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# Metacognitive Awareness and EFL Learners' Perceptions and Experiences in Utilising ChatGPT for Writing Feedback

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## ABSTRACT

The present study explored EFL students' perceptions and experiences in utilising ChatGPT to seek feedback for writing. The present study also examined how levels of metacognitive awareness (MA) influenced these perceptions and experiences. Utilising a mixed-method research design, the study collected data from a total of 40 EFL undergraduates over a semester-long writing course. Data collection methods included self-report questionnaires and semi-structured interviews. Data analyses comprised both quantitative and qualitative approaches. Quantitatively, *t*-tests and Mann–Whitney *U* tests were used to compare group differences, while regression analyses were conducted to explore relationships between variables. Qualitatively, thematic analysis was employed to identify and interpret patterns within the data. Quantitative analysis revealed significant differences in writing experiences and perceptions, including motivation for writing, engagement, self-efficacy and collaborative writing tendency. Furthermore, a positive correlation was found between MA scores and students' perceptions and practices of using ChatGPT. Analysis of interview data highlighted a range of perceptions and experiences between the high and low MA students, with behaviours spanning from mere copying words from ChatGPT to effective use of ChatGPT for writing feedback. Key factors that influenced the effective use of ChatGPT for writing assistance included metacognitive awareness, critical thinking skills and cognitive efforts. The findings highlight implications for writing teachers and students in teaching and learning English as a foreign language.

## 1 | Introduction

Providing effective feedback for English as a Foreign Language (EFL) writing is a significant challenge for teachers. Peer feedback involves students reviewing and providing constructive critiques of each other's work, encouraging critical thinking by exposing learners to diverse perspectives and writing styles (Chen and Hapgood 2021; Lin et al. 2021). Through this process, learners can gain valuable insights into their own writing by understanding what their peers perceive as strengths and areas for improvement. However, delivering personalised and constructive feedback can be time-consuming (McMartin-Miller 2014). Teacher–student relationship may influence learners' inclination to seek feedback for revision (Liu, Storch, and Morton 2022). Furthermore, learners

may lack the metacognitive awareness necessary for feedback during writing (Teng and Ma 2024).

Given these challenges, an alternate is to examine machine-generated feedback for writing. Machine feedback is based on software or automated tools to generate feedback on writing. These systems, often referred to as Automated Writing Evaluation (AWE) systems, analyse text for various elements such as grammar, syntax, coherence and style, fostering learners' engagement with writing (Zhang 2020). The immediacy and precision of machine feedback provide students with timely and actionable suggestions, allowing them to make real-time improvements to their work. In the realm of writing instruction, peer feedback and machine feedback serve distinct

yet complementary roles, but there is a growing need to place greater emphasis on machine feedback (Guo and Wang 2024).

The importance of machine feedback is increasingly tied to advancements in artificial intelligence (AI). AI-powered feedback systems offer immediate, objective and consistent evaluations, particularly in areas such as grammar, syntax and style. AI is not only transforming individual lives but also reshaping entire communities (Borenstein and Howard 2021). Recent advancements in ChatGPT encouraged researchers to reflect on English language teaching and learning (Gao, Wang, and Wang 2024; Huang, Wang, and Zhang 2024; Kohnke, Moorhouse, and Zou 2023; Toncelli and Kostka 2024; Wang and Xue 2024). ChatGPT, a sophisticated large language model (LLM), exemplifies this transformation by generating responses to a wide array of prompts, including languages, instructions and questions (Open AI 2024). ChatGPT is designed to engage in human-like conversations. It can understand and generate text that simulates chat-based conversations with humans, making it particularly helpful for writing feedback (Huang 2023; Teng 2024a). The integration of ChatGPT into language teaching and learning underscores the importance of fostering digital competencies. LLMs serve as an essential tool for involving EFL students in more sophisticated and contextually rich language use. Engagement with LLMs in language education has become a crucial factor in enhancing learning experiences (Wang and Reynolds 2024; Wang and Wang 2024). As educators and students interact with AI-driven tools, they develop digital literacy skills on par with today's technology-driven world. ChatGPT's ability to facilitate these interactions highlights its potential to bring digital literacy to a new stage, where learners not only consume digital content but also actively engage with AI technologies to enhance their learning experiences.

Applied linguistics researchers are exploring both the benefits and challenges associated with using ChatGPT (Kohnke, Moorhouse, and Zou 2023). A primary concern is the ethical implications of using ChatGPT for academic writing (Teng 2023a). The debate on whether to “Use or Not to Use” AI continues unabated (Wu, Wang, and Wang 2024). Despite these concerns, AI technology has shown to be a valuable asset in writing (Godwin-Jones 2022; Teng 2024b), and acceptance of generative AI positively predicts the well-being and self-efficacy of EFL learners (Huang, Wang, and Zhang 2024). ChatGPT is helpful for writing assessments (Mizumoto and Eguchi 2023; Mizumoto et al. 2024). The tool's ability to provide immediate, detailed feedback makes it an invaluable resource for both teachers and students. EFL Students in Japan supported the use of ChatGPT to enhance their editing and proofreading strategies (Allen and Mizumoto 2024). Similarly, Chinese EFL students have reported increased behavioural, cognitive, and emotional engagement after interacting with AI-driven chatbots (Wang and Xue 2024). These findings suggest that AI tools can significantly improve student engagement and motivation in language learning.

Despite the importance of metacognitive awareness (MA) in relation to ChatGPT for research competency (Abdelhalim 2024), the understanding of MA in the context of ChatGPT for writing in a foreign language context remains underexplored. MA involves the ability to reflect on and regulate one's cognitive processes, which is crucial when using advanced AI tools like ChatGPT. It enables EFL learners to critically assess the tool's suggestions,

discern when to accept or modify those suggestions, and understand the limitations and potential biases inherent in AI-generated content. The present study examined the actual use and impact of ChatGPT in writing, informing the critical use of ChatGPT for writing (Javier and Moorhouse 2023), and highlighting how metacognitive skills can enhance users' ability to effectively integrate AI assistance into their writing processes. By exploring how ChatGPT can be incorporated into writing, the present study delves into the dynamics of EFL learners' writing and MA, shedding light on a deeper understanding of both their own cognitive processes and the capabilities and awareness of using ChatGPT for seeking and processing feedback.

