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The Impact of AI-Based Group Dynamic Assessment on L2 Writing Proficiency

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Abstract

The development of (G)DA and AI technologies, including AI chatbots, has a substantial impact on EFL learners' writing skills in EFL writing instruction. Previous studies have shown that dialogic interactions in graduated mediation (G)DA enhance learners' engagement and motivation, assist them in internalization and self-regulation, and promote L2 writing abilities. However, the feedback generated by AI chatbots with human-generated mediation in group dynamic assessment (GDA) on EFL writing proficiency has been unexplored. This exploratory study examines the implementation and effects of integrating AI-generated feedback with human-generated mediation in group dynamic assessment (GDA) on EFL writing proficiency. The participants were 45 upper-intermediate female EFL learners randomly assigned into three groups: one receiving teacher-mediated AI-based GDA (N = 15), one receiving teacher-mediated GDA (N = 15), and a control group in conventional writing classes. The t-test results revealed that learners in the AI-based GDA group performed better on the post-test after completing the 12 intervention sessions over six weeks. ANOVA results showed significant differences among the three groups in their post-test scores, which indicated the outperformance of the AI-based GDA group. Further, in response to the interview, the AI-based GDA group admitted that their L2 writing abilities improved due to gaining autonomy, increasing motivation, and enhancing collaboration during the intervention. The findings suggest using AI chatbots like ChatGPT and human mediation as technological dynamic assessment mediators to enhance L2 writing proficiency. Integrating AI and DA seems promising in extending EFL practices by providing individualised fine-tuned feedback and broadening EFL learners' self-regulatory practices.

Keywords:
Group dynamic assessment, Artificial Intelligence, AI chatbots, Chat-GPT, writing proficiency

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Introduction

English writing proficiency is an essential skill in EFL contexts. In general, Iranian EFL learners face several challenges in improving their writing abilities (Aghajani & Salehi, 2021), which may hinder their development in writing skills, such as sentence structure, vocabulary usage, and coherence (Rasekh & Tolue, 2009). Obstacles, including limited resource availability, overcrowded classrooms, and diverse student skill levels, pose substantial challenges to providing effective writing instruction (Naghdipour, 2016) and necessitate innovative instructional approaches and technological advancements to enhance learning outcomes. In this vein, implementing dynamic assessment (DA) as an approach that intermingles teaching and assessment seems promising.

Based on Vygotsky's Sociocultural Theory of Mind (SCT), DA emphasizes evaluating an individual's potential for learning and development by focusing on practical activities (Lantolf & Poehner, 2004; Lantolf & Poehner, 2014) rather than solely measuring their current abilities. Poehner (2008) argues that assessment and instruction are the two sides of the same coin. In DA, the teacher mediates when the learner faces a challenge in the learning process to address their learning needs collaboratively (Poehner et al., 2017), as Vygotsky (1978) believed that learning occurs in a social context. DA is delivered either as an interventionist or an interactionist process, where standardized in-advance support and graduated emergent assistance are provided to learners, respectively (Poehner, 2008; Shrestha, 2020). Interventionist and interactionist DA may target a person or an entire class, i.e., group dynamic assessment (Poehner, 2009). Collective mediation in GDA targets individual students and their peers. In concurrent GDA, brief individualised interactions are typical, but in cumulative GDA, individuals take turns during interactions (Poehner, 2009). Mediation leads to independent functioning, which means developing learners' Zone of Proximal Development (ZPD) (Poehner, 2008). ZPD is the gap between one's current abilities and the potential level of development (Vygotsky, 1978), which is brought to the surface by actively engaging in mediation provided by tools such as technology-based ones or humans' reciprocal interaction (Kozulin, 2003; Wertsch, 2007). According to DA's theoretical underpinnings, Artificial Intelligence (AI) can effectively play the mediator role and enhance L2 learning skills (Ai, 2017; Jeon, 2023)

Utilising (G)DA and AI technologies, including AI chatbots, in EFL writing instruction substantially impacts EFL learners' writing skills. Previous studies have proven that dialogic interactions in the form of graduated mediation in (G)DA enhance learners' engagement and motivation, assist them in internalisation and self-regulation, and promote L2 writing abilities (Afshari et al., 2020; Rezai et al., 2024; Mallahi & Saadat, 2020; Shabani, 2018). In the same vein, AI chatbots are considered useful pedagogical tools that pave the way for personalised language learning experiences,

