and beneficial for diverse users (Bibi & Atta, 2024; Sakirin & Said, 2023). From a social learning theory perspective, Iranian EAP students with diverse degrees of digital literacy engaged with ChatGPT, a conversational AI system built to generate human-like text according to user input. This interaction allowed them to observe and learn from the model's outputs, facilitating their language development. By observing how ChatGPT generated responses and suggestions for their writing, students could learn new vocabulary, sentence structures, and writing techniques through imitation and practice (Bandura, 1997). Although ChatGPT is an artificial intelligence tool, its interactive nature simulates a social interaction between the student and the system. Through this interaction, students engaged in a form of collaborative learning where they received feedback, guidance, and support from ChatGPT to improve their writing skills (Baskara, 2023).

Drawing on the qualitative data, employing ChatGPT in academic writing instruction for EAP students showed promising outcomes in enhancing writing accuracy. Firstly, ChatGPT's skill in providing on-the-spot feedback and suggestions about grammar, syntax, and vocabulary errors enabled students to identify and correct mistakes more efficiently, which resonate with conclusions pointed out by Lingard (2023). Our findings are also commensurate with Barrot's (2023) claim that by receiving instant feedback from ChatGPT at different stages of writing, students can address errors as they occur, leading to a more iterative and focused approach to writing improvement. This immediate feedback loop not only assisted the students to upscale their writing accuracy but also reinforced their planning, retrieval, and reviewing, thereby contributing to the development of their composing rate and writing fluency (Abdel Latif, 2013).

Another prominent result concerned the ChatGPT's provision of personalized feedback which, as argued by Harunasari (2023), aids students in understanding and applying grammatical rules and conventions effectively. The personalized nature of ChatGPT's feedback tailors suggestions to individual students' needs, allowing for targeted support in areas where students may struggle, ultimately contributing to enhanced writing accuracy (Mahapatra, 2024).

Last but not least, the responsive and involvement-promoting features of ChatGPT as a writing tool, which were highlighted in Azadnia's (2024) descriptive research, could motivate students to engage deeply with the writing process and strive for steady progress. The instant responses and guidance provided by ChatGPT created a dynamic learning environment that encouraged students to experiment with different language choices and structures. This experimentation fostered a deeper understanding of language mechanics and encouraged students to take risks in their writing, leading to increased confidence and proficiency.

More scrutiny disclosed that using ChatGPT posed several challenges to the learners, notably inappropriate responses and limited access. Our findings corroborate the notorious claim in the literature about ChatGPT's sensitivity to prompt quality. Research indicates that when prompts are vague or poorly constructed, ChatGPT might yield irrelevant or inaccurate responses (Chan & Hu, 2023). Moreover, when users provide detailed and well-structured prompts, ChatGPT is more likely to generate relevant and accurate outputs (Fathi & Rahimi, 2024; Oskoui et al., 2024). Further analysis revealed that learners faced limitations in content scope, a challenge frequently associated with AI tools like ChatGPT (Ray, 2023). Additionally, participants pointed out difficulties in accessing the application due to internet censorship in Iran, which restricts access to major platforms such as Google Play and Telegram. To circumvent these restrictions and access blocked applications, users often resort to using Virtual Private Networks (VPNs) (Hashemzadegan & Gholami, 2022).

6. Conclusion

The quantitative results of this research provided compelling evidence that integrating ChatGPT in the academic writing instruction substantially promoted EAP students' writing abilities. It indicated that students with either high or low digital literacy benefitted substantially from ChatGPT with only minimal difference in their achievements. Drawing on the qualitative findings, the participants expressed confidence in the improvements in their writing accuracy and fluency resulting from the integration of ChatGPT in the classroom while acknowledging some challenges such as inappropriate responses and limited access. Indeed, the qualitative data gathered through interviews corroborated the quantitative findings, adding depth to the study's results and highlighting the perceived benefits of using ChatGPT beyond statistical measures. Overall, the research suggests that ChatGPT holds promise as a valuable

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tool for improving academic writing skills among Iranian EAP students, offering a versatile and effective means of supporting language learning and development in educational settings.

The integration of ChatGPT for enhancing academic writing skills among Iranian EAP students has significant pedagogical implications for various target groups. EAP teachers can rely on ChatGPT as a supplementary tool to provide personalized feedback and support to students, helping them identify common writing errors, suggest improvements, and develop their writing skills. By incorporating ChatGPT into their teaching practices, EAP teachers can enhance the quality of feedback provided to students and promote independent learning. For Iranian EAP students, the use of ChatGPT offers opportunities to receive instant feedback on their writing, improve language skills, and enhance academic writing proficiency. L2 learners can resort to ChatGPT as a self-study tool to practice writing, expand vocabulary, and refine their writing style. Engaging with ChatGPT enables students to gain a deeper understanding of effective writing strategies and strengthen their mastery over writing.

Teacher educators play a crucial role in preparing future EAP teachers by incorporating training on AI tools like ChatGPT into teacher preparation programs. Educators can explore how ChatGPT can be integrated into EAP curriculum design and assessment practices to support student learning outcomes. By familiarizing EAP teachers with the merits and pitfalls of using AI tools in language instruction, teacher educators can promote effective implementation strategies. Developers of EAP materials can collaborate with AI experts to create customized ChatGPT-based resources in line with special needs of Iranian EAP students. By designing writing tasks and prompts that align with ChatGPT's capabilities, material developers can provide targeted support for students' academic writing development. Incorporating AI-driven tools like ChatGPT into EAP materials enhances interactivity, engagement, and effectiveness of learning resources.

The present study yielded positive findings; however, it faced a number of constraints which need to be taken into account. This study focused exclusively on ChatGPT as an AI-driven tool for supporting the writing development of EAP students. Other AI tools such as Complexity AI, Character AI, and Gemini could also be examined to compare their efficiency with that of ChatGPT. The academic Task 2 of IELTS was examined in this study; future researches could examine the usefulness of ChatGPT in relation to Task 1 & 2 of the General Module as well as other skills (e.g. reading, speaking, and listening). A significant finding of the current study was the students' challenges in formulating appropriate prompts, which often resulted in receiving irrelevant responses. Therefore, a dedicated study on how to develop prompt literacy among AI users is worth exploration.

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