## 2 | Literature Review

### 2.1 | ChatGPT for Feedback

Peer feedback is a crucial component of the writing process (Rollinson 2005; Storch 2002). It plays a vital role in helping students refine their writing skills by encouraging critical thinking and self-reflection. This process for both giving and processing feedback requires metacognitive awareness in understanding and processing feedback (Teng and Ma 2024). Such awareness allows students to thoughtfully engage with feedback, leading to more meaningful revisions and improvements in their writing. However, peer feedback may lack quality (Guo, Chen, and Qiao 2022), especially when considering learners' varied writing proficiency (Ruegg 2015). EFL students may only provide surface-level feedback on grammar use and word structures (Rahimi 2013), leaving deeper issues related to content organisation, argument development, and coherence unaddressed.

Timely and comprehensive teacher feedback tailored to each student's specific needs is thus necessary for the possible enhancement of writing (Er, Dimitriadis, and Gašević 2021). Teachers can provide feedback that is not only corrective but also encouraging, helping to motivate students and build their confidence in writing (Brookhart 2008). Teachers can also tailor their feedback to address the specific needs and proficiency levels of individual students, helping students focus on their unique areas for improvement and enhancing their writing experiences (Ferris 2003). Teacher feedback on content may be general rather than detailed and helpful (Zacharias 2007). This limitation highlights the necessity for alternative feedback mechanisms to provide more personalised and actionable insights, enabling students to receive detailed guidance that can effectively address their individual challenges and promote meaningful improvements in their writing skills.

In recent years, researchers have explored machine feedback as an alternate efficient mode of feedback. Pre-trained large language models (LLMs), like ChatGPT, may provide opportunities and benefits for writing feedback (Teng 2024b). ChatGPT-4o (Open AI 2024), an advanced LLM, has garnered significant attention shortly after its release. Unlike its predecessors—GPT-1, GPT-2, GPT-3 and GPT-4—ChatGPT-4o employs reinforcement learning from human feedback to ensure a higher-level objectivity of its language modelling.

Bans on ChatGPT had been gradually released and the era of AI has come (Zhang and Tur 2024). ChatGPT has been used to

replace teacher feedback (Guo and Wang 2024) and student feedback (Teng 2024a). Recent studies have explored the potential of ChatGPT-based feedback, examining its impact on both teaching and learning. For teachers, ChatGPT can generate feedback that aligns with instructional guidelines, offering relevant comments on student work. However, this feedback may sometimes lack depth and originality (ElSary 2024). This limitation is attributed to the nature of ChatGPT, which relies on statistical patterns derived from its training data, potentially constraining its ability to provide novel insights (Grassini 2023). For students, ChatGPT-based feedback is often characterised by its detail, fluency and coherence, making it a valuable tool for enhancing writing quality (Teng 2024a). Specifically, it has been shown to improve students' skills in writing argumentative essays (Su, Lin, and Lai 2023). Furthermore, ChatGPT provides EFL learners with instant and personalised feedback, allowing them to engage in continuous practice and refinement of their writing skills (Tsai, Lin, and Brown 2024). This immediacy and customisation offer students numerous opportunities to enhance their proficiency and confidence in writing, summarised by Imran and Almusharraf (2023) and Teng (2024b). Overall, ChatGPT, based on an understanding of language patterns, can benefit writing feedback (Kalyan 2024; Rudolph, Tan, and Tan 2023). While the debate and concerns surrounding ChatGPT persist, research on its use to support student writers shows promise.

## 2.2 | AI for Writing

Advanced LLMs like ChatGPT demonstrate significant potential in enhancing writing training. Teng (2024b) conducted a systematic review of studies on using ChatGPT for writing, highlighting the opportunities, potential and challenges of using ChatGPT. Similarly, Barrot (2023) reviewed the pitfalls and benefits of incorporating ChatGPT into L2 writing, noting that ChatGPT can benefit L2 writing.

Several empirical studies have examined the integration of ChatGPT into writing settings. For example, Mizumoto and Eguchi (2023) examined ChatGPT for automated essay scoring (AES). Their findings indicated that AES using GPT is reliable. The reliability of scoring accuracy showcased ChatGPT's capability to provide feedback for writing. In another study, Mizumoto et al. (2024) investigated ChatGPT's potential for writing assessment. Data were from the Cambridge Learner Corpus First Certificate in English (CLC FCE) data set. Compared with Grammarly, a stronger correlation between ChatGPT and human ratings was detected. This highlighted the higher reliability of ChatGPT than Grammarly for writing assessment. In a study focusing on 33 Japanese EFL learners, Allen and Mizumoto (2024) divided the participants into two groups: writing groups and AI-assisted groups. ChatGPT was used to provide feedback for editing and proofreading. Students mostly preferred using ChatGPT for writing because ChatGPT could provide effective feedback. They recommended the incorporation of ChatGPT for EFL writing, especially for editing and proofreading. In a similar vein, Ghafouri, Hassaskhah, and Mahdavi-Zafarghandi (2024) explored the use of ChatGPT in writing. Data were from 12 EFL teachers and 48 learners. The program followed a three-phased writing instruction protocol: (1) planning, (2) instruction and (3) assessment. The use of ChatGPT significantly enhanced teachers' self-efficacy and

learners' writing performance. ChatGPT was found to nurture teachers' and learners' self-efficacy.

There are also some studies focusing on the Chinese context. For example, Teng (2024a) analysed EFL learners' perceptions and experiences to use ChatGPT for writing, involving 45 EFL learners in Macau. Drawing upon data from questionnaires and qualitative interviews, the findings supported significant positive effects of ChatGPT on writing, including increased motivation, self-efficacy, engagement and collaborative writing tendencies. While students mostly expressed positive attitudes towards using ChatGPT for feedback, some concerns about ethical use and over-reliance on the technology were noted. Again, Shen and Teng (2024) explored the impact of AI-assisted writing on EFL learners' critical thinking skills. The study involved 204 EFL students in China and focused on evaluating learners' writing proficiency aided by AI tools. The results supported a significant and positive correlation between AI-assisted writing, critical thinking skills and self-directed learning competency, emphasising the potential of AI technologies in writing.

The above studies highlight the potential of ChatGPT in supporting student writings. The benefits include positive feedback, increased self-efficacy, improved critical thinking skills, self-regulation, writing accuracy and assessment capabilities. However, concerns about over-reliance on technology and its ethical use remain. In addition, the examination of learners' metacognitive awareness in the use of ChatGPT is needed to understand learners' awareness and willingness in using ChatGPT for writing.