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increase writing confidence and motivation, and provide useful on-the-spot feedback (Guo & Li, 2024; Guo et al., 2022; Guo et al., 2023; Su et al., 2023; Zhang et al., 2023). The existing body of literature has highlighted the benefits of dynamic assessment in enhancing EFL writing abilities by utilising both human mediation and technology interventions. There is a scarcity of research integrating group dynamic assessment with AI chatbots such as ChatGPT in EFL writing instruction. To the researchers' best knowledge, only Jeon (2023) investigated the effect of Chatbot-Assisted Dynamic Assessment (CA-DA) on vocabulary learning. The study involved fifty-three Korean EFL primary school learners who were randomly assigned to three groups: Chatbot-Assisted Dynamic Assessment (CA-DA), Chatbot-Assisted Non-Dynamic Assessment (CA-NDA), and a control group. The results showed that the CA-DA group's vocabulary growth outperformed the other groups. This suggests that CA-DA can support vocabulary learning while providing diagnostic information about students' vocabulary acquisition.

With empirical studies on (G)DA and ChatGPT-assisted EFL writing, a notable gap exists in the literature regarding the integration of AI chatbots with GDA techniques for EFL writing development and the exploration of EFL learners' viewpoints. The combination of GDA with AI chatbots, such as ChatGPT, signifies a notable progression in EFL writing pedagogy, a sector that remains underexplored. This combination is significant as it integrates the collaborative and interactive elements of GDA with the new functionalities of ChatGPT, thereby overcoming the constraints typically associated with conventional DA approaches. ChatGPT's capabilities align perfectly with DA principles, providing prompt, context-specific feedback on written prompts or text files, allowing for subsequent modifications. This is particularly advantageous for students who thrive on iterative learning methodologies. By utilising AI's ability for real-time engagement, educators can cultivate a more responsive and engaging learning environment that enhances the continual development of writing skills.

Furthermore, the amalgamation of GDA and ChatGPT could revolutionise collaborative learning environments by improving writing skills and fostering participation. This combination has the potential to offer fresh perspectives on how collaborative learning settings and AI-powered technologies might enhance writing proficiency and engagement in terms of accuracy (using precise and correct lexical items), appropriacy (using suitable lexical and functional items in specific contexts), and textual organisation (how to organise the text). This would help bridge the literature gap and advance the field of EFL writing instruction. The following research questions guided this study:

What is the impact of AI-based GDA on EFL writing proficiency?

Which AI-based GDA approach is more effective in improving EFL writing proficiency?

What are the participants' perceptions of AI-based GDA in EFL writing?

Literature review

DA and GDA in EFL writing

(G)DA addressed learners' previous and potential abilities that should emerge (Sternberg & Grigorenko, 2002) through social interaction and ZPD-tuned mediation (Dann, 2014). Lantolf et al. (2015) emphasize the advantages of dynamic assessment for children with special needs. This approach, via scaffolding and mediation, offers an alternative to conventional assessment approaches. Poehner (2007) elaborates on the concept, highlighting that dynamic assessment questions the idea that individual performance is the only measure of abilities. Mediation, whether through human interaction or technological assistance, is essential in (G)DA as it enhances learning and delivers personalised interventions to individuals. Mediation refers to using signs or guidance provided by teachers or technology to enhance ongoing activities and improve learning outcomes (Davin et al., 2016).

Several studies have investigated the effectiveness of (G)DA for EFL writing. Afshari et al. (2020) conducted a survey of 60 Iranian EFL learners, finding that GDA techniques enhanced learners' self-regulation and academic writing abilities, particularly among low-ability learners, and were positively perceived by both students and teachers. Similarly, Xian (2020) demonstrated that interventionist DA and online scoring systems significantly improved the writing accuracy of Chinese EFL learners. In an exploratory case study, Kushki et al. (2022) compared interventionist and interactionist DA approaches for argumentative writing among five EFL learners. The results showed that learners in the interactionist group improved significantly and were more responsive to mediation.

