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Utilising artificial intelligence-enhanced writing mediation to develop academic writing skills in EFL learners: a qualitative study

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ABSTRACT

As innovative artificial intelligence (AI) platforms continue to demonstrate their effectiveness in mediating learners' language learning, further exploration is necessary to realise how AI contributes to English language learners' writing skills development. Following Vygotskian social constructivist theory of learning, we employed a qualitative research design to explore the impact of AI-enhanced writing mediation on English as a foreign language (EFL) learners' academic writing skills. Fourteen EFL learners, preparing for the IELTS examination, actively participated in interactive writing activities utilising ChatGPT, regarded as an AI platform, wherein they received implicit and explicit writing mediation to develop their academic writing skills. By tracking the microgenetic development of the learners, conducting observations of their interactive writing activities with the AI platform, and keeping a reflexive journal, the findings corroborated that the AI platform's writing mediation substantially contributed to the learners' academic writing skills development. Employing follow-up think-aloud interviews, the learners also highlighted their positive attitudes and perceptions towards the role of AI-enhanced writing mediation in developing their academic writing skills. The study provides pedagogical and practical implications for developing AI-enhanced writing mediation for EFL learners.

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AI-enhanced writing mediation; ChatGPT; academic writing skills; EFL learners

1. Introduction

Writing performance, which is regarded as a critical component of English language learners' language learning proficiency, comprises the mastery of various language learning areas, including task achievement, coherence and cohesion, lexicon, and grammatical range and accuracy (Ebadi & Rahimi, 2019; Hoang & Hoang, 2022; Shi et al., 2020). Writing

skills contribute to learners communicating their ideas, expressing their thoughts with precision, and achieving academic excellence across diverse professional settings (Cancino & Panes, 2021; Lee & Evans, 2019; Poehner & Yu, 2022; Sasaki et al., 2018). It is claimed that interactive writing activities with other learners and regular writing comments and feedback significantly contribute to English language learners' writing skills development (Abe, 2020; Jianling, 2018; Lee & Abdul Rabu, 2022; Rahimi & Fathi, 2022). Nevertheless, learners' interactive writing activities with their peers, as well as monitoring and supporting their writing with insightful comments and feedback, often take considerable time and effort. Moreover, learners usually report their lack of motivation in writing courses which can impede their capacity to dedicate time and energy to effectively develop their writing skills (Fathi & Rahimi, 2022; Rahimi & Fathi, 2022).

The incorporation of technologies and online platforms into English language writing courses is believed to offer a promising solution in addressing specific writing barriers, such as time limitations. (Chung & Ahn, 2022; Ebadi & Rahimi, 2018; Lin et al., 2022; Reynolds & Kao, 2021; Zou & Xie, 2019). As learners participating in conventional interactive writing activities and relying on manual feedback lead to delays that impede their prompt writing development, the incorporation of technologies aims to address such issues by providing immediate and automated feedback. This allows learners to efficiently manage their time, receive timely guidance, and thereby improve their writing skills within the constraints of a typical academic schedule (Liu et al., 2022). In addition, the accessibility of technologies and online platforms anywhere and anytime enables learners to conveniently engage in interactive and individual writing activities at their own pace and across diverse settings (Hoang & Hoang, 2022; Lee et al., 2016; Rahimi & Fathi, 2022; Such, 2021).

Artificial intelligence (AI)-enhanced computer and mobile programmes, for instance, are increasingly utilised to facilitate learners' writing skills and motivation (Liu et al., 2021). AI-assisted platforms, such as ChatGPT, provide effective feedback and comments, helping learners develop their writing performance (Barrot, 2023b; Su et al., 2023; Yan, 2023). Such platforms help learners avoid grammatical and lexical mistakes and errors by suggesting alternative structures and sentences (Yan, 2023). Several studies have addressed the role of AI platforms in developing English language learners' writing skills (Hsiao & Chang, 2023; Liu et al., 2021; Yan, 2023). For instance, Liu et al. (2021) found that AI-mediated language learning significantly contributed to English as a foreign language (EFL) learners' writing development. Similarly, Yan (2023) demonstrated that ChatGPT effectively enhanced EFL learners' writing skills.

Whilst previous studies have explored the impact of AI on writing skills, there remains a lack of focus on writing mediation grounded in Vygotsky's (1978) social constructivism and its specific impact on developing English language learners' academic writing skills. In language learning contexts, this theory highlights the importance of collaborative language learning activities and scaffolding to facilitate learners' development from their current level of competence to a higher and potential level of functioning. Therefore, integrating Vygotsky's (1978) social constructivism into studies on writing mediation allows for a deeper understanding of how interactive writing activities affect academic writing skills development. On the other hand, in the EFL context, research has inadequately addressed the impact of AI-enhanced writing mediation on learners' academic writing skills, particularly where learners' interactive and individual writing activities face challenges associated with temporal constraints and limited feedback opportunities. That is, the current literature does not sufficiently address how AI platforms, such as ChatGPT, can be employed as more knowledgeable others to facilitate gradual academic writing skills development and autonomous writing performance in EFL learners. On the other hand, as AI technologies become increasingly integrated into educational settings, realising how AI-enhanced writing mediation affects EFL learners' academic writing skills, especially *via* interactive and co-constructive writing activities, can also inform pedagogical practices and the design of AI-based educational platforms.

The current study aimed to fill the identified gap by investigating how AI-based writing mediation, informed by Vygotskian social constructivism, contributed to EFL learners' academic writing skills development. Specifically, we explored the impact of AI-mediated interactive writing activities utilising ChatGPT on EFL learners' academic writing skills. Following Vygotskian social constructivism, ChatGPT was instructed to diagnose the learners' writing issues and synchronously provide relevant writing mediation to help the learners achieve their potential and autonomous level of functioning in writing. ChatGPT provided writing mediation on the learners' writing tasks from the most implicit to the most explicit. Implicit writing mediation was initially provided to encourage the learners' independent addressing of their writing issues. If this did not help, more explicit writing mediation was provided. Learners who relied on implicit or no AI-based writing mediation displayed self-regulation and autonomous functioning in writing. In this study, we also attempted to uncover the mediation moves (i.e. the order of AI-assisted implicit and explicit writing mediation) and reciprocity patterns (i.e. learner responsiveness to the AI-enhanced writing mediation) to indicate how ChatGPT helped the learners gradually achieve their self-regulated writing skills.

To enhance the comprehensiveness of our data collection, facilitate the emergence of pertinent themes and categories, and significantly contribute to the innovation of the present study, we utilised a microgenetic method to track the moment-to-moment variations and development of the learners' academic writing skills, along with conducting observation of their interactive writing activities with the AI platform and maintaining a reflexive journal. We further explored EFL learners' attitudes and perceptions towards the impact of AI-enhanced writing mediation on their academic writing skills to shed more light on the findings of the study on the one hand, and to provide comprehensive insights into the pedagogical implications of incorporating AI-assisted writing mediation into EFL writing courses on the other hand. To this aim, think-aloud interviews were conducted to retrospectively explore the learners' cognitive processes, perceptions, and experiences with the AI-assisted writing mediation, along with tracking their writing development from other-regulation (interactive use of AI mediation) to self-regulation (autonomous writing task completion). The practical and pedagogical implications are discussed next.

2. Literature review

2.1. Theoretical framework

In this study, the interactive writing activities between the EFL learners and ChatGPT followed Vygotsky's (1978) social constructivism. Based on this theoretical underpinning, the interaction between a more skilled individual or platform and a less skilled learner can help learners gradually obtain and internalise their cognitive abilities and act autonomously during learning activities (Vygotsky, 1986). Vygotsky (1986) argued that 'every function in [learners'] cultural development appears twice: first, on the social level, and later, on the individual level; first, between [learners and an intellectual platform] (inter-psychological), and then, inside [learners] (intra-psychological)' (p. 57). According to social constructivist theory, the gap between [learners'] actual developmental level as identified by independent problem solving and the potential development as determined *via* problem solving in collaboration with more skilled individuals or platforms is referred to as learners' zone of proximal development (ZPD) or their potential level of functioning. In other words, ZPD is conceptualised as 'those functions that have not yet matured but are in the process of maturation' (Vygotsky, 1978, p. 86). Learners can achieve their ZPD in the learning context *via* collaborative learning activities and through receiving mediation from a more capable and intellectual platform like ChatGPT. In the context of sociocultural theory, the terms mediate, mediation, and mediational are often utilised interchangeably to describe the process by

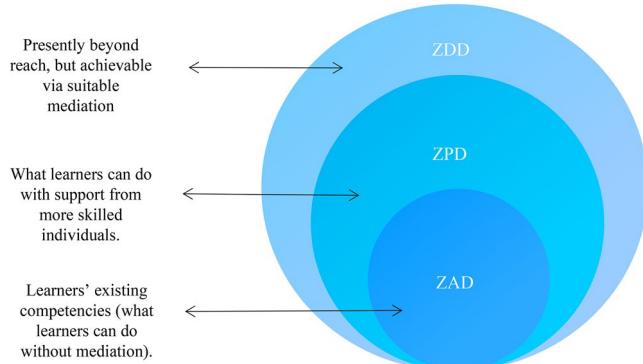


Figure 1. Vygotskian social constructivist theory of learning.

which social interaction and cultural platforms facilitate cognitive development. Learners' ZPD level is situated intermediate to the zone of actual development (ZAD), which encompasses tasks and competencies currently within learners' independent reach, and the zone of distant development (ZDD), which includes knowledge and skills lying beyond immediate accessibility and requires external mediation and assistance. Figure 1 displays Vygotsky's social constructivist theory of learning.