## 2.3 | ChatGPT and Metacognitive Awareness

Metacognitive awareness (MA) is closely linked to self-regulation, strategic control and self-efficacy (Teng 2023b). According to metacognition theory, MA encompasses a broad spectrum of metacognitive experiences related to seeking meaning for goal setting (Flavell 1979). Brown's (1987) model of MA identifies two primary components: knowledge of cognition and regulation of cognition. Knowledge of cognition involves understanding one's own cognitive processes. Efklides (2008) also explains that this type of knowledge includes information from memory that helps learners understand their cognitive abilities, resources, and strategies. Paris, Cross, and Lipson (1984) further classify knowledge into three distinct categories: declarative knowledge, which refers to the information about skills, resources and abilities that is stored in the mind, procedural knowledge, which encompasses the understanding of processes and strategies needed to accomplish a task, and conditional knowledge, which involves knowing when and why to apply particular learning strategies.

Regulation of cognition entails employing metacognitive strategies such as planning, monitoring and evaluating to oversee cognitive and learning activities (Flavell 1987). Schraw and Dennison (1994) identified five key subprocesses that support metacognitive regulation. These include Planning, which involves establishing objectives and effectively distributing resources; Information Management Strategies, which entail skillfully handling information through techniques such as organising, summarising, elaborating and concentrating; Monitoring, which



requires continuously evaluating learning progress and the application of strategies; Debugging Strategies, which focus on correcting misunderstandings and errors in performance and Learning Evaluation, which involves critically assessing both performance outcomes and the effectiveness of the strategies used. Together, these subprocesses form a comprehensive framework for enhancing metacognitive regulation, ultimately improving learning and performance. Effective coordination of knowledge and regulation can enhance learning (Schraw 2001). Higher levels of MA are associated with greater responsibility, self-efficacy and better self-regulation (O'Malley and Chamot 1990).

Teng (2024c) applied metacognitive awareness to virtual reality (VR) and proposed an integrated framework to explore MA and learner autonomy within VR digital gaming environments. Metacognitive processes were interpreted as adaptivity, control and feedback, while autonomy was viewed in terms of location, formality, pedagogy and locus of control. This framework enables learners to exert control over digital learning, highlighting a need for building a language-learning community. Similarly, Mizumoto (2023) introduced the Metacognitive Resource Use (MRU) framework, positioning data-driven learning within an expansive ecosystem of generative AI tools. This framework focuses on metacognitive knowledge and regulation, leveraging the strengths of both data-driven learning (DDL) and generative AI (GenAI) while mitigating their weaknesses. The study highlights the importance of MA in integrating AI resources. Likewise, Abdelhalim (2024) investigated the metacognitive awareness of learners in utilising ChatGPT to enhance research skills. The study gathered both quantitative and qualitative data from 27 EFL undergraduate students, consisting of 12 with low metacognitive awareness (MA) and 15 with high MA, over the course of one semester. The quantitative analysis revealed notable differences in how ChatGPT was used by the low and high MA groups. Additionally, a positive correlation was found between MA scores and students' perceptions of ChatGPT, highlighting varied perceptions and practices between those with high and low MA.

Overall, exploring MA in the context of ChatGPT offers promising avenues for understanding knowledge and regulation of cognition. However, learners' MA in using ChatGPT for writing, particularly EFL students' perceptions and experiences in seeking feedback for writing, remains underexplored. Further research is needed to understand the role of MA in the effective use of ChatGPT in EFL writing settings.

## 2.4 | The Present Study

Current research on AI-assisted writing often emphasises learners' perceptions and experiences with tools like ChatGPT or contrasts these tools with traditional writing instruction methods. The present study seeks to delve deeper into students' MA in using ChatGPT for writing feedback. In particular, it aims to explore ChatGPT's impact on learners' writing perceptions and experiences, measured through writing motivation, self-efficacy, collaborative tendencies and engagement, alongside the development of MA, which includes declarative, procedural and conditional knowledge, as well as planning, monitoring and evaluation. The present study aims to address the following research questions:

1. How does ChatGPT influence EFL students' writing experiences, perceptions and metacognitive awareness?
2. What is the relationship between EFL students' levels of metacognitive awareness and their perceptions and experiences in utilising ChatGPT for writing feedback?
3. What factors affect EFL learners' use of ChatGPT for writing feedback?

## 3 | Methodology

### 3.1 | Participants

The study involved 40 students from two English Practical Writing classes, instructed by the same teacher. Each class had 20 students, with one class comprising 11 males and 9 females, and the other 10 males and 10 females. Participants were from the Language and Translation program, primarily from Macao, speaking Cantonese as their first language, with a few from mainland China speaking Mandarin. Based on a university-standardised English test, the participants exhibited low to intermediate proficiency. Consent forms were signed, affirming their rights and the option to withdraw, though no withdrawals occurred. The module aimed to enhance academic writing skills, using a process-oriented approach over 15 weeks.

### 3.2 | Group Treatment

Students were randomly divided into two groups: one class utilised AI tools, while the other did not. Both classes had the same instructor, materials and course requirements. The AI group engaged with tools like Poe—an alternative to ChatGPT—for writing tasks during class, whereas the other class followed a teacher-led, peer-collaboration approach. Poe (<https://poe.com/>) was chosen due to ChatGPT's unavailability in Macau, offering ChatGPT access for free classroom use.

### 3.3 | Instruments

#### 3.3.1 | Questionnaire

To collect quantitative data, questionnaires on students' perception and experiences and metacognitive awareness were employed.

#### 3.3.2 | Writing Perception and Experiences in the Context of ChatGPT

A well-designed questionnaire can yield significant insights into learners' experiences (Creswell and Creswell 2018). The adopted survey from Teng (2024a) reflects ideas from previous research (Collie, Martin, and Curwood 2016; Ling et al. 2021; Teng and Wang 2023; Teng and Yang 2023). The focus was on motivation for writing, engagement in writing, self-efficacy in writing and collaborative writing tendency. The validity of this survey was well-established through rigorous testing and cross-referencing with existing literature, ensuring that the constructs are relevant to current research contexts. This tool was

used to explore participants' experiences and preferences concerning their writing activities and their utilisation of ChatGPT for writing.

The questionnaire was administered in Chinese. Each dimension consisted of 5 items, totalling 20 items. Participants rated each statement on a 5-point Likert scale, where 1 indicated strong disagreement and 5 indicated strong agreement.

### 3.4 | Metacognitive Awareness

The present study employed Teng's (2020) Metacognitive Writing Strategies Questionnaire (MWSQ), adapted from Schraw and Dennison's (1994) Metacognitive Awareness Inventory (MAI), to assess students' MA levels. The adaptation from MAI maintains the validity in relation to the comprehensive assessment of metacognitive awareness. It consists of 45 items across two categories: knowledge of cognition (20 items) and regulation of cognition (25 items), using a 5-point Likert scale from "1-always false" to "5-always true." Knowledge of cognition consists of three subcategories: declarative knowledge (8 items), procedural knowledge (5 items) and conditional knowledge (7 items). Regulation of cognition includes three subcategories: planning (6 items), monitoring (9 items) and evaluation (10 items).