Beyond conventional DA methods, Rezai et al. (2022) found that online peer-dynamic assessment effectively enhanced writing proficiency among high school students through peer feedback and collaborative learning among Iranian EFL learners. This study emphasises the potential of online platforms to facilitate DA implementation. Furthermore, Sherkuziyeva et al. (2023) explored the effect of computerised dynamic assessment (C-DA) on test anxiety, writing performance, and oral proficiency of 64 Iranian EFL learners. The findings suggested that C-DA improved learners' written and oral skills by providing an anxiety-free atmosphere. Zhang and Xi's (2023) research explored a different application of DA, focusing on metacognitive competence and self-regulated writing among 64 Chinese EFL learners. The results showed that DA improved self-regulated writing skills and positively impacted their attitudes toward writing confidence.

Abdulaal and Al-Johani (2024) compared dynamic and non-dynamic assessments. They found that Saudi EFL learners in the dynamic assessment group outperformed them

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in writing and positively perceived this instructional experience. Additionally, the study by Fard and Derakhshi (2019) highlighted the positive impact of dynamic assessment on promoting writing linguistic accuracy and test performance among EFL learners. This review highlights the growing body of research supporting the efficacy of DA and GDA for enhancing EFL writing skills.

Enhancing Lesson Planning with AI Integration

The education sector is experiencing a new wave of innovation with the emergence of Artificial Intelligence (AI). Artificial intelligence (AI) utilises machine learning, natural language processing, and neural networks to mimic human intelligence on computers (Hamet & Tremblay, 2017). Like other human endeavours, language teaching relies on constantly selecting materials, activities, and methods (Tsui, 2003). This suggests that AI can potentially influence these crucial decisions in language teaching.

The emergence of generative AI has sparked growing interest in its potential applications in education. As Peterson et al. (2021) pointed out, the 21st century has witnessed significant changes in teacher-teaching practices, primarily due to technological advances such as AI. The effective integration of artificial intelligence (AI) technologies into education (Bai et al., 2024; Barton & Dexter, 2020) can be undeniably influenced by educators' perceptions of their own abilities. Educational AI tools help with lesson planning by offering pedagogical frameworks, differentiated activities, and engaging multimedia content. These AI-powered solutions hold immense potential to enhance learning by offering students new and engaging ways to acquire knowledge. Developing lesson plans is a crucial step for teachers, as it allows them to integrate technology (such as AI) to improve teaching effectiveness and address diverse student needs. This process is essential for new teachers, as it helps them develop critical teaching skills, including reflection, assessment, and media selection (König et al., 2020). In another study, Gràcia et al. (2023) stated that primary school teachers can improve their efficacy by incorporating artificial intelligence (AI)-based technology into their EFL instruction. Asadi and Taheri (2024) highlighted that integrating AI with a teacher's instructional approach significantly enhances students' learning outcomes in language learning classrooms, demonstrating the potential for improved engagement and personalised feedback.

AI can transform how teachers plan lessons by allowing them to personalise learning experiences and respond even more effectively to diverse student needs (Uysal & Yüksel, 2024). Similarly, Wu (2024) emphasised that lesson planning is time-consuming and that teachers must consider various aspects such as objectives, activities, and teaching methods. He suggests that Large Language Models (LLMs) can offer valuable support by streamlining this process. Wu indicated that LLMs, such as ChatGPT, can act as "idea generators" that can help teachers brainstorm writing prompts and

discussion topics aligned with specific learning objectives. This can save teachers valuable time that would have been previously spent developing these elements. Additionally, Wu acknowledged the importance of differentiated instruction, where assignments are tailored to students' proficiency levels.

Ong and Annamalai (2024) claimed that technology can be a powerful tool to enhance learning by adding value and enhancing the effectiveness of instruction. However, many teachers still require additional training and support to integrate technology into their classrooms effectively. Similarly, Asadi and Taheri (2024) suggested that implementing AI-powered learning support systems in a phased manner in academic environments could bring significant benefits and lead to a more effective learning experience for students. AI-based educational platforms and applications can tailor learning experiences to meet the individual needs and knowledge levels of each student. This closer alignment leads to a more efficient learning process for everyone.