Following the social constructivist theory, identifying learners' mediational moves and reciprocity patterns during collaboration with more capable individuals reveals how learners achieve self-regulation or autonomous functioning over time. This can be identified *via* learners' interaction with a more capable individual or platform and how learners attempt to co-construct their language skills through such interactive learning activities. The social constructivist theory is followed in this study to involve the EFL learners in interactive writing activities with ChatGPT, which could be considered a more capable writing assistance. Following Aljaafreh and Lantolf (1994) model, the EFL learners in this study received writing mediation from the most implicit to the most explicit mediation based on their ZPD. That is, ChatGPT was instructed to initially provide more implicit writing mediation to help the learners address their writing issues and enhance their academic writing skills. If implicit writing mediation did not help the learners address their writing issues, ChatGPT would suggest more explicit writing mediation to help the learners overcome their weaknesses and develop their academic writing skills. If the learners required less AI-based explicit writing mediation and demonstrated greater responsiveness to the writing support, they exhibited increasingly evident microgenetic development in their academic writing skills. Utilising this model, our study tracked the EFL learners' academic writing skills development by adjusting the level of writing mediation

provided by ChatGPT with each learner's ZPD. This means that the learners received tailored and personalised writing mediation from ChatGPT that corresponded to their current academic writing skills, which allowed for gradual writing advancement. By observing how the learners responded to the various levels of writing mediation provided by ChatGPT, we could recognise the learners' writing developmental trajectory and pinpoint writing areas requiring further mediation.

The utilisation of Vygotsky's (1978) sociocultural theory provided a conceptual framework through which we could effectively examine and interpret the findings of the study. We applied this theoretical framework to realise how the EFL learners' academic writing skills were developed through AI-enhanced writing mediation. That is, by adopting a qualitative approach grounded in sociocultural theory, we focused on the dynamic interplay between the EFL learners, their writing tasks, and the AI-enhanced writing support provided by ChatGPT. Additionally, sociocultural theory helped carry out the data analysis by capitalising on the importance of collaborative writing environments, scaffolding, and the role of external platforms in contributing to the learners' academic writing skills development. Overall, the integration of sociocultural theory in the study provided valuable insights into the complex dynamics of AI-assisted writing mediation in EFL contexts and enriched the interpretation of the findings.

2.2. AI

AI is conceptualised as a sophisticated system incorporating intelligent programmes that in collaboration with human input and assistance can accomplish various learning tasks (Aldosari, 2020). Following Ertel and Black (2018), AI is capable of making informed decisions similar to those of humans, particularly in educational contexts. Building upon previous research (e.g. Luckin et al., 2016; Sun et al., 2021; Xia et al., 2022; Zhang & Zou, 2020), AI could be integrated into language learning and teaching environments not only to improve language instructors' teaching methodologies but also to positively affect language learners' language learning performance (Sun et al., 2021; Zhang & Zou, 2020) and their attitudes and perceptions towards AI-assisted language learning (Xia et al., 2022). Different AI-supported online platforms, such as Andy English Chatbot, Grammarly, Kahoot, etc. (Barrot, 2022, 2023a; Fathi et al., 2024; Wang & Tahir, 2020), are available for providing essential language input and output to help language learners improve their language learning. AI platforms, which are accessible on both computer and mobile devices, serve as valuable resources for language learners who aim to develop their different language learning skills, especially their writing skills.

For instance, ChatGPT (Chat Generative Pretrained Transformer) represents an AI-based Chatbot developed by OpenAI which could be incorporated into different language learning curricula to develop language learners' various language learning skills, such as writing skills (Barrot, 2023b). ChatGPT can produce correct and more appropriate lexical and grammatical structures to help learners accomplish more coherent and cohesive writing tasks. This platform could also be regarded as a valuable resource for addressing learners' writing-related challenges and issues by providing immediate and personalised feedback on writing areas, such as task achievement, coherence and cohesion, lexicon, and grammatical range and accuracy (Barrot, 2023b). For example, this AI platform offers alternative suggestions to rectify lexically and grammatically incorrect sentences to improve learners' writing skills. Nevertheless, frequent reliance on the ChatGPT's generated text may potentially undermine learners' writing skills. On the other hand, the utilisation of ChatGPT-generated texts could raise concerns of plagiarism, which may further require learners to carefully review and edit their written texts (Niloy et al., 2023; Yan, 2023).

It also needs to be asserted that the integration of AI into language education differs from the integration of other technologies, such as automated feedback platforms. For example, whilst online platforms like Grammarly primarily concentrate on providing automated feedback on grammar, spelling, and punctuation (Barrot, 2022), AI in language education, exemplified by platforms like ChatGPT, offers a broader range of functionalities (Barrot, 2023b). ChatGPT can facilitate interactive and adaptive learning experiences by providing personalised writing mediation, generating contextually relevant content, and fostering natural language interactions (Su et al., 2023; Yan, 2023). Unlike other technologies, AI-based programmes have the capability to realise and respond to learners' queries in real time, offering targeted support tailored to their individual learning needs. Additionally, AI can simulate authentic language use and provide opportunities for immersive language practice to develop language learners' learning skills (Su et al., 2023). Therefore, the integration of AI into language education represents a paradigm shift towards more dynamic, interactive, and learner-centred approaches compared to the adoption of conventional technologies.

Several studies have been conducted exploring the role of AI platforms, such as ChatGPT, Smart RoamLingo, etc., in improving learners' different language learning components (Fitria, 2023; Hsu et al., 2023; Hwang et al., 2023; Jeon et al., 2023; Xu et al., 2022; Zheng et al., 2021), especially their writing skills (Su et al., 2023; Yan, 2023). Yan (2023), for example, explored the impact of ChatGPT-supported language learning on the writing performance of EFL students studying in an

undergraduate EFL programme in China. Over the course of one week, a cohort of 35 undergraduate EFL students engaged in a dedicated practicum focused on the application of ChatGPT's text generation affordance in developing writing performance. For the purposes of the practicum, all other standard instructional sessions in other courses across the curriculum were suspended. Each day comprised two instructional sessions, each lasting 45 minutes, and six practical sessions, providing an immersive environment for the students to explore and apply the text-generation capabilities of ChatGPT in the EFL writing context and do some undergraduate-level writing tasks with ChatGPT. Qualitative data collection and analysis, such as observing the students' behaviours in the class, documenting learning logs, and carrying out thematisation analysis for the interview, were conducted to meet the purposes of the study. The results indicated the positive roles of ChatGPT in contributing to the learners' writing performance. The findings further demonstrated that ChatGPT helped the learners accomplish their writing tasks more efficiently by giving immediate feedback and writing suggestions. Expanding on the findings drawn by Yan (2023), our study specifically focused on the gradual development of EFL learners' academic writing skills *via* AI writing mediation utilising ChatGPT. By adopting a qualitative approach and exploring EFL learners' attitudes and perceptions towards the AI-enhanced writing mediation, we provided further understanding into how ChatGPT gradually contributed to the development of EFL learners' academic writing skills from other-regulation and interactive writing activities to self-regulation and autonomous functioning in writing.

In much the same vein, Hwang et al. (2023) examined the effects of AI-supported writing feedback utilising Smart RoamLingo application on the writing performance of EFL learners with diverse backgrounds and varying experiences with online learning. The AI platform helped the learners accomplish their writing tasks by giving them sample sentences, writing suggestions, and personalised feedback. The required data were collected by checking the learners' perceptions, concerns, and expectations regarding the AI programme. The findings showed that the learners who utilised Smart RoamLingo application for writing tasks outperformed those who did not apply Smart RoamLingo application for their writing activities. Hwang et al. argued that the findings might be related to the contextualisation and personalisation affordances of Smart RoamLingo application which gave the learners immediate and more appropriate writing feedback and comments to develop their writing tasks. Whilst Hwang et al. focused on the impact of AI-supported writing feedback provided by Smart RoamLingo, we explored how AI writing mediation, facilitated by ChatGPT, contributed to the gradual development of EFL learners' academic writing skills. By exploring EFL learners'

attitudes and perceptions towards the ChatGPT's writing mediation, we also added insights into how AI platforms could be optimally integrated into interactive writing courses to develop EFL learners' academic writing skills.

Similarly, Liu et al. (2021) investigated the role of AI in improving EFL learners' writing skills. They proposed a novel approach called reflective thinking promotion mechanism-based AI-supported English writing (RTP-AIEW) to enhance the learners' thinking and writing skills. This approach encouraged the learners to engage in reflective thinking activities during the writing process. For instance, the learners considered different perspectives, evaluated their writing choices, and made informed decisions. Applying a quasi-experimental research design, the learners in the experimental group created written texts utilising the AI platform and received sample sentences and personalised feedback to revise and improve their written texts. The results showcased the more significant contribution of the RTP-AIEW approach to the learners' writing skills improvements. Liu et al. further claimed that AI could substantially contribute to the learners' self-regulated and autonomous learning by providing immediate and user-friendly writing feedback. Findings further confirmed the positive role of the RTP-AIEW approach in decreasing the learners' cognitive load, which led to the learners' significant writing improvements. The integration of reflective thinking with AI support also enhanced the learners' overall positive learning experience and perceptions. In the current study, we provided additional depth to the literature by exploring the effectiveness of the unique affordances of ChatGPT in providing writing mediation tailored to EFL learners' academic writing skills. By adopting Vygotsky's (1978) socio-constructivist theory, we aimed to clarify how the interactive writing activities between the EFL learners and ChatGPT facilitated the gradual development of the learners' academic writing skills and autonomous writing performance. Moreover, our study contributed to the literature by shedding light on the factors affecting EFL learners' responsiveness to AI-enhanced writing mediation.