### 3.5 | Semi-Structured Interviews

Ten students (five with high MA and five with low MA) participated in semi-structured interviews to discuss their ChatGPT-related perceptions and practices. Open-ended questions explored their goals, feedback-seeking experiences, writing skill enhancement and perceptions and benefits of using ChatGPT for writing. Interviews were transcribed by the author and verified by participants for accuracy. These interview questions aim to seek additional qualitative data that can complement the questionnaire results. Examples of questions for the interviews were as follows:

1. Can you share your goals in using ChatGPT for writing?
2. Can you share how you used ChatGPT for seeking feedback in writing?
3. How did ChatGPT help you?
4. In what ways did ChatGPT enhance your writing?
5. Did you find ChatGPT to be a reliable resource?
6. What were the advantages or benefits of using ChatGPT for writing?
7. How can ChatGPT help you plan, monitor and evaluate your writings?

### 3.6 | Procedures for Data Collection

The participants were informed about the research objectives and signed a consent form to take part in the study.

Questionnaires were administered to participants at the conclusion of the course, designed to be completed in approximately 20 min. These questionnaires aimed to gather quantitative data on the students' experiences and perceptions regarding the course content and the use of AI tools. In addition to the questionnaires, semi-structured interviews were conducted with randomly selected students from the AI group. These interviews involved both high and low MA students and lasted around 10 min each. The semi-structured format allowed for flexibility in questioning, enabling the interviewer to explore topics in depth based on the students' responses. This approach provided rich qualitative insights, offering a deeper understanding of individual experiences and perceptions that complemented the quantitative data collected through the questionnaires. Both the questionnaires and interviews were conducted in Chinese. This choice was made to ensure that all participants could fully comprehend the questions and express their thoughts comfortably and accurately. Using their native language helped reduce any potential language barriers, fostering an environment where students felt more at ease sharing their honest opinions and reflections. This approach was crucial in obtaining reliable and meaningful data to inform the study's findings.

### 3.7 | Data Analysis

Data analysis was conducted using Stata 18.0, a powerful statistical software package, to perform a range of statistical tests and create visualisations that helped interpret the findings. To compare differences between groups, the analysis employed both *t*-tests and Mann-Whitney *U* tests. *T*-tests were used to compare the means of two groups, assuming data met the normality assumption, while the Mann-Whitney *U* test, a non-parametric test, was used when the data did not meet these assumptions. This approach ensured that the analysis was both comprehensive and appropriate for the data characteristics, providing reliable insights into group differences. Regression analyses were conducted to explore the influence of MA on EFL students' writing experiences and their perceptions of using ChatGPT. These analyses helped identify potential predictors and assess the strength and direction of relationships between variables. By incorporating MA as a variable, the study aimed to understand how students' self-awareness and regulation of cognitive processes might impact their engagement with AI tools and their overall writing development.

For the qualitative data obtained from interviews, thematic coding was employed to identify and analyse patterns and themes within the data. The coding process involved systematically categorising the data into themes that emerged from the participants' responses. To ensure the accuracy and validity of the coding, participants were invited to review the transcripts and the corresponding codes. This participant verification process helped confirm that the interpretations accurately reflected their views and experiences, enhancing the credibility of the qualitative findings. Through this approach, the study provided a nuanced understanding of the interplay between MA, writing experiences and perceptions of ChatGPT among EFL students.

## 4 | Results

### 4.1 | RQ1: ChatGPT on Writing Perceptions and Experiences and Metacognitive Awareness

The first research question explored the role of ChatGPT on EFL students' perceptions and experiences and metacognitive awareness. The first step was to explore the reliability of the surveys.

Based on the provided results in Table 1, the Cronbach's alpha ( $\alpha$ ) values for all the variables range from 0.673 to 0.907, both in the pre-test and post-test conditions. The variables have acceptable to good internal consistency reliability, indicating that the items within each variable are measuring the same underlying construct. The Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy values range from 0.6 to 0.79, both in the pre-test and post-test conditions. The KMO results suggest that the sample size is adequate for further statistical analysis.

Table 2 lists the descriptive statistics of the examined variables for the two examined groups of using not using AI (ChatGPT).

In Table 2, the sample was divided into two groups of not using AI for writing ( $n = 20$ ) and using AI for writing ( $n = 20$ ). In terms of post-test measures (MW\_post, SEW\_post, CBW\_post, WE\_post, DK\_post, PK\_post, CK\_post, P\_post, M\_post, E\_post), the group

TABLE 1 | Reliability of the surveys.

Variables	Test time	Alpha	KMO
Motivation for writing	Post	0.804	0.76
Self-efficacy for writing	Post	0.794	0.75
Collaborative writing tendency	Post	0.867	0.71
Writing engagement	Post	0.907	0.73
Declarative knowledge	Post	0.887	0.76
Procedural knowledge	Post	0.837	0.77
Conditional knowledge	Post	0.869	0.75
Planning	Post	0.765	0.74
Monitoring	Post	0.761	0.79
Evaluating	Post	0.831	0.75
Motivation for writing	Pre	0.715	0.6
Self-efficacy for writing	Pre	0.701	0.67
Collaborative writing tendency	Pre	0.77	0.63
Writing engagement	Pre	0.789	0.61
Declarative knowledge	Pre	0.864	0.69
Procedural knowledge	Pre	0.759	0.65
Conditional knowledge	Pre	0.764	0.62
Planning	Pre	0.673	0.68
Monitoring	Pre	0.708	0.69
Evaluating	Pre	0.768	0.65

using AI had significantly higher mean scores compared to the group of not using ChatGPT. The  $p$  values for these post-test measures were all less than 0.05, indicating statistically significant differences between the two groups. In terms of pre-test measures, the differences between the groups of using or not using ChatGPT were less pronounced. Only motivation for writing (MW\_pre) and declarative knowledge (DK\_pre) showed statistically significant differences ( $p < 0.05$ ) between the two groups. The other pre-test measures did not show statistically significant differences between the groups.

The visualised results in Figures 1 and 2 also suggest that participants of using ChatGPT had significantly better outcomes in the post-test measures compared to the participants of not using ChatGPT. This indicates that AI assistance had a significant impact on the post-test outcomes, while the pre-test measures were more similar between the two groups.