Previous studies have primarily focused on the integration of AI in education. Recent research suggests that AI tools have significant potential to improve the adult EFL lesson-planning process (Uysal & Yüksel, 2024). The existing literature highlights the considerable impact of AI in EFL teaching. However, no research articles on "To Teach AI" integrated lesson planning and its implications for EFL teacher training could be found. Notably, there is a critical gap in the literature and a lack of research on "To Teach AI" integrated lesson planning and its implications for teacher training. This study aims to fill this gap by exploring teachers' perspectives on "Teach AI." By delving deeper into teachers' experiences with "To Teach AI," this research aims to provide practical insights for educators and help them develop these technologies in the future. This in-depth investigation aims to contribute to a deeper understanding of how AI tools can be utilised in the context of EFL classrooms and inform future research on AI-assisted lesson planning in this domain. Understanding how teachers perceive and use "To Teach AI" will be critical to maximising their effectiveness in supporting and enhancing student learning experiences.

AI chatbots and ChatGPT in EFL education

AI chatbots are sophisticated conversational systems that imitate human-like interactions via text-based interfaces, messaging apps, websites, and mobile applications. These computer systems have diverse applications in education, customer service, healthcare, and other fields (Mashilo & Shekgola, 2024). AI chatbots are becoming increasingly prevalent in education to assist students' learning, deliver customized feedback, and enhance student engagement (Wu & Yu, 2023). The use of AI chatbots in educational environments aims to enhance learning outcomes, facilitate self-directed learning, and provide timely support to students (Asadi & Taheri, 2024; Lin & Yu, 2024). The Generative Pre-Trained Transformer (GPT), developed by OpenAI, is a prominent

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example of AI chatbot technology. ChatGPT has garnered considerable popularity due to its capacity to explain complex issues in a user-friendly manner, produce high-quality texts, and interpret text meaning (Adeshola & Adepoju, 2023; Gleason, 2022). The impact of ChatGPT on education is well acknowledged, and there are some cautions regarding its use (Tlili et al., 2023; Vargas-Murillo et al., 2023). AI chatbots are becoming more advanced as they incorporate natural language processing and machine learning technologies. This advancement is expected to enhance their ability to understand and respond to user input, leading to more sophisticated and efficient conversations (Lin et al., 2023; Abdulkader & Al-Irhayim, 2022; Manigandan & Sivakumar, 2024).

Language education is one of the primary beneficiaries of AI and ChatGPT. An overarching concept evident in the literature is the beneficial impact of AI chatbots on learners' motivation. In a quasi-experimental study, Silitonga et al. (2023) demonstrated that an AI chatbot increases English writing motivation and engagement by providing immediate constructive feedback. Likewise, Hawanti & Zubaydulloevna (2023) found that ChatGPT–based writing instruction reduces Indonesian EFL learners' writing anxiety by providing immediate feedback without making them feel rushed. In addition to providing motivational advantages, Song and Song (2023) found that ChatGPT enhanced academic EFL writing proficiency in organisation, coherence, grammar, and vocabulary. In a subsequent study, Xiao (2024) investigated the impact of ChatGPT as an AI writing assistant for EFL learners. It was found that the group that used ChatGPT during the pre- and post-writing stages performed better in terms of content, structure, and language use. Li et al.'s (2024) quasi-experimental study among Chinese students further confirmed that ChatGPT significantly contributes to writing performance in terms of content quality and language expression.

Method

Design

This study employed a sequential exploratory mixed-methods approach, consisting of two distinct phases, to investigate the incorporation of GDA and ChatGPT in English EFL writing education. The initial quantitative phase utilised a pretest-posttest control group design to evaluate the influence of group dynamic assessment and ChatGPT on the participants. One experimental group was provided instruction incorporating GDA mediated by the instructor and utilising ChatGPT as the technology-based mediating tool (TAIGDA group). In contrast, one experimental group and the control group adhered to teacher-mediated group dynamic assessment (TGDA) and conventional writing instruction without mediation. The qualitative data collection involved individual online interviews to understand learners' viewpoints on combining the AI chatbot with the teacher's mediation.