Su et al. (2023) also incorporated ChatGPT into an EFL argumentative writing course to help EFL learners with their writing tasks, such as outline preparation, content revision, proofreading, and post-writing reflection, on the one hand, and to help them improve their argumentative writing skills on the other hand. The learners communicated with ChatGPT by receiving desired feedback and output for their writing tasks to meet their writing needs. Su et al. claimed that ChatGPT significantly contributed to the EFL learners' writing skills improvements. They asserted that ChatGPT provided more immediate and relevant writing comments and helped the learners accomplish their writing tasks more effectively. ChatGPT also gave the learners more suitable and complex

writing feedback and comments to revise their written texts more coherently and cohesively. Further, ChatGPT substantially contributed to the learners' writing organisation and writing content by recommending more appropriate writing choices. Whilst Su et al. examined the overall impact of ChatGPT on writing tasks and argumentative writing performance, our study addressed more specific writing processes and cognitive development of EFL learners by exploring their microgenetic development in academic writing skills over time. Drawing on theoretical frameworks, such as Vygotsky's social constructivism and Aljaafreh and Lantolf's mediation model, our study provided comprehensive insights into how AI writing mediation gradually developed the academic writing skills in EFL learners.

3. Purpose of the study

The literature highlighted the positive and negative impact of AI-based writing feedback and comments on different language learning skills of English language learners (Fitria, 2023; Jeon et al., 2023; Niloy et al., 2023; Xu et al., 2022; Yan, 2023; Zheng et al., 2021), especially their writing skills (Hwang et al., 2023; Liu et al., 2021; Su et al., 2023; Yan, 2023). The literature further showcased that English language learners held positive attitudes and perceptions towards utilising AI platforms to improve their writing skills. Nevertheless, there is still a gap in the literature exploring the contribution of AI-assisted writing mediation to English language learners' gradual academic writing skills development, especially in the EFL context. To this end, the current study sought a comprehensive exploration into how AI-enhanced writing mediation utilising ChatGPT helped EFL learners gradually become competent and autonomous writers. Furthermore, this study explored the EFL learners' attitudes and perceptions towards the contribution of AI-assisted writing mediation to their academic writing skills development. The findings provided valuable insights into how AI-enhanced writing mediation fostered the development of learners' academic writing skills in the EFL context. The following research enquiry guided the purposes of the current study:

How does AI-enhanced writing mediation contribute to EFL learners' academic writing skills development?

4. Method

In the current study, a qualitative research design was applied for both data collection and analysis to address the research enquiry. Exploring learner-AI writing interactions and think-aloud interviews, the present

study sought to indicate how AI-enhanced writing mediation using ChatGPT contributed to the development of academic writing skills in EFL learners. This allowed not only for a holistic understanding of the learners' writing processes and development but also the underlying dynamics, introspective practices, and changes in their writing behaviours and perceptions.

4.1. Context and participants

We selected B1-level EFL learners attending a well-known International English Language Testing System (IELTS) preparation centre as the participants of this qualitative study. Adopting a purposive sampling method for selecting the participants, we ensured that the learners possessed the specific language proficiency and contextual characteristics necessary for a focused exploration of the impact of AI-enhanced writing mediation in the targeted IELTS preparation setting. Additionally, the purposive sampling method facilitated the selection of learners who were readily available for the researcher/mediator, ensuring practicality in the data collection. Fourteen EFL learners, ranging in age from 19 to 25, willingly took part in the research. The participating EFL learners had diverse academic backgrounds and varying experiences in academic writing. On average, the learners had been studying English for six to ten years and were currently preparing for the IELTS examination which required a mastery of academic writing skills. The participants were familiar with language learning technologies and basic AI-assisted platforms commonly used in language learning contexts.

Our purposeful selection of the participants targeted learners at the B1 proficiency level, ensuring they were adequately motivated and familiar with IELTS academic writing and language learning technologies. B1 proficiency level particularly matched the purposes of the study, since B1-level learners possessed adequate academic writing skills to benefit significantly from targeted writing mediation and still exhibited areas requiring substantial development. The need to prepare for the high-stakes IELTS examination also ensured that the learners enthusiastically applied the writing mediation to their writing tasks. This allowed for the effective evaluation of the ChatGPT's writing mediation in fostering interactive and autonomous writing skills. On the other hand, the sample size of 14 participants was consistent with the established practices in qualitative research, where data saturation is typically achieved through in-depth analysis of a focused group. That is, throughout the data collection process, we continually monitored for thematic saturation, ensuring that no new, significant themes emerged from the interviews with additional participants.

The participants' language proficiency level was confirmed through the placement tests administered by the IELTS preparation centre. To assess their English writing proficiency, the learners were given a pre-study writing task, where they had to write an essay on a given topic. Trained assessors then marked the essays according to the B1 level descriptors of the Common European Framework of Reference for Languages (CEFR). Throughout the research process, ethical considerations were of utmost importance. All the participants provided informed consent before taking part in the study. They were fully briefed about the purposes of the study and ensured that their data would only be used for research purposes. Additionally, the confidentiality and anonymity of their contributions were emphasised. The learners were also informed that they could withdraw from the study at any point without any negative repercussions. To safeguard confidentiality, the participants were assigned pseudonyms, such as L1, L2, L3, ..., and L14. All data collected during the research were securely stored and accessible only to the research team, ensuring the participating learners' privacy and data protection.

4.2. Data collection procedures

To ensure the trustworthiness and credibility of the study, triangulation, which involves using multiple methods or data sources, was utilised. This involved cross-referencing data from multiple sources, including participant essays, transcribed recordings of the assessment sessions, think-aloud interviews, and observations and a reflexive journal made by the researcher/mediator during the writing interactions. Initially, to assess the learners' English writing proficiency at the B1 level of the CEFR, a pre-study writing task was administered to each learner. The writing task required the learners to write a 400-word argumentative essay on the topic 'Should social media platforms be held responsible for the spread of misinformation?' within a predetermined time frame. This specific writing topic was chosen as it was relevant to current events, allowed for diverse viewpoints, and encouraged critical thinking skills—all qualities essential for successful academic writing at the B1 level. The essay prompt specifically instructed the learners to formulate a clear thesis statement outlining their stance on the issue, provide at least two well-supported arguments using relevant evidence, and conclude by summarising their main points. Trained assessors then evaluated the essays using the B1 level descriptors of the CEFR, focusing on criteria, such as grammatical accuracy, lexical complexity, organisational structure, and overall clarity of expression in presenting their arguments, to confirm the learners' writing proficiency level.

Before starting the experiment, the learners were presented with YouTube instructional videos to become familiar with how to utilise

ChatGPT for interactive writing activities. The researcher/mediator also explained the affordances of ChatGPT and instructed the learners on how to create a ChatGPT 3.5 account and use it for interactive writing purposes. The main data collection process involved online sessions between the learners and ChatGPT. These sessions (8 sessions, each lasting 75 minutes) were conducted using a text-based chat interface that allowed for real-time writing interactions with ChatGPT. Each learner engaged in a series of writing tasks designed to elicit specific academic writing skills.

During each session, the learners were encouraged to verbalise their thoughts and reflections whilst interacting with ChatGPT. For example, a learner verbalised 'I am starting with a general statement about global warming to introduce the topic' whilst typing their introduction. In each session, the learners accomplished a writing task and synchronously received writing mediation from ChatGPT. ChatGPT was specifically instructed to suggest academic sample sentences on the learners' writing, considering their preparation for the academic IELTS examination. ChatGPT was also instructed to provide writing mediation from the most implicit to the most explicit mediation according to the learners' ZPD level (Aljaafreh & Lantolf, 1994). This means that implicit writing mediation was initially provided by ChatGPT to help the learners address their writing issues. Implicit writing mediation involved offering subtle guidance aimed at provoking independent problem solving and critical thinking among the learners to encourage them to address their writing issues. For instance, a learner wrote 'The effects of global warming is seen everywhere', and ChatGPT suggested 'Consider checking the subject-verb agreement in this sentence' to prompt the learner to identify and correct the error independently.

If implicit writing mediation did not contribute to the learners' writing, the learners were provided with less implicit and more explicit AI-enhanced writing mediation, providing more direct and structured support to address their writing issues. For example, ChatGPT proposed 'In your sentence, "The effects of global warming is seen everywhere," change "is" to "are" to match the plural subject "effects"' to help the learner realise and apply grammatical rules more clearly. The progression of writing mediation from implicit to explicit was tailored to each learner's writing needs. If a learner consistently applied implicit writing mediation effectively, the mediation remained subtle and implicit. Conversely, if more support was needed, the writing mediation became increasingly explicit. Based on Aljaafreh and Lantolf (1994) model, the learners relying on more implicit or no AI writing mediation showed that they achieved their self-regulation or autonomous functioning in writing. **Figure 2** illustrates the criteria for AI-enhanced writing mediation based

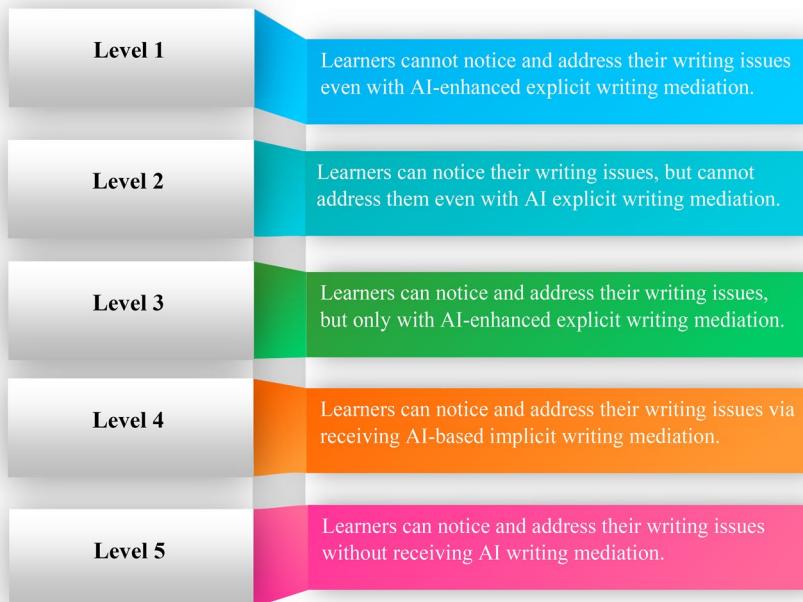


Figure 2. The criterion for AI writing mediation.

on Aljaafreh and Lantolf (1994) model, which indicates how the learners achieved self-regulation/autonomous functioning in writing (i.e. their gradual academic writing skills development) through the provision of tailored and personalised writing mediation.