The difference between the pre-test and post-test for each indicator is reported in Figure 3.  $x$  represents the average of 6 indicators of metacognitive awareness, and  $y$  represents the average of 4 indicators of writing perceptions and experiences in using ChatGPT for writing.

Assuming a normal distribution, the results of the  $t$ -test are shown in Table 3.

In the present study, the data were not normally distributed, we mainly looked at the results of the Mann–Whitney  $U$  test, which are shown in Table 4.

Based on the provided statistical results in Table 4, the following can be concluded: For the average of 6 indicators ( $x$ ) and the average of 4 indicators ( $y$ ), the differences between the two groups (with AI and without AI) reached statistical significance ( $p < 0.001$ ). This indicates that the improvement in these indicators was significantly greater for the group using AI compared to the control group without AI. Specifically, in the 6 indicators of DK (declarative knowledge), PK (procedural knowledge), CK (condition knowledge), P (planning), M (monitoring), and E (evaluating), the mean values of the AI group were significantly higher than the non-AI group ( $p < 0.001$ ). For the indicators of MW (motivation for writing), CBW (collaborative writing tendency), and WE (writing engagement), the improvement in the AI group was also significantly greater than the non-AI group ( $p < 0.01$  or  $p < 0.001$ ). The only indicator that did not reach statistical significance was SEW (self-efficacy for writing), where the difference between the two groups was only marginally significant ( $p = 0.056$ ).

### 4.2 | RQ2: Metacognitive Awareness Levels and Writing Perceptions and Practices

We first explored the correlation matrix provided among the examined variables. The correlation matrix provides insights into the relationships between various writing-related constructs, which could be useful for understanding the relationship of the underlying factors.

There were positive and significant correlations among the examined variables of writing experiences and metacognitive awareness

**TABLE 2** | Descriptive statistics of the survey for the classroom writing and AI assistance group.

		Stratified by AI use		No		Yes		<i>p</i>
		<i>n</i>	Mean	SD	Mean	SD		
Motivation for writing	Post	MW_post (mean [SD])	3.59	0.35	4.34	0.38	< 0.001***	
Self-efficacy for writing	Post	SEW_post (mean [SD])	3.66	0.34	3.96	0.52	0.037**	
Collaborative writing tendency	Post	CBW_post (mean [SD])	3.58	0.37	4.14	0.45	< 0.001***	
Writing engagement	Post	WE_post (mean [SD])	3.48	0.39	4.26	0.54	< 0.001***	
Declarative knowledge	Post	DK_post (mean [SD])	3.46	0.32	4.4	0.27	< 0.001***	
Procedural knowledge	Post	PK_post (mean [SD])	3.54	0.38	4.09	0.47	< 0.001***	
Conditional knowledge	Post	CK_post (mean [SD])	3.44	0.36	4.26	0.36	< 0.001***	
Planning	Post	P_post (mean [SD])	3.64	0.27	4.14	0.31	< 0.001***	
Monitoring	Post	M_post (mean [SD])	3.4	0.19	3.97	0.28	< 0.001***	
Evaluating	Post	E_post (mean [SD])	3.5	0.18	4.22	0.22	< 0.001***	
Motivation for writing	Pre	MW_pre (mean [SD])	3.48	0.38	3.17	0.51	0.036**	
Self-efficacy for writing	Pre	SEW_pre (mean [SD])	3.47	0.44	3.46	0.33	0.936	
Collaborative writing tendency	Pre	CBW_pre (mean [SD])	3.56	0.33	3.6	0.39	0.729	
Writing engagement	Pre	WE_pre (mean [SD])	3.47	0.4	3.31	0.59	0.32	
Declarative knowledge	Pre	DK_pre (mean [SD])	3.36	0.44	3	0.67	0.053*	
Procedural knowledge	Pre	PK_pre (mean [SD])	3.3	0.42	3.27	0.28	0.794	
Conditional knowledge	Pre	CK_pre (mean [SD])	3.06	0.25	3.1	0.47	0.704	
Planning	Pre	P_pre (mean [SD])	3.32	0.28	3.38	0.29	0.511	
Monitoring	Pre	M_pre (mean [SD])	3.06	0.15	3.16	0.28	0.191	
Evaluating	Pre	E_pre (mean [SD])	3.04	0.19	3.1	0.29	0.443	

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

(Figure 4). For example, the cell at the intersection of motivation for writing and self-efficacy for writing has a value of 0.16, indicating a positive relationship between the two constructs. The cell at the intersection of declarative and procedural knowledge has a value of 0.37, indicating a stronger positive correlation between these constructs.

Figure 5 and Table 5 present the linear results.

Based on the provided linear regression results in Figure 5 and Table 5, the following conclusions can be drawn. The regression coefficient indicates that the independent variable  $x$  (metacognitive awareness) has a significant positive linear relationship with the dependent variable  $y$  (perceptions and experiences in using ChatGPT for writing). For every unit increase in  $x$ , there is an approximately 1.24 unit increase in  $y$ , suggesting a strong positive correlation between  $x$  and  $y$ .

The regression coefficient for the AI variable is  $-0.18146$ , but the  $p$  value is  $0.106$ , which is greater than the significance level of  $0.05$ . This means that the use of AI does not have a significant effect on  $y$ , after controlling for the influence of  $x$ . In other words, whether

using AI assistance or not does not have a significant impact on the value of  $y$ , if we do not consider  $x$ .

The model's goodness of fit is very high, with an  $R^2$  of  $0.8631$ , indicating that the model can explain  $86.31\%$  of the total variation in  $y$ . This suggests that the independent variables  $x$  and AI can very well explain the changes in the dependent variable  $y$ .

Overall, this linear regression model shows that the independent variable  $x$  has a significant positive linear relationship with the dependent variable  $y$ , whereas the AI variable does not have a significant effect on  $y$ , if we do not consider  $x$ . The overall fit of the model is very high, and it has strong explanatory power for the changes in  $y$ .

### 4.3 | RQ3: Factors Contributed to EFL Learners' Use of ChatGPT for Writing

The analysis identified three key factors that affect how ChatGPT is used for obtaining writing feedback: metacognitive awareness, critical thinking skills and cognitive efforts.