Participants

This study was carried out at a private language institute in Iran. After receiving consent forms from three intact classes and the institute regarding the study's aims, procedures, and participants' rights to voluntarily participate and maintain confidentiality, group homogeneity was ensured. The 45 participants were homogenous in their age (14-16), gender (female), English proficiency level (B2), no prior experience with AI-based instruction and were assigned to three groups based on the intervention type (teacher AI-mediated group dynamic assessment [TAIGDA, N=15], teacher-mediated group dynamic assessment [TGDA, N=15], and control group [N=15]).

Instruments

A DIALANG test was administered as a pre-test (https://dialangweb.lancaster.ac.uk/) to ensure homogeneity among participants regarding English language proficiency. Using the Common European Framework, the DIALANG test is a computer-based diagnostic tool that evaluates language competency in reading, writing, listening, vocabulary, and grammar from A1 (most proficient) to C2 (least proficient). The test assessed the participants' writing skill levels before the intervention.

Google Meet was selected as the primary platform for delivering online language classes to both experimental groups due to its user-friendly interface and accessibility. Google Meet facilitated synchronous interaction between the teacher and learners via video conferencing, allowing screen sharing to display learners' writing assignments and offer (AI-based) group dynamic assessment. During three sessions, internet instability resulted in some mediation delivery delays (below one minute), which were negligible. The study utilized ChatGPT 3.5 as a technological mediation tool for the TAIGDA group to provide learners with prompt insights into their writing skills and areas for improvement. This feedback was supplemented with teacher mediation during intervention sessions to guarantee the precision and comprehensiveness of the assessment. Writing tasks (listed below) were adopted based on learners' level from *Write and Improve with Cambridge,* available at https://writeandimprove.com/testzone-b2

Living in cities

How can we judge whether a film is good or bad?

School holidays

Is the internet worse than TV?

University education

Historic buildings

Workplace

Clothes in the workplace

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Follow-up semi-structured interviews were conducted individually to investigate participants' perceptions of AI-based GDA for EFL writing instruction. The interview guide included four questions. (Appendix A).

Data collection procedure

This study was conducted over 12 sequential sessions. Pre- and post-tests (DIALNG online test) were administered before (1st session) and following (12th session) the eight instructional sessions. DIALNG also served as the baseline measure to identify problematic areas of learners' writing proficiency, i.e., accuracy, appropriacy, and textual organisation, as it targets these writing aspects. The experimental groups received instructions via Google Meet, the invitation link of which was shared with each class separately. The TAIGDA group benefited from the teacher and ChatGPT-generated feedback, while the TGDA group received guidance solely from the teacher. The control group participated in conventional writing classes. Instructional sessions were held in Google Meet for the two experimental groups. For the TAIGDA, the teacher started their chat-GPT, gave it a prompt, copied and pasted a learner's essay in the chat, and shared the screen (each session was devoted to 2-3 essays).

The teacher initiated the mediation with the most implicit hint and then proceeded to the bot's mediation by repeating or modifying it. This way, meditation was provided both orally (through the teacher's voice) and in writing (through the bot's text). This continued until the learner found the problematic area and corrected it. In the TGDA class, only teacher-mediated instruction was delivered, i.e., the teacher provided oral hints while only the essay text was screen-shared. All students were allowed to use their microphones during GDA sessions, and all sessions were screen-recorded for later analysis, which resulted in a typology of mediational moves (Table 1) for the TAIGDA group. As the fine-tuned moves emerged from the intervention sessions, they were applied across learners based on their responsiveness to mediation. In the last sessions, individual online interviews with the TAIGDA group were conducted to gather qualitative data on participants' experiences.