Whilst the current study did not explore the exact number of repetitions needed for the learners to achieve proper editing utilising ChatGPT, the findings on the development of autonomy and self-regulation (Section 5.1.5) offered valuable insights in this regard. As the learners progressed through the interactive sessions, the ChatGPT's writing mediation became increasingly implicit to encourage the learners to internalise feedback and develop independent editing skills. This suggested that with continued practice and the ChatGPT's assistance, the learners could reduce their reliance on repeated writing mediation and achieved self-regulated writing over time.

The ChatGPT's writing mediation revolved around sentence-by-sentence feedback on task achievement, coherence and cohesion, lexicon, grammatical range and accuracy, and other writing aspects. The learners could draft and enter the written texts directly in the chat window and receive immediate writing mediation from ChatGPT. This iterative process allowed for continuous refinement of the writing as the learners considered the ChatGPT's suggestions alongside their own judgement. It

is important to note that whilst the primary mode of interaction was sentence-by-sentence, ChatGPT also offered the option to upload full drafts for comprehensive writing mediation in some cases.

Think-aloud interviews were also conducted to explore the learners' cognitive processes, perceptions, and experiences with the AI-enhanced writing mediation on the one hand, and to uncover their developmental level from other-regulation (i.e. doing writing tasks interactively using the AI's writing mediation) towards self-regulation (i.e. doing writing tasks autonomously) on the other hand. To effectively explore the learners' cognitive processes, perceptions, and experiences, the researcher/mediator followed a well-defined three-phase structure, including the introduction phase, where the researcher/mediator established rapport and explained the purposes of the interview, the prompted reflection phase, where the researcher/mediator presented open-ended prompts to encourage the learners to think aloud whilst elaborating on their experiences, and the probing and clarification phase, where the researcher/mediator utilised follow-up questions to deeply explore the learners' thought processes, perceptions, and experiences, ensuring a comprehensive understanding of their unique perspectives.

The researcher/mediator utilised prompts to explore the learners' cognitive processing during their interactions with the ChatGPT's writing mediation by asking such questions as 'When considering the ChatGPT's writing mediation to change "were running" to "was running" in the sentence "The students were running late because the bus broke down," can you describe the thought process you went through in deciding how to integrate it?' and 'How did you evaluate the ease or difficulty of incorporating the ChatGPT's writing mediation into your writing? Can you elaborate on the reasons behind your experience?'. To explore the overall attitudes and perceptions of the learners towards the writing mediation, the researcher/mediator enquired with questions, like 'In your perspective, how impactful was the ChatGPT's writing mediation in developing your academic writing skills?' and 'How did the experience of the AI-assisted writing mediation compare to your usual writing practices? Can you elaborate on any specific differences'. Finally, to explore their experiences of the effects and challenges of the AI platform's writing mediation, the researcher/mediator posed questions, such as 'Can you describe a particular instance where the ChatGPT's writing mediation affected your academic writing skills?' and 'Were there any aspects of the AI-enhanced writing experience that you found particularly challenging? If so, can you elaborate on the nature of these challenges?'. The think-aloud interviews provided valuable insights into the learners' engagement with the AI's writing mediation and its impact on their writing skills.

Both data collection procedures (i.e. the synchronous writing tasks with ChatGPT and the subsequent think-aloud interviews) were set to clarify the impact of the AI-enhanced writing mediation on the EFL learners' academic writing skills development. The synchronous writing tasks with ChatGPT allowed the learners to actively engage with the AI-enhanced writing mediation and receive immediate writing mediation to address their writing issues. This interactive process enabled the learners to directly experience the impact of AI-based writing mediation on their academic writing skills development. The subsequent think-aloud interviews also explored the learners' cognitive processes, perceptions, and experiences with the AI-assisted writing mediation in greater depth. By exploring the learners' retrospective insights and reflections on the impact of the ChatGPT's writing mediation on their academic writing skills development, the interviews provided valuable insights into the learners' understanding and interpretation of the AI-enhanced writing mediation. On the other hand, whilst the synchronous writing tasks revealed the practical application and immediate impact of the AI-assisted writing mediation, the think-aloud interviews explored the learners' perceptions and experiences, thereby complementing and enriching the findings obtained from the initial data collection.

Furthermore, throughout the data collection and analysis, the researcher/mediator applied observations and kept a reflexive journal. The researcher/mediator was conscious of his own potential biases or preconceived notions that could affect the interpretation of the findings. By being self-aware and objective, the researcher/mediator aimed to minimise any subjectivity in the research process. To this aim, the researcher/mediator maintained a reflexive journal to document the personal assumptions, experiences, and emotional responses that could unconsciously shape the research process. Regular entries in the journal facilitated self-reflection and fostered awareness of how these factors might affect data interpretation. Moreover, the research team engaged in frequent discussions to challenge individual perspectives and ensure a balanced interpretation of the findings. All the online sessions, think-aloud interviews, observations, and the reflexive journal entries were recorded to ensure accurate data. These recordings were later transcribed verbatim to facilitate in-depth analysis and interpretation of the learners' responses.

The use of triangulation, which involves cross-referencing data from multiple sources, significantly enhanced the credibility of our findings. Utilising a microgenetic method to track moment-to-moment variations in the learners' academic writing skills allowed us to explore the learners' detailed writing developmental variations. This combined with the direct observations of the interactive writing activities with the AI platform provided a rich, contextual understanding of how the learners

engaged with the writing mediation. Further, keeping a reflexive journal allowed for continuous reflection and documentation of the researcher/mediator's insights, which additionally enriched our findings. Moreover, the think-aloud interviews offered retrospective insights into the learners' cognitive processes, perceptions, and experiences with the AI-assisted writing mediation, which provided a deeper understanding of the role of the AI-enhanced writing mediation in developing the academic writing skills in the learners. Triangulating such data sources—microgenetic method, observational data, reflexive journal entries, and think-aloud interviews—allowed us to cross-verify information, identify consistent patterns, and uncover convergent themes. This comprehensive approach ensured that our findings were not reliant on a single data source, thereby increasing the credibility of our findings.

4.3. Data analysis

4.3.1. Language-related episodes

A microgenetic method, which is suitable for checking the moment-to-moment language learning variations and progressions (Lantolf, 2000), was used in this study. To this end, the transcribed writing interactions between ChatGPT and the learners during the online sessions were examined to check the writing mediation moves and the learners' reciprocity to such mediation. The microgenetic method, which originated in developmental psychology, involves closely tracking and documenting the cognitive and behavioural changes of learners over brief, intensive intervals. In this study, the microgenetic method was utilised to examine the dynamics of the learners' writing development by meticulously checking the writing interactions between ChatGPT and the learners during the online sessions. This method allowed for an in-depth exploration of the learners' evolving responses to writing mediation moves, shedding light on the intricate and moment-to-moment processes involved in their writing development. The microgenetic method focused on the documentation of language-related episodes (LREs) during the online sessions. According to Swain (2001), LREs are 'any part of a dialogue where students talk about the language they are producing, question their language use, or other- or self-correct their language production' (p. 287). LREs of the interactions between ChatGPT and the learners in the online sessions were tracked to find the movement from other-regulation to self-regulation based on the learners' required writing mediation moves and reciprocity movements.

To triangulate the data, the researcher/mediator conducted regular observations of the learners' interactive writing activities with ChatGPT and kept a reflexive journal. The observations and journal data were transcribed alongside the results of LREs to identify recurring patterns,

themes, and mediational strategies employed by ChatGPT to mediate the EFL learners' academic writing skills. To this end, adopting a thematic analysis approach, the researcher/mediator and another independent coder initially reviewed all the transcripts line-by-line to highlight the LREs (i.e. codes) where the learners discussed how they interpreted and implemented the ChatGPT's writing mediation, how they considered the writing mediation against their own personal judgement, and how they reflected on their writing development throughout the interactive writing process. The two coders then compared their initial LREs and collaboratively defined clear criteria for identifying LREs to ensure consistency and accuracy in the coding process. The transcripts were subsequently recoded based on the defined criteria, ensuring a reliable and consistent approach for identifying relevant LREs. The identified LREs were then categorised based on the specific aspects of the AI-mediated writing mediation the learners addressed (e.g. perceived effectiveness of writing mediation, challenges encountered, impact on self-regulation in writing). These categories were further analysed to identify recurring themes and patterns. This provided valuable insights into the learners' cognitive processes, perceptions, and the overall impact of the ChatGPT's writing mediation on writing skills development from other-regulation towards self-regulation.

4.3.2. Thematic analysis

The data collected from the transcripts of think-aloud interviews underwent thematic analysis. Open thematic coding was initially carried out by the researcher/mediator to recognise key themes related to EFL learners' attitudes and perceptions towards the impact of the ChatGPT's writing mediation on their academic writing skills development. Afterwards, axial coding was conducted to group these themes according to their interrelationships. Each group was subsequently labelled to reflect the constituent themes. The processes of open coding, axial coding, and labelling were conducted in a reiterative and bottom-up manner. The following excerpt from one of the learners' transcribed interviews exemplifies the analytical approach employed:

- (1) ChatGPT helped me struggle with using proper linking phrases to connect my writing ideas. (2) However, it is not perfect. Sometimes, it suggests things that do not fit the context. So, I have to be careful and double-check its suggestions.