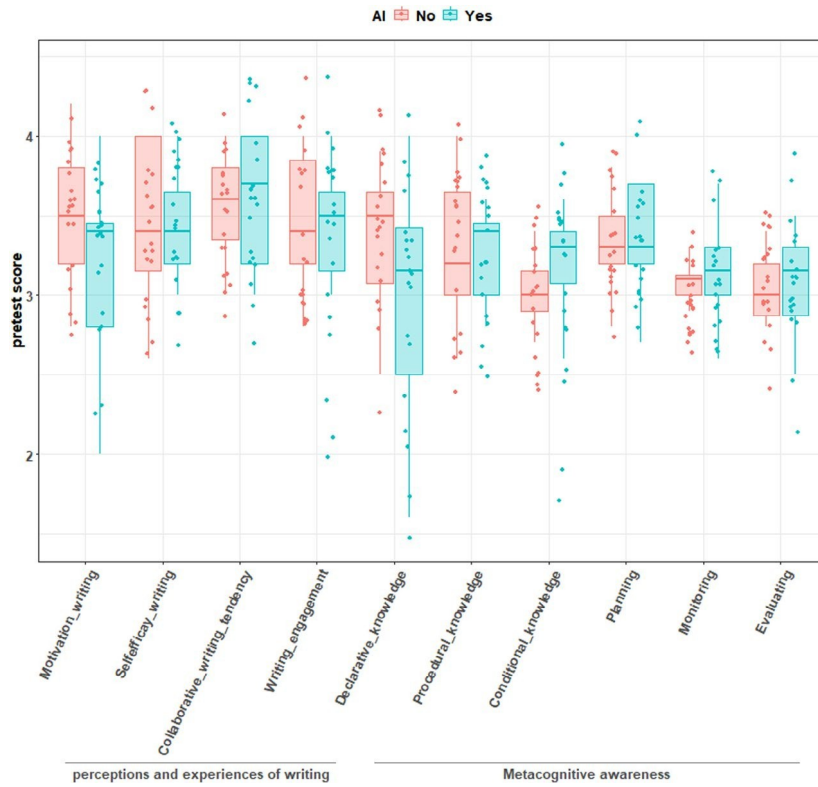


FIGURE 1 | The incorporation of AI in writing for pre-test scores.

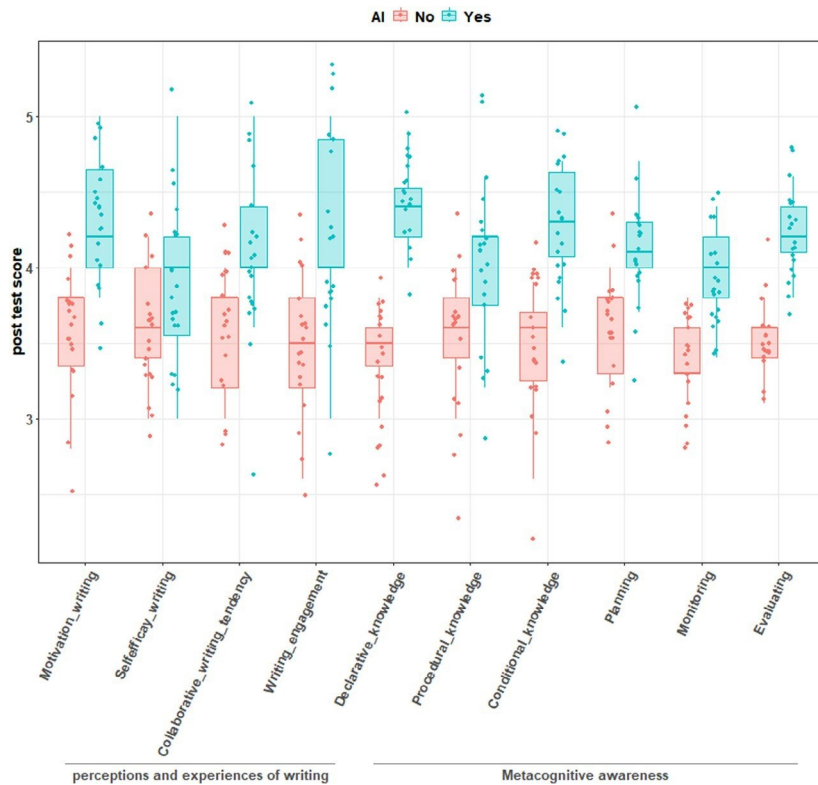


FIGURE 2 | The incorporation of AI in writing for post-test scores.

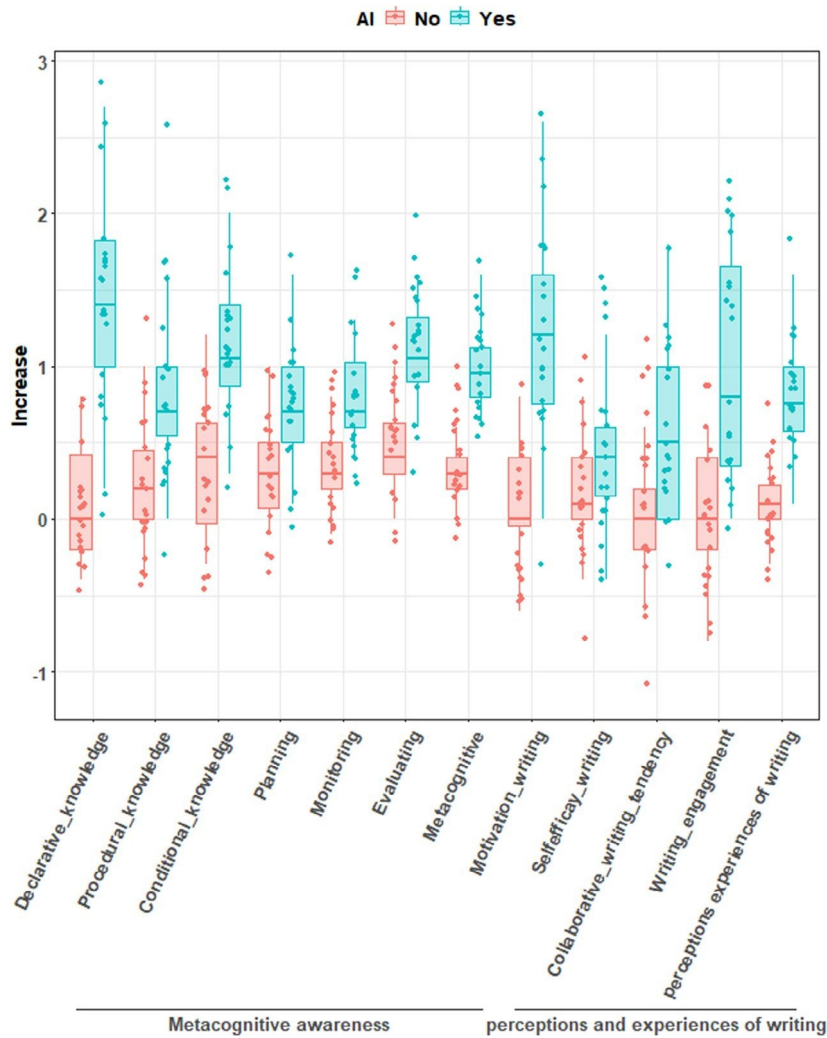


FIGURE 3 | Increase in metacognitive awareness and writing perceptions demonstrated by the two groups.