Table1

The typology of mediational moves from the most implicit to the most explicit

Moves	Description
1. Showing the erroneous paragraph	Specifying the paragraph number
2. Showing the erroneous sentence	Specifying the sentence line
3. Reading out load the erroneous sentence	Reading in raising intonation

4. Asking to think about the sentence	Using cues (e.g. what is wrong here?)
5. Resorting to cognitive resources	Asking to memorise previous materials
6. Showing the exact problematic part	Using cues (e.g. this sentence is problematic)
7. Asking to correct the problematic part	Offering options to choose from
8. Correcting the error with some explanations	Using the most direct cues (e.g. you should write this because…)

Data analysis

We used SPSS to analyze the quantitative data, i.e., scores from pre- and post-tests were statistically analyzed to investigate the effect of TAIGDA on the learners' writing proficiency. Within-group differences were explored using three paired-sample t-tests and one-way ANOVA to identify the post-test differences resulting from the mediational sessions. Thematic analysis was employed to analyse the interview data, which facilitated the identification of emerging themes from the interview data and labelling them as inspired and impacted by the recorded instructional sessions.

After identifying these initial themes, a deductive approach was adopted. At this stage, the tentative categories were tested against new data from subsequent interviews to verify consistency and refine the categories. This iterative process continued until saturation was reached, meaning no new information, insights, or themes emerged. At this point, the themes were refined and cross-checked against the data to ensure they accurately reflected the participants' experiences and perceptions. The data analysis also involved grouping the initial codes into preliminary themes, which represented the participants' core ideas. The themes were then refined through constant comparison to ensure coherence and that the final themes captured the most significant and recurring patterns. Finally, these refined themes were interpreted as the answers to the research questions.

Results

Quantitative results

Three paired-sample t-tests were conducted to compare the pre- and post-test scores of each group. Tables 2 and 3 indicate that the TAIGDA and TGDA pre- and post-test scores differed (sig < 0.05), i.e., both groups performed better in the post-test. The

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control group's pre- and post-test scores did not differ significantly, as shown in Table 4 ($p > 0.05$).

Table 2

Paired samples t-test for the TAIGDA group

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair	per.TAI - post.TAI	-2.333	1.718	.444	-3.285	-1.382	-5.259	14	.001

Table 3

Paired samples t-test for the TGDA group

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair	per.TGDA - post.TGDA	-1.067	1.907	.492	-2.123	-.010	-2.166	14	.048

Table 4

Paired samples t-test for the control group

									Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	
					Lower	Upper			

Pair	per. Control post. control	-.400	1.682	.434	-1.331	.531	-.921	14	.373

ANOVA results (Table 5) indicated that there was a significant difference among the groups concerning their post-test scores (sig < 0.05). A post-hoc comparison pinpointed where the difference lay, as shown in Table 6. Scheffe's post hoc pairwise comparisons revealed that the TAIGDA group had a meaningful difference from the TGDA and control groups and performed better in their post-test.

Table 5

ANOVA results of post-test scores

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	43.911	2	21.956	3.864	.029
Within Groups	238.667	42	5.683		
Total	282.578	44			

Table 6

Scheffe's test for the comparison of means of the three groups on the post-test

					95% Confidence Interval	
(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
TAI	TGDA	1.467	.870	.253	-.74	3.68
	control	2.400*	.870	.030	.19	4.61
TGDA	TAI	-1.467	.870	.253	-3.68	.74

	control	.933	.870	.567	-1.28	3.14
control	TAI	-2.400*	.870	.030	-4.61	-.19
	TGDA	-.933	.870	.567	-3.14	1.28

*. The mean difference is significant at the 0.05 level.

Qualitative results

We thematically analysed the interview data from the teacher-mediated AI-based group to understand participants' perceptions of AI-based GDA for EFL writing instruction. This section highlights the emerging themes that illuminate the participants' experiences with the intervention, accompanied by extracts from the interview data. The results show that participants regarded AI-based GDA as a helpful tool in addressing the following issues:

Enhanced collaborative learning

Participants believed that AI-based mediation enhanced collaboration by facilitating the exchange of ideas and feedback among teachers and peers. They appreciated the chance to collaborate on assignments, which fostered an encouraging learning environment. They believed that ChatGPT played a crucial role in mediating interactions, which motivated more engagement and interpersonal interaction.

"Sharing ideas and getting feedback from my teacher and classmates was great, and the AI pointed out things I had not noticed. It felt like we were all learning together and improving our writing step by step."

Increased autonomy and self-awareness

Participants pointed to how the ChatGPT feedback helped them recognise their writing proficiency level and areas for improvement. Moreover, they noted increased learning autonomy as they took more responsibility for their learning and made well-informed choices regarding their writing process. This context fostered their autonomy and reflective thinking, helping them become more proficient writers.