As evident, the transcribed piece was divided into two excerpts. Excerpt 1 illustrates the learner's heightened awareness of their writing issues; hence, it was categorised under the theme of 'boosting awareness of writing issues' within the 'developing writing insights and competences' category. Excerpt 2, which addresses ChatGPT's production of

inappropriate writing samples, was classified under the theme of ‘producing inaccurate writing samples’ within the ‘confronting challenges posed by ChatGPT’ category. A second researcher independently coded a subset of the data (approximately 25% of the transcripts) to further ensure the trustworthiness of the generated themes and categories. The researchers then compared their coding and any discrepancies were discussed and resolved through consensus. This involved revisiting the relevant data segments, critically evaluating alternative interpretations, and ultimately reaching a consensus on the most appropriate coding. This collaborative approach ensured that the final thematic analysis reflected a comprehensive and accurate representation of the data.

5. Results

Through thematic analysis of the online writing sessions, participant essays, and researcher/mediator’s observations and reflexive journal entries, a framework of mediation typology and a framework of reciprocity typology emerged, revealing the microgenetic development of the learners’ academic writing skills.

5.1. *Mediation typology*

The uncovered mediation typology framework categorises the various writing mediation utilised by ChatGPT to facilitate academic writing skills development in the EFL learners. These categories represent a spectrum of writing mediational strategies, ranging from subtle prompts that helped the learners towards self-discovery (implicit writing mediation) to more direct interventions that explicitly addressed the writing issues (explicit writing mediation). This continuum fosters a gradual progression towards learner autonomy as the learners internalised their mediated writing abilities using the AI’s writing assistance. The categories of the mediation typology with their respective descriptions and mediational strategies are presented in [Table 1](#).

The mediational strategies in [Table 1](#) illustrate how ChatGPT assisted the learners in developing their academic writing skills during the online sessions. The learners reported that they found the ChatGPT’s writing mediation helpful in identifying their writing weaknesses, allowing them to focus on specific areas for academic writing skills development. The repeated utilisation of the ChatGPT’s writing mediation contributed to the learners’ reduced apprehension about making mistakes, their growing confidence in their writing abilities, and ultimately their increased autonomy and control over the writing process. The following sections clarify and exemplify the uncovered mediational strategies.

Table 1. Mediation typology.

Mediation categories	Description	Mediationsal strategies
M1: Scaffolding awareness	Learners are prompted to utilise the ChatGPT's mediation to become aware of grammar, vocabulary, and other writing issues.	M1.1. Identifying recurring mistakes and weaknesses in grammar, vocabulary, or sentence structure. M1.2. Drawing attention to specific areas for writing development based on the ChatGPT's mediation.
M2: Targeted writing mediation	Learners receive specific writing mediation from ChatGPT to identify and address academic writing issues.	M2.1. Utilising the ChatGPT's mediation to develop coherence and logical flow of ideas. M2.2. Incorporating the ChatGPT's mediation for lexical and grammatical development.
M3: Confidence building reinforcement	Learners gain confidence in their writing skills through repeated practice and positive reinforcement from ChatGPT.	M3.1. Providing positive feedback that emphasises strengths and progress. M3.2. Offering non-judgemental support to reduce anxiety about making mistakes.
M4: Critical thinking prompts	Learners develop critical thinking skills by evaluating the ChatGPT's mediation and making informed decisions about the writing suggestions.	M4.1. Prompting learners to question and assess the rationale behind the ChatGPT's mediation. M4.2. Encouraging learners to consider the effectiveness of the ChatGPT's mediation for their specific writing goals.
M5: Fading prompts and increased autonomy	Learners progress towards self-regulated writing as they internalise the mediation provided by ChatGPT.	M5.1. Encouraging independent application of learned writing strategies. M5.2. Observing a decrease in reliance on ChatGPT for writing tasks.

5.1.1. Scaffolding awareness

The scaffolding awareness category (M1) focused on prompting the learners to utilise the ChatGPT's writing mediation to identify and become aware of recurring grammar, vocabulary, and other writing issues. The learners were encouraged to pay attention to the ChatGPT's mediation and suggestions for writing development in order to identify and realise their writing weaknesses. L1, for example, demonstrated awareness-raising during an AI-assisted online writing session with ChatGPT. After receiving mediation on their writing, L1 noticed a recurring error related to subject-verb agreement. *via* the ChatGPT's mediation for writing development (M1.1), L1 became aware of their weakness in that area. In subsequent writing tasks, L1 actively paid attention to the ChatGPT's mediation, specifically focusing on subject-verb agreement, resulting in marked development in their writing (M1.2). The following excerpt shows how L1 applied the ChatGPT's mediation to address the subject-verb agreement in their writing.

Excerpt 1:

L1: ...The majority of glaciers has melted in recent decades...

ChatGPT: In this paragraph, the subject-verb agreement seems inconsistent. Please check for subject-verb agreement errors.

L1: Hmm, I received a comment about subject-verb agreement. Let me review my paragraph. Oh, I see! I tend to overlook this issue. I often forget to match the subject with the correct verb form.

ChatGPT: Your paragraph shows improved subject-verb agreement.

As evident in Excerpt 1, learners utilising the ChatGPT's writing mediation showed a more targeted approach to revisions. ChatGPT provided writing mediation that specifically concentrated on writing weaknesses and allowed the learners to address the writing issues directly. For instance, L1 consistently corrected the subject-verb agreement error after receiving prompts from ChatGPT. However, without AI assistance, the provided writing mediation may have lacked the precise guidance needed to identify and correct specific writing weaknesses. This could result in broader revisions that were less effective in addressing fundamental writing weaknesses.

5.1.2. Targeted writing mediation

Under the targeted writing mediation category (M2), the learners received specific mediation from ChatGPT to effectively address their academic writing issues. This involved incorporating the ChatGPT's writing mediation to enhance coherence and logical flow of ideas, as well as implementing suggested lexical and grammatical mediation. During an online session, for instance, whilst composing an essay on the advantages of renewable energy, L2 received specific writing mediation from ChatGPT on writing issues related to coherence and logical flow of ideas. The ChatGPT's writing mediation highlighted the need for better transitions between paragraphs (M2.1). L2 incorporated the ChatGPT's writing mediation for linking phrases and developed the flow of their writing. Additionally, ChatGPT offered lexical and grammatical mediation (M2.2), which L2 readily implemented, leading to a more cohesive essay. Excerpt 2 displays how L2 utilised the ChatGPT's writing mediation to address their writing issues related to coherence and logical flow of ideas.

Excerpt 2:

ChatGPT: Your essay lacks smooth transitions between paragraphs. Consider using appropriate linking phrases to enhance coherence.

L2: I need to work on my paragraph transitions. ChatGPT suggests using linking phrases. Let's see... Ah, that makes sense! I should use 'furthermore' to connect these ideas.

ChatGPT: Your use of linking phrases has significantly improved the flow between paragraphs.

As indicated in Excerpt 2, L2 exhibited a broader exploration of transitions between paragraphs. The ChatGPT's writing mediation

encouraged revision, which led to more developed writing. For example, L2 used the transition word furthermore to enhance coherence, which resulted in a more cohesive essay structure and an improved, sophisticated writing style. The lack of AI-enhanced writing mediation may have constrained the learners' exploration, and resulted in essays that, whilst grammatically correct, lacked stylistic variety and sophistication.

5.1.3. Confidence building reinforcement

The confidence-building reinforcement category (M3) played a crucial role in fostering the learners' confidence in their writing skills. Through repeated practice and positive reinforcement from ChatGPT, the learners felt less apprehensive about making mistakes due to the non-judgemental nature of the AI platform, they received more positive feedback, and recognised development in their academic writing skills attributed to the ChatGPT's writing mediation. L3, initially apprehensive about making mistakes, found reassurance and confidence *via* the ChatGPT's non-judgemental nature. As ChatGPT provided positive reinforcement and constructive writing mediation (M3.1), L3 felt more at ease experimenting with new vocabulary and complex sentence structures. With time, L3 recognised the noticeable development in their academic writing skills, attributing their progress to the ChatGPT's non-judgemental, supportive writing mediation (M3.2). Excerpt 3 indicates L3's utilisation of the ChatGPT's writing mediation to boost their self-confidence in writing activities.

Excerpt 3:

ChatGPT: You attempted to use complex sentence structures effectively. Keep experimenting with vocabulary and sentence variety.

L3: I was nervous about trying more complex sentences, but the ChatGPT's mediation is encouraging. Let me experiment with using 'moreover' to add more sophistication.

ChatGPT: Your use of advanced vocabulary and sentence structures enhances the overall quality of your writing.

Excerpt 3 shows that L3 benefited from the non-judgmental nature of the ChatGPT's writing mediation, which fostered a more confident approach for writing revision. For example, L3 was encouraged by the ChatGPT's writing mediation to include complex sentences in their writing. This positive non-judgmental nature of the ChatGPT's writing mediation created a convenient and safe atmosphere for L3 to include more complex structures in their writing without fear of failure. Without the ChatGPT's writing mediation, however, the learners might have felt less confident during writing revisions due to the possibility of receiving critical feedback. The lack of non-judgmental writing mediation could have led to less creative writing

revisions, as the learners might have prioritised conforming to established structures rather than nurturing their distinctive writing voice.