#### 4.4 | Metacognitive Awareness Is Essential to the Use of ChatGPT for Writing

Interviews highlighted the crucial role of metacognitive awareness in effectively using ChatGPT for writing. Students with high metacognitive awareness stressed the importance of monitoring and regulating their thought processes when engaging with ChatGPT. Instead of passively accepting AI-generated content, these students emphasised a need to actively consider writing objectives, provide relevant context and critically assess the quality and relevance of ChatGPT's responses. For instance, one student remarked:

Being mindful of my own thinking is vital when using ChatGPT for assignments. I constantly reassess my goals, the information I need to provide, and whether the output meets my needs. It's easy to accept whatever ChatGPT offers, but that can lead to missing the mark.

This statement illustrates how metacognitive awareness helps students avoid blindly relying on AI, instead using ChatGPT as a tool within a reflective writing process. By being aware of

their cognitive processes, students can discern when ChatGPT's feedback aligns with their goals or requires further guidance.

Similar experiences were reported by other students with high metacognitive awareness, who managed to offload some writing tasks to ChatGPT while preserving "cognitive resources for higher-order thinking and decision-making," allowing the students to "engage more productively with the writing process."

Conversely, a lack of metacognitive skills can hinder the effective use of AI tools like ChatGPT. Students with low metacognitive awareness struggled to navigate and benefit from AI technologies in academic writing. One student noted

I've used ChatGPT for feedback, but sometimes the feedback doesn't address key issues. I'm not always sure what to expect or how to frame requests for useful feedback.

This comment reveals a lack of metacognitive awareness, as this student seemed unaware of ChatGPT's capabilities and

**TABLE 3** | T-test results.

	Total		No		Yes		<i>p</i>
	Mean	SD	Mean	SD	Mean	SD	
DK (mean [SD])	0.75	0.876	0.09	0.38	1.41	0.73	< 0.001
PK (mean [SD])	0.53	0.546	0.24	0.4	0.82	0.52	< 0.001
CK (mean [SD])	0.772	0.592	0.39	0.42	1.16	0.49	< 0.001
P (mean [SD])	0.54	0.399	0.32	0.3	0.75	0.38	< 0.001
M (mean [SD])	0.575	0.355	0.33	0.24	0.81	0.28	< 0.001
E (mean [SD])	0.795	0.425	0.47	0.23	1.12	0.31	< 0.001
<i>x</i> (mean [SD])	0.657	0.431	0.3	0.2	1.02	0.27	< 0.001
MW (mean [SD])	0.64	0.735	0.11	0.36	1.17	0.62	< 0.001
SEW(mean [SD])	0.345	0.514	0.19	0.37	0.5	0.6	0.056
CBW (mean [SD])	0.28	0.541	0.02	0.45	0.54	0.51	0.001
WE (mean [SD])	0.48	0.776	0.01	0.46	0.95	0.75	< 0.001
<i>y</i> (mean [SD])	0.448	0.496	0.1	0.27	0.8	0.41	< 0.001

**TABLE 4** | Mann–Whitney *U* test results.

Item	No	Yes	<i>p</i>
DK (median [IQR])	0.00 [−0.20, 0.42]	1.40 [1.00, 1.83]	< 0.0001
PK (median [IQR])	0.20 [0.00, 0.45]	0.70 [0.55, 1.00]	0.0004
CK (median [IQR])	0.40 [−0.03, 0.63]	1.05 [0.88, 1.40]	< 0.0001
P (median [IQR])	0.30 [0.07, 0.50]	0.70 [0.50, 1.00]	0.0005
M (median [IQR])	0.30 [0.20, 0.50]	0.70 [0.60, 1.02]	< 0.0001
E_(median [IQR])	0.40 [0.30, 0.63]	1.05 [0.90, 1.33]	< 0.0001
<i>x</i> (median [IQR])	0.30 [0.20, 0.40]	0.95 [0.80, 1.12]	< 0.0001
MW (median [IQR])	0.00 [−0.05, 0.40]	1.20 [0.75, 1.60]	< 0.0001
SEW (median [IQR])	0.10 [0.00, 0.40]	0.40 [0.15, 0.60]	0.064
CBW(median [IQR])	0.00 [−0.20, 0.20]	0.50 [0.00, 1.00]	0.0024
WE (median [IQR])	0.00 [−0.20, 0.40]	0.80 [0.35, 1.65]	0.0002
<i>y</i> (median [IQR])	0.10 [0.00, 0.23]	0.75 [0.58, 1.00]	< 0.0001

limitations in providing meaningful feedback. Without understanding how to elicit useful critique, this student accepted AI output without evaluating its alignment with the writing goals.

the AI's capabilities and critically assess its feedback, the students were unable to integrate ChatGPT's input in a meaningful way.

Other students who demonstrated a lack of metacognitive regulation also reported similar experiences. They described an ability to “monitoring the feedback received from ChatGPT,” “evaluating its relevance and quality” and “making adjustments to their approach as needed.” Instead, they passively accepted whatever output the AI provides, even when it may not align with their original writing goals and needs. The lack of metacognitive awareness prevented the students from using ChatGPT as an effective supplementary tool for their writing process. Without a clear understanding of how to leverage

#### 4.5 | Critical Thinking Skills Are Essential to the Use of ChatGPT for Writing

Students with high levels of metacognitive awareness stressed the necessity of applying critical thinking skills when engaging with ChatGPT. Interview findings reveal that students possessing strong critical thinking abilities are better prepared to handle the challenges and opportunities that AI-powered tools present in educational settings. One student noted