"Using the ChatGPT helped me notice where I was making mistakes. After initial sessions, I felt more confident about fixing my mistakes, which made me think more about improving my writing overall."

Increased motivation and engagement

AI-driven, relevant feedback offered by the teacher boosted learners' autonomy and competence, thereby enhancing their intrinsic motivation. In addition, GDA established a supportive and engaging learning atmosphere in which individual learners' needs were considered, allowing them to feel a sense of belonging and connectedness to the whole class's aims. By transforming writing from an independent to a collaborative and interactive process, AGDA can create a more dynamic and enjoyable learning experience, ultimately enhancing motivation and engagement.

"Getting instant feedback from ChatGPT on our writing motivated me. It felt like a game sometimes, trying to improve our texts based on the hints. Sharing ideas with classmates and seeing how they approached the tasks was also helpful."

Dynamics of interaction and feedback

The interaction between teacher and chatbot feedback in the AI-based GDA framework substantially improved learners' writing skills. By integrating human experience with the computational capabilities of AI, learners gain advantages from a comprehensive approach to language learning. The teachers delivered comprehensive, contextualised feedback that was fine-tuned to learning objectives, as ChatGPT provided focused, immediate responses regarding specific language aspects. This reciprocal interaction fostered an environment conducive to learning, where learners received extensive guidance, allowing them to discover and correct writing errors.

"Receiving relevant feedback from different sources helped me notice my writing issues from different perspectives. The AI suggestions were quick and showed mistakes I could not recognise…. when the teacher explained in detail and showed me how to correct my mistakes. I felt I was learning much faster."

Improved second language writing skills

The collaborative nature of the GDA classes promoted learners' language awareness, as they could actively engage in the assessment process of their peers' assignments. Furthermore, ChatGPT-driven feedback regarding grammar, vocabulary, and coherence benefited learners' writing proficiency. These were tailored to meet learners' individual needs, leading to autonomous recognition of writing errors.

"The chatbot gave me helpful tips about grammar and word choice. My teacher also helped me understand how to make my writing clearer and sound better."

Discussion

The results of this study provide evidence that using an AI chatbot to facilitate GDA can significantly improve EFL learners' writing skills. Regarding the first research question,

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the observed improvements in writing proficiency underscore the potential of utilizing technology in language classes to create engaging and productive learning environments. Our research builds upon prior investigations by Rashidi and Nejad (2018) and Rezaee et al. (2019), which highlighted the significant benefits of dynamic assessment for EFL learners, specifically in enhancing their writing abilities from the early stages of the writing process to the ultimate result. Their research indicates that dynamic assessment serves a purpose beyond error correction. It involves establishing a setting where learners can actively participate in linguistic activities and develop a deeper comprehension. This strategy improves writing skills and stimulates and encourages learners on their language-learning journey. The advent of AI has profoundly changed how we acquire proficiency in different languages. Recent research (2024; Kemelbekova, 2024; Qiao & Zhao, 2023) demonstrates that AI tools can significantly enhance language proficiency. It is akin to having an intelligent tutor who can adjust to the unique requirements of each learner.

Regarding the second research question, we found that learners who received both AI and human mediation outperformed their counterparts. This is in line with Thaha Abdullateef and Mohammedzein (2021) and Fard and Derakhshi (2019), who highlight the vital need for teachers as facilitators in utilising dynamic assessment to augment learners' improvement (Nazli & Yahya, 2023). This emphasises the importance of human involvement in learning, especially in an era where AI has a considerable influence. The collaboration between instructors and technology is widely recognised as a vital factor in improving educational results. Using technological tools, educators can adapt their instructional approaches to more effectively meet the varied needs of pupils. The significance of integrating technology into language teaching techniques is emphasised by previous literature (Kukulska-Hulme & Viberg, 2018). Integrating technology with excellent pedagogical approaches can significantly enhance language learning experiences. Although technology possesses remarkable powers, the human touch remains indispensable. Thaha Abdullateef and Mohammedzein (2021) and Fard and Derakhshi (2019) emphasise the significance of balancing human supervision and technical improvements to deliver effective instruction. It is crucial to have a strong and cooperative relationship between instructors and technology to create dynamic, engaging, and student-focused language learning environments.