5.1.4. Critical thinking prompts

The critical thinking prompts category (M4) concentrated on developing the learners' critical thinking skills. The learners were encouraged to question and assess the rationale behind the ChatGPT's writing mediation, enabling them to make informed decisions about whether to implement or disregard the writing mediation. During an online session, for example, whilst writing a persuasive essay on the importance of cultural exchange programmes, L4 received writing mediation from ChatGPT, which suggested a change in wording for a key term. ChatGPT proposed using a more formal synonym. Instead of blindly accepting the suggestion, L4 engaged critically with the writing mediation, questioned its validity, and considered alternative possibilities (M4.1). L4 considered the potential impact of the writing mediation on the target audience (young adults) and the overall tone of the essay. Recognising that the original term appealed more to the target audience, L4 opted to retain it whilst strengthening the supporting arguments. That is, through such thoughtful evaluation, L4 made informed decisions about incorporating some of the ChatGPT's writing mediation whilst retaining their original ideas (M4.2), demonstrating an advanced level of critical thinking and autonomy. Excerpt 4 shows how the ChatGPT's writing mediation provoked L4's critical thinking skills.

Excerpt 4:

ChatGPT: Consider revising the supporting evidence for your argument. Provide more specific examples to strengthen your point.

L4: ChatGPT suggests I revise my supporting evidence. I need to evaluate its relevance. Hmm, some points are valid, but others could be strengthened with more specific examples.

ChatGPT: Your revised argument showcases stronger evidence, making your position more convincing.

As indicated in Excerpt 4, L4 was encouraged to critically evaluate the writing mediation provided by ChatGPT. L4 analysed the validity of the suggested wording change for a key term and ultimately decided to retain the original term to maintain the intended voice. Such AI-enhanced writing mediation fostered critical thinking skills by encouraging the learners to evaluate the merits of the writing mediation against their own writing goals. However, without AI assistance, the learners may not have had the opportunity to develop critical thinking skills related to revising their writing.

5.1.5. Fading prompts and increased autonomy

Lastly, the fading prompts and increased autonomy category (M5) represented the learners' progression towards self-regulated writing. As the learners internalised the ChatGPT's writing mediation and guidance, they became more capable of applying the learned writing strategies without heavily relying on the ChatGPT's assistance. This category highlighted the learners' increased agency and control over their writing process. As the online sessions progressed, the learners, such as L5 increasingly internalised the writing mediation and feedback provided by ChatGPT. L5 was encouraged to autonomously utilise the learned writing strategies without heavily relying on the ChatGPT's writing mediation (M5.1). Furthermore, L5 confidently experimented with sentence structures without prompting, showcasing increased agency and autonomy (M5.2) over their writing process using ChatGPT as a supplementary platform for occasional validation rather than constant guidance. Excerpt 5 exemplifies the role of ChatGPT in enhancing L5's writing autonomy.

Excerpt 5:

ChatGPT: Your use of advanced vocabulary is commendable. You have become proficient in applying various writing strategies.

L5: I am glad to receive positive feedback on my vocabulary. I can now apply these strategies without constantly relying on the ChatGPT's writing mediation.

ChatGPT: Your writing demonstrates a high level of autonomy and self-regulation. Well done!

Excerpt 5 reveals that L5 progressively internalised the writing mediation suggested by ChatGPT and eventually relied less on such prompts. This indicated the learners' self-regulation in their academic writing skills. Without AI assistance, however, the learners might have shown slower progress towards self-regulated writing. Overall, utilising the ChatGPT's writing mediation, the learners demonstrated a more focused approach to addressing their writing weaknesses, explored advanced writing techniques, and developed stronger critical thinking and self-regulation skills.

5.2. Reciprocity typology

The reciprocity typology for the learners' responses to the ChatGPT's writing mediation during the online sessions involved four main categories, each of which demonstrated a different level of responsiveness and interaction with the ChatGPT's writing mediation. The reciprocity typology explored the learners' responses to the ChatGPT's writing mediation during the online sessions, and illustrated their progression from passive acceptance to active autonomy in the writing process. The reciprocity categories along with their descriptions and reciprocity moves are presented in Table 2.

Table 2 demonstrates that as the learners became more acquainted with the ChatGPT's writing mediation, they transitioned from uncritical acceptance (R1) to critical engagement (R2) in the writing mediation which corroborated their growing autonomy in response to AI-enhanced writing mediation. Subsequently, the learners progressed towards independent judgement (R3) and achieved a balance between the ChatGPT's mediation with their own writing preferences. In the final stage of autonomous writing (R4), the learners used ChatGPT as a supplementary platform for occasional validation, which indicated a significant level of autonomy and self-regulation in the learners' writing process. The following sections clarify how various uncovered reciprocity moves were utilised by the learners to address the AI-based writing mediation.

5.2.1. Uncritical acceptance

In the uncritical acceptance stage (R1), the learners initially accepted the ChatGPT's writing mediation uncritically without questioning its validity. The learners followed the writing mediation and suggestions provided by the ChatGPT without further evaluation. Excerpt 6 reveals how L1 responded to the writing mediation at this stage.

Excerpt 6:

ChatGPT: Your essay structure is well-organised.

L1: ChatGPT says my essay structure is good. I will follow its suggestion and keep it as it is.

ChatGPT: Your essay structure remains consistent and effective.

Table 2. Reciprocity typology.

Reciprocity categories	Description	Reciprocity moves
R1: Uncritical acceptance	Learners initially accepted the ChatGPT's writing mediation uncritically, without question.	R1.1. Following the ChatGPT's suggestions without further evaluation.
R2: Critical engagement	Learners started to question and evaluate the ChatGPT's mediation before implementing any changes.	R2.1. Reflecting on the appropriateness of the ChatGPT's recommendations. R2.2. Seeking further explanations for the ChatGPT's mediation.
R3: Independent judgement	Learners began to make their informed decisions based on a combination of the ChatGPT's writing mediation and personal judgement.	R3.1. Making informed choices about implementing or disregarding the ChatGPT's suggestions. R3.2. Combining the ChatGPT's mediation with learners' own writing preferences.
R4: Autonomous writing	Learners exhibited increased autonomy in their writing, relying less on the ChatGPT's writing mediation.	R4.1. Demonstrating self-regulated writing abilities. R4.2. Utilising ChatGPT as a platform for occasional validation rather than dependence.

5.2.2. Critical engagement

As the learners progressed in their academic writing skills, they transitioned into critical engagement (R2) when addressing the ChatGPT's writing mediation. In this stage, the learners began questioning and evaluating the ChatGPT's writing mediation before implementing any changes. They reflected on the appropriateness of the ChatGPT's recommendations and sought further explanations, when necessary. For example, Excerpt 7 indicates L2's response to the writing mediation.

Excerpt 7:

ChatGPT: Consider rephrasing this sentence for clarity.

L2: ChatGPT suggests rephrasing. Let me think about it. I will rewrite the sentence to make it clearer.

ChatGPT: Your rephrased sentence enhances the clarity of your argument.

5.2.3. Independent judgement

Upon further writing development, the learners achieved the independent judgement of the writing mediation (R3). Here, the learners started making their own decisions based on a combination of the ChatGPT's writing mediation and personal judgement. The learners demonstrated the ability to make informed decisions about whether to implement or disregard the ChatGPT's writing mediation, and found a balance between the ChatGPT's writing mediation and their own writing preferences. Excerpt 8, for instance, shows how L3 was engaged in the independent judgement of the ChatGPT's writing mediation.

Excerpt 8:

ChatGPT: You may want to consider using more specific examples to support your points.

L3: The ChatGPT's feedback is helpful, but I want to add my own touch. I will include both the ChatGPT's suggestions and my personal examples.

ChatGPT: Your use of specific examples strengthens the credibility of your arguments.

5.2.4. Autonomous writing

Finally, the autonomous writing stage (R4) reflected the learners' increased autonomy in their writing process. The learners exhibited self-regulated writing abilities and relied less on the ChatGPT's writing mediation and recommendation. Instead, the learners utilised ChatGPT as a supplementary platform for occasional validation, which showed a significant level of independence and self-regulation. Excerpt 9 demonstrates how L4 responded to the writing mediation in this regard.

Excerpt 9:

ChatGPT: Your essay demonstrates a strong grasp of the topic.

L4: I have gained enough confidence in my academic writing skills. I can independently write my essay without relying heavily on ChatGPT.

ChatGPT: Your essay showcases autonomous writing with well-developed arguments and coherent structure.

Overall, the findings from the mediation and reciprocity typologies indicated how AI-assisted writing mediation contributed to the EFL learners' academic writing skills development. It was indicated that instructing ChatGPT to provide tailored and personalised writing mediation on the EFL learners' writing issues and actively engaging with such writing mediation to address the writing weaknesses played a significant role in the learners' academic writing skills development. That is, by receiving tailored writing mediation from ChatGPT, the learners were able to target specific areas of their writing weakness and gradually develop their academic writing skills. The learners' responsiveness to the provided writing mediation indicated their active involvement in the learning process which was essential for their academic writing skills development.

On the other hand, the findings demonstrated that the provision of both implicit and explicit writing mediation was effective since it addressed the different writing needs of the EFL learners. Implicit writing mediation provided a more subtle form of assistance and allowed the learners to independently reflect on their writing issues and make connections with the guidance provided by ChatGPT. Such writing mediation encouraged the learners to develop their problem-solving and critical thinking skills and fostered a deeper understanding of the writing concepts. Explicit writing mediation also suggested more direct support and concrete strategies, and provided the learners with clear instruction and guidance on how to address specific writing issues. Explicit writing mediation was beneficial for the learners who required more structured assistance or who were struggling to identify and rectify their writing issues.