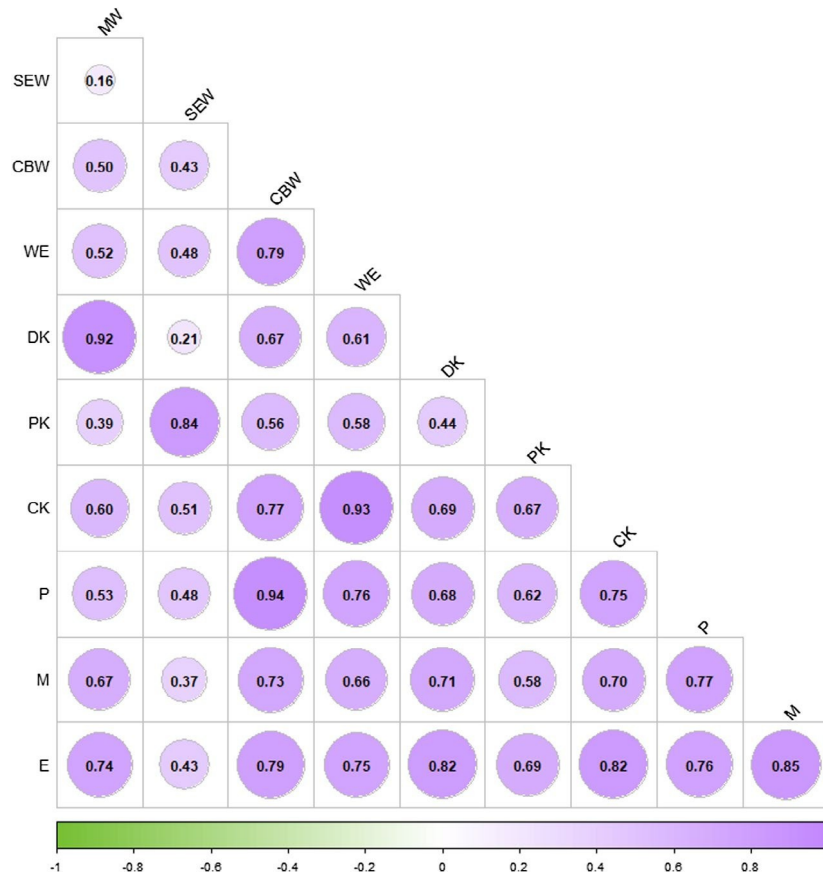


FIGURE 4 | Correlation among the examined variables.

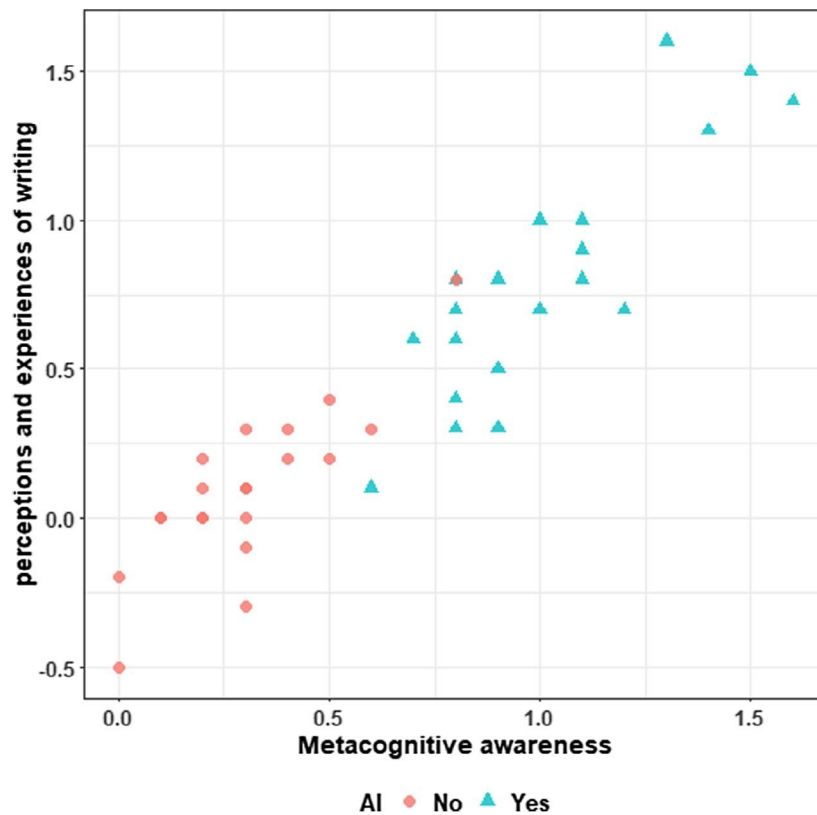


FIGURE 5 | Linear regression results.



**TABLE 5** | Linear regression results.

Metric	Values
Relationship between $y$ and $x$	Linear relationship
Regression model	$y \sim x + AI$
Residuals	Min: -0.39500 1Q: -0.13582 Median: 0.02583 3Q: 0.13238 Max: 0.44666
Coefficients	(Intercept): -0.27694 ( $p < 0.001$ ) $x$ : 1.23980 ( $p < 0.001$ ) AI yes: -0.18146 ( $p = 0.106$ )
Residual standard error	0.1883 on 37° of freedom
Multiple $R^2$	0.8631
Adjusted $R^2$	0.8557
$F$ -statistic	116.6 on 2 and 37 DF, $p < 2.2e-16$

It's essential to maintain a critical perspective when using ChatGPT, even if the initial outputs appear impressive. I constantly evaluate the AI's responses for potential biases, factual errors, or logical gaps. I don't just accept what is generated; I carefully consider if it meets my needs or requires further guidance.

This student's observations highlight the importance of critically monitoring the cognitive processes and adjusting the use of ChatGPT accordingly. Instead of passively accepting AI outputs, the student emphasised the need for thorough analysis and evaluation.

Other students with higher metacognitive awareness demonstrated their ability to identify potential limitations and biases in the AI system, actively assess the relevance, accuracy and logic of ChatGPT's responses and make informed decisions about whether the AI's output meets their needs or requires refinement. This awareness of critical thinking skills enabled students to use ChatGPT as a tool while maintaining control over their learning and creative processes. They did not merely rely on AI to do their work but integrated it thoughtfully based on a nuanced understanding of its strengths and weaknesses.

Conversely, the interview data also show that a lack of critical thinking skills can hinder students from effectively engaging with new technologies like ChatGPT in educational contexts. Without higher-order cognitive and thinking skills, students struggled to navigate the challenges and opportunities presented by AI tools. One student shared:

I tried using ChatGPT for my writing assignments a few times, but I didn't really grasp how it worked or what to expect. The outputs often didn't make sense, and I wasn't sure if I could trust them. Eventually, I stopped using it because it seemed more trouble than it was worth.

This student's remarks reflect a lack of critical thinking skills in using ChatGPT. The student appeared to have limited understanding of ChatGPT's capabilities and limitations, leading to

confusion and uncertainty about its outputs. This lack of comprehension prevented the student from effectively utilising ChatGPT

as a writing aid