Regarding the last research question, integrating AI chatbots and GDA significantly improved our participants' learning, especially in writing. AI solutions, such as ChatGPT, have become increasingly important in facilitating collaborative learning settings, where students, teachers, and technology work together to enhance the learning experience (Chitra Dhanapal & Alfaruque, 2024). In our study, this supportive setting for collaborative learning is facilitated by the opportunity provided by GDA to exchange ideas and receive corrective feedback from knowledgeable individuals, as well as AI-assisted information sharing, as supported by previous studies (Chitra Dhanapal & Alfaruque, 2024; Ghahderijani et al., 2021; Kazemi et al., 2020). Another benefit stated

by our participants was enhanced autonomy and self-awareness. Through DA practices and instructor hints, participants can gain higher control in L2 learning (Ahmadian & Sanaeifar, 2024; Özturan et al., 2023), which can increase over time (Özturan, 2022). Learners' autonomy can further increase with the use of technology mediation, such as AI-based feedback, which enables the identification and correction of writing errors independently (Chitra Dhanapal & Alfaruque, 2024). Autonomy, in turn, empowers learners to take more responsibility for their learning (Davin & Herazo, 2020; Sohrabi & Ahmadi Safa, 2020), which indicates internalising mediation (Qin & Nian, 2024).

Furthermore, the motivational impact of GDA and AI on language learning was favoured by the participants. Increased motivation is directly related to autonomy and self-regulation, which can substantially develop language abilities (Byrne, 1996). This finding aligns with previous research, which has shown that (G)DA and AI chatbots increase L2 learners' motivation (Estrada-Araoz, 2023; Özturan et al., 2023; Rezai, 2023; Rezai et al., 2024; Song & Song, 2023; Wei, 2023). Finally, the revolutionary capacity of AI chatbots like ChatGPT significantly develops L2 learners' writing abilities as it provides timely feedback aligned with specific learning objectives (Ali et al., 2023; Chitra Dhanapal & Alfaruque, 2024). This feature, when combined with GDA prompts, resulted in self-regulation, which was interpreted as learner growth (Aljaafreh & Lantolf, 1994; Jeon, 2023; Lantolf & Thorne, 2006).

Conclusion

This exploratory study investigated the impact of AI-based GDA on the development of Iranian EFL learners' writing abilities. This study was motivated by scant research on incorporating AI-based chatbots as technological mediating tools in DA. The findings demonstrated that AI chatbots, such as ChatGPT, can be employed as helpful technological mediations in DA classes. The study confirmed that human and technological mediation worked in tandem to improve writing abilities, providing several advantages.

This study has several pedagogical implications. First, chatbot-assisted GDA provided learners with oral and written corrective feedback, catering to different learning styles. This helps the instructor implement DA practices for the whole class simultaneously and minimizes their labor, as two feedback modalities are provided at once. This also increases teachers' understanding of class dynamics and learners' special needs as they unfold during DA treatments. Technology-assisted language learning can also benefit from this study, as the revolutionary impact of AI chatbots on L2 learning remains largely unexplored and in need of empirical evidence. AI specialists can launch and develop AI chatbots that provide oral feedback to maximise their positive contribution to language learning.

The study has several limitations, so caution is needed when interpreting and generalising the results. First, including both genders in the study may alter the results,

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and future studies can investigate the effects of gender. Second, the period between the pre- and post-test was short, which can be accommodated by administering a delayed post-test to alleviate practice effects. Third, as including 15 participants in each group was a rule of thumb, expanding the number of learners is suggested for further research. Fourth, the long-term effects of AI-mediated GDA on EFL learners' autonomy can be explored in longitudinal studies. Finally, comparing the effects of different AI chatbots and their performance across different proficiency levels can be explored in the future.

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Appendix A: Interview Questions

1. What were the most salient advantages of AI-based mediation?
2. What challenges did you face in this course?
3. What do you think about the advantages of the course for your overall EFL abilities?
4. Which kind of mediation would you prefer in the future? Why?