By incorporating both implicit and explicit writing mediation, the learners had the flexibility to engage with the ChatGPT's writing mediation in a way that best suited their individual writing preferences and needs, and helped them gradually take ownership of their writing process. Following the mediation and reciprocity typologies, the movement from implicit to explicit writing mediation was carefully monitored to correspond to each learner's ZPD. By doing so, the writing mediation tailored its support level based on the learners' developing competence to help them move towards greater self-regulation and autonomous functioning in writing (i.e. their ZDD level). The findings revealed that the learners

gradually relied on more implicit or no AI writing mediation which showed their growing self-regulation and autonomy in accomplishing their writing tasks. To explain and support these findings and to provide valuable insights into the learners' understanding and interpretation of the AI-based writing mediation, we further explored the learners' attitudes and perceptions towards the impact of the ChatGPT's writing mediation on their academic writing skills development *via* think-aloud interviews.

5.3. Learner perception

We conducted think-aloud interviews with the learners to gain insights into how they were engaged in the interactive writing activities with ChatGPT. Several themes and categories were generated addressing the learners' positive and negative attitudes and perceptions towards the impact of the ChatGPT's writing mediation on their academic writing skills. The emerged themes and categories also addressed the research enquiry of the study regarding the contribution of the ChatGPT's writing mediation to the learners' academic writing skills development by providing comprehensive qualitative findings on the learners' experiences and perspectives. This allowed us to triangulate the findings from the think-aloud interviews with those obtained from the initial data collection so as to provide a comprehensive understanding of the role of the ChatGPT's writing mediation in developing the EFL learners' academic writing skills. **Figure 3** presents the generated themes and categories.

As indicated in **Figure 3**, four categories along with 13 themes were generated, among which three categories and 10 themes addressed the EFL learners' positive attitudes and perceptions towards the impact of the ChatGPT's writing mediation on their academic writing skills and one category along with three themes addressed their negative attitudes and perceptions in that regard. The first group of themes revolved around the learners' positive attitudes and perceptions towards the role of ChatGPT in nurturing their critical analysis and writing effectiveness. In this line, for instance, the learners capitalised on the role of ChatGPT in provoking them to consider both the AI-enhanced writing mediation and their own personal judgement to make the best decision on how to address their writing issues. That is, the learners not only acknowledged the AI's writing mediation but also involved their own judgement in implementing their writing-related issues which could help strengthen their writing argument. This generated theme also emphasised the dynamic interaction between the learners and ChatGPT and the learners' critical thinking development, which facilitated their academic writing skills. Excerpt 13 shows what L14 asserted.

Excerpt 13:

I used the AI-assisted writing mediation to add more examples and reinforce my writing argument.

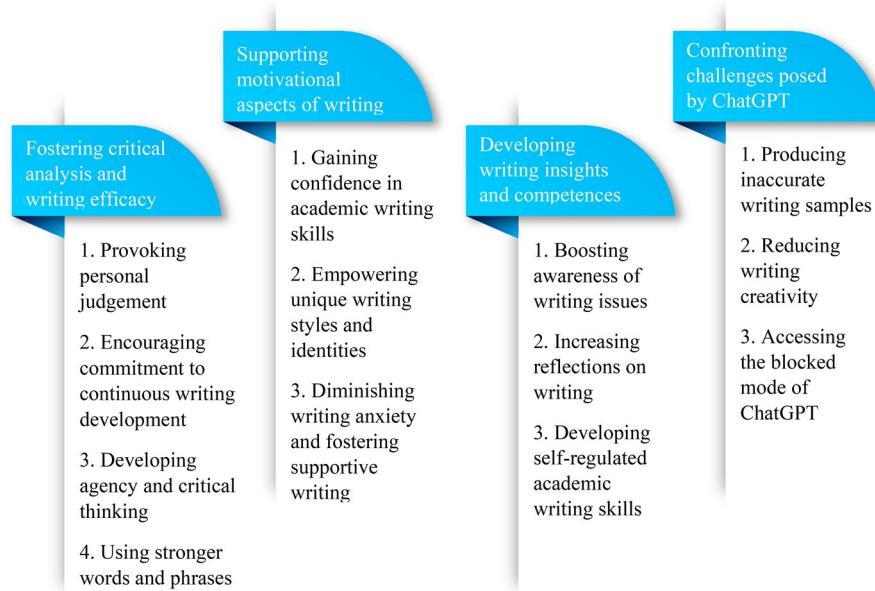


Figure 3. Generated themes and categories about the contribution of ChatGPT's writing mediation to academic writing skills development.

The learners also reported that interaction with ChatGPT helped them constantly track their writing progress. This highlighted the role of AI in encouraging the learners to become active participants in their writing processes and showed commitment to continuous writing development. L6, as presented in Excerpt 15, mentioned how ChatGPT helped them track and develop a component of their writing performance.

Excerpt 15:

I am glad to see that my vocabulary knowledge has developed due to the ChatGPT's regular writing mediation. I have been working on expanding it.

The learners' engagement with the ChatGPT's writing mediation varied throughout the assessment sessions. Initially, some learners exhibited a tendency to accept the AI's suggestions uncritically. However, as the learners became more familiar with the platform and its limitations, they started to question the writing mediation and made their own judgements. This evolution in engagement indicated the learners' increasing agency and critical thinking in response to the AI-assisted writing mediation. Excerpt 19 indicates what L9 argued.

Excerpt 19:

In the beginning, I would just follow whatever ChatGPT suggested. But then, I realised that sometimes it gave odd suggestions; so, I started to think more about its feedback and decided if it made sense for my writing.

The learners further thought that the ChatGPT's writing mediation substantially contributed to their writing development. For example, the

AI's writing mediation helped the learners adopt stronger transition words and phrases between the paragraphs to develop the flow of their writing. This capitalised on the practical impact of ChatGPT for providing more effective writing mediation and developing the academic writing skills of the learners. Excerpt 11 indicates what L13 pointed out.

Excerpt 11:

Based on the AI's writing mediation, I could use better transitions to make my writing flow smoothly.

The second group of themes focused on the supportive, motivational, and emotional roles of the AI platform's writing mediation in contributing to the learners' EFL academic writing skills development. The learners, in this regard, claimed that they gradually gained confidence in their academic writing skills, but would occasionally consult ChatGPT for more guidance. This highlighted the fact that ChatGPT was subsequently utilised by the learners not as a primary source of support but as a supplementary platform for guidance and validation. It showed the learners' self-regulated abilities in their writing as they relied on their writing skills and would selectively apply the AI's writing mediation to develop their writing quality. Excerpt 16, for instance, shows the claim made by L10.

Excerpt 16:

I still check with ChatGPT occasionally to make sure I am on the right track, but I do not rely on it as much as before.

In addition, the learners expressed that ChatGPT helped them apply their unique style to their writing. That is, the AI's writing mediation empowered the learners to accomplish their writing tasks based on their individual ideas and preferences. This highlighted the substantial role of ChatGPT, which not only provided writing mediation but also encouraged them to become authors in their own right, resulting in a distinct presence in their writing. It further capitalised on the effective role of ChatGPT in assisting the learners to construct their own identities in their writing. Excerpt 17 reveals what L8 contended in this regard.

Excerpt 17:

I want my voice to be heard in this essay, so I make sure it reflects my ideas and style.

In general, the learners' attitudes and perceptions towards the AI-enhanced writing mediation were positive. The learners viewed ChatGPT as a valuable writing partner that facilitated continuous academic writing skills development. The learners appreciated the instant accessibility of ChatGPT which allowed them to receive immediate writing mediation without time constraints. The platform's non-judgemental nature was also perceived as beneficial in reducing writing apprehension and fostering a supportive writing environment. Excerpt 18 shows L3's assertion.

Excerpt 18:

This platform is like a helpful friend. It always gives me feedback, and I do not feel nervous about making errors and mistakes. It is great to have such a platform to develop my writing.

The third group of themes also concentrated on the effectiveness of the ChatGPT's writing mediation in developing writing insights and competences. For instance, the learners highlighted the significant role of the AI's writing mediation in boosting their awareness of their writing issues, such as the inappropriate utilisation of linking devices to connect the ideas in their writing. This indicated that ChatGPT acted as an effective AI platform for enhancing the learners' academic writing skills awareness and development. Excerpt 10 shows what L11 stated in this regard.

Excerpt 10:

ChatGPT helped me struggle with using proper linking phrases to connect my writing ideas.

The learners further believed that ChatGPT increased their reflections on writing mediation. This helped the learners reflect on the provided writing mediation before incorporating it into their written texts and make informed decisions about which writing mediation to integrate into their writing, which contributed to the clarity of their essays. This uncovered theme also revealed that the AI's writing mediation contributed to the learners' autonomous writing. For instance, Excerpt 12 reveals what L3 asserted.

Excerpt 12:

I thought about each AI's suggestion carefully and chose the ones that made my essay clearer and more convincing.

Another generated theme in this category revolved around the significant role of the AI's writing mediation in developing the learners' self-regulated writing abilities. This means that the provided writing mediation helped the learners gradually rely on their writing abilities rather than solely relying on the AI's writing mediation. At this stage, the learners could confidently revise their written texts based on their academic writing skills and capabilities. In this regard, Excerpt 14 indicates the assertion made by L12.

Excerpt 14:

I don't rely on ChatGPT for everything now. I trust my own judgement and make decisions about my writing.

Whilst ChatGPT proved to be a valuable mediator for EFL academic writing skills development, some challenges and limitations were also identified. The fourth group of themes, in this regard, addressed the challenges and limitations posed by the AI platform when giving writing

mediation. The learners, for instance, reported occasional inaccuracies in the ChatGPT's writing mediation, especially regarding context-specific language usage and cultural references. Moreover, some learners expressed concerns about becoming too reliant on ChatGPT and its potential negative impact on their creativity and originality. Excerpt 20 indicates what L11 asserted.

Excerpt 20:

ChatGPT is helpful, but it is not perfect. Sometimes, it suggests things that do not fit the context. So, I have to be careful and double-check its suggestions.

Finally, the internet connection and the restriction of ChatGPT in the current context were matters of considerable concern for the learners. The learners required a high-speed internet connection and, as in the current context access to ChatGPT was blocked requiring the use of a VPN, the learners would have access to a non-restricted mode of the original platform to conveniently communicate with AI.

6. Discussion

Drawing on Vygotsky's (1978) social constructivist theory of learning, we explored the contribution of AI-enhanced writing mediation to the academic writing skills development of EFL learners. The findings uncovered mediation and reciprocity typologies showcasing how the EFL learners gradually developed their academic writing skills through engagement with the AI-assisted writing mediation. The follow-up interview findings further highlighted that the EFL learners held positive attitudes and perceptions towards the utilisation of ChatGPT in their writing process. The findings are consistent with those of Su et al. (2023) who corroborated the significant and positive roles of ChatGPT in developing EFL learners' writing skills. The findings could be due to the engaging learner-AI interactive writing activities. Each time the learners asked ChatGPT to give them writing mediation, ChatGPT provided the learners with more suitable and specific writing alternatives to more appropriately address their writing issues on the one hand, and develop their academic writing skills on the other hand. This further motivated the learners in the writing activities as they received more immediate and personalised writing mediation. On the other hand, ChatGPT contributed to the learners' better writing performance which, as a positive reinforcement, resulted in the learners' further motivation and engagement in the writing activities. Liu et al. (2021), in this regard, argued that AI played a crucial role in boosting learners' motivation in further writing activities. The subsequent interview findings of the study also highlighted that the learners held positive attitudes and perceptions towards utilising

ChatGPT for developing their academic writing skills, findings that supported the above-mentioned findings of the current study.

Following Vygotsky's (1978) social constructivism, AI in this study played a significant role in enhancing the learners' self-regulated and autonomous writing abilities. The learners were initially engaged in interactive writing activities with ChatGPT. That is, the learners received AI-based writing mediation each time they requested ChatGPT to generate alternative sentences and texts about their writing issues. ChatGPT was trained to provide either implicit or explicit writing mediation based on the learners' writing development and their writing ZPD. The learners who were closer to their potential academic writing skills development required fewer explicit writing mediation and more implicit or no writing mediation. According to Aljaafreh and Lantolf (1994), learners who asked for less explicit writing mediation had greater microgenetic writing development. This means that the learners who requested less or no AI-assisted writing mediation had more writing development and could accomplish their writing tasks autonomously, without the contribution of ChatGPT. As ChatGPT generated more immediate and relevant implicit and explicit writing mediation, it substantially contributed to the learners' gradual transitioning from other-regulation (interactive writing activities with ChatGPT) to self-regulation (autonomous writing performance). Liu et al. (2021) also corroborated the indispensable attributes of AI platforms in fostering EFL learners' self-regulated and autonomous learning. During the interview sessions of the current study, the learners further claimed that ChatGPT contributed to their self-regulated writing abilities, findings which were in harmony with the aforementioned findings.

The EFL learners' writing development could be attributable to the carefully structured writing mediation provided by ChatGPT (i.e. AI-based implicit and explicit writing mediation). The writing mediation was tailored to the specific needs and writing development levels of the EFL learners. This ensured that the learners received writing mediation and support in areas where they needed development which further bridged the gap between their current academic writing skills and their potential level of functioning (i.e. their ZPD level). Aljaafreh and Lantolf (1994) argued that writing mediation is more effective when it is thoughtfully structured and tailored to correspond to the learners' writing abilities. Barrot (2023b) and Yan (2023), in alignment with these findings, claimed that AI platforms provided more effective writing feedback and made a more profound contribution to learners' writing skills. The findings were also consistent with those of Su et al. (2023) who confirmed that ChatGPT provided more immediate and pertinent writing comments. Su et al. (2023) similarly argued that ChatGPT provided feedback closely associated with the specific writing issues and abilities of the learners,

which enabled them to address their writing issues immediately and utilise the writing feedback more effectively. Such findings are also in harmony with the interview results in which the learners asserted that ChatGPT gave them more relevant and immediate writing mediation to effectively and efficiently develop their academic writing skills.

Further, compared to learners' interactive writing activities with other peers and/or the instructor, the learners in the current study were less anxious when accomplishing their writing tasks with the AI's writing support and mediation. The diminished writing anxiety levels of the learners might be due to the non-judgemental nature of ChatGPT, the absence of social pressures, and the availability of immediate, consistent, and supportive writing mediation. This means that the learners did not experience any anxiety-producing factors whilst accomplishing their writing tasks, which further motivated them to do their writing tasks more appropriately and develop their academic writing skills. That is, such a relaxed and motivating learning environment helped the learners concentrate on accomplishing their writing tasks and developing their writing skills. Several researchers, such as Hoang and Hoang (2022), Lee et al. (2016), and Rahimi and Fathi (2022), claim that this could be related to the availability of online platforms anywhere and anytime which helps the learners accomplish their language learning tasks at their own pace and convenience. The study's interview results also corroborated such findings by highlighting that ChatGPT engaged the learners in the writing activities by reducing their anxiety levels.

ChatGPT also contributed to the learners' various academic writing skills development, such as task achievement, coherence and cohesion, lexicon, and grammatical range and accuracy, by giving them immediate writing mediation and suggestions. For example, ChatGPT gave the learners ideas to write about different key features of their writing topic and provided the opportunity to apply some strategies, such as organising the writing ideas, utilising appropriate transition words and cohesive devices, and incorporating relevant pronoun references and more consistent verb tenses, to develop their writing task achievement and coherence and cohesion. Additionally, ChatGPT suggested synonyms and more alternative vocabulary and grammar choices which helped the learners expand their lexicon and grammatical structures and become more skilled in selecting more suitable words and grammar structures for different parts of their written texts.

7. Conclusion

In the current study, we explored the impact of AI-supported writing mediation on EFL learners' academic writing skills following Vygotskian

social constructivist theory of learning. The findings indicated that the ChatGPT's structured implicit and explicit writing mediation (Aljaafreh & Lantolf, 1994) contributed to the EFL learners' academic writing skills development on the one hand, and helped them achieve their potential level of development (i.e. their ZPD level) in writing on the other hand. As the learners gradually required less explicit writing mediation and became more responsive to the writing mediation provided by ChatGPT, they showcased potential development in their academic writing skills. The tailored writing mediation facilitated gradual academic writing skills development, allowing the learners to develop their different writing areas, such as coherence, organisation, grammar, vocabulary, etc. By closely monitoring the learners' responses to the varying levels of writing mediation provided by ChatGPT, our study also identified areas of strength and weakness in the learners' writing, enabling targeted intervention and support. The findings further demonstrated that the learners had positive attitudes and perceptions towards the contribution of ChatGPT to their writing skills development. The findings could be due to the engaging, meticulously structured, immediate, and more relevant writing mediation provided by ChatGPT.

The findings present several pedagogical and practical implications for the EFL context. For instance, the generated structured mediation and reciprocity typologies could be applied in AI-enhanced writing courses to help EFL learners reach their potential academic writing skills development more effectively. Based on their current writing abilities, EFL learners can receive more relevant and immediate implicit and/or explicit AI-based writing mediation and develop different areas of their writing, such as task achievement, coherence and cohesion, lexicon, and grammatical range and accuracy. EFL learners can also utilise ChatGPT anywhere and anytime to more enthusiastically work on their writing tasks at their own pace. The findings could particularly benefit less capable EFL learners who require more writing mediation. ChatGPT can provide such learners with a reasonable amount of immediate and relevant implicit and/or explicit writing mediation to help them achieve their ZPD level. This is achieved either by applying the uncovered writing mediation and reciprocity typologies or by generating their own context-specific writing mediation and reciprocity typologies. EFL instructors may also use ChatGPT as the supplementary and complementary online learning platform to further develop EFL learners' academic writing skills up to their ZPD and ZDD levels.

However, to provide EFL learners with more engaging AI-assisted writing courses, EFL educators and instructors need to train EFL learners on how to effectively apply the AI-based writing mediation to develop their academic writing skills. Future researchers may replicate the current

study in various English language learning settings to deepen our understandings on how the AI-based writing mediation gradually contributes to the learners' potential academic writing skills development. Future studies could further explore the optimal number of editing repetitions needed for EFL learners utilising AI-enhanced writing platforms. This could involve tracking changes made across revisions and analysing the correlation between editing frequency and academic writing skills development. Other researchers might also compare the effectiveness of AI-assisted writing mediation and the writing mediation provided by an EFL instructor to shed more light on the findings.

Moreover, whilst a control group design offers advantages in establishing causal relationships, it was not deemed essential for the present research objectives. The current qualitative research prioritised rich, contextualised understanding over statistical generalisation. That is, our focus centred on exploring EFL learners' interactions with ChatGPT, the specific writing mediation the learners received, and the learners' developing thought processes during the writing processes. A control group design, emphasising pre- and post-test comparisons, would not have facilitated the detailed exploration of these dynamic factors. However, although the qualitative nature of this study suggested valuable insights into the EFL learners' experiences, it restricted the generalisability of the findings. Future researchers, conducting a large-scale study, might explore the comparative effectiveness of AI-assisted writing mediation against traditional methods by employing control groups whilst, at the same time, concentrating on the detailed explorations of the AI's writing mediation and the learners' writing processes. Furthermore, a larger sample size in experimental research might enable a more comprehensive analysis of writing samples to identify EFL learners' writing development based on their essays and the evidence related to their academic writing skills.

Disclosure statement

No potential conflict of interest was reported by the authors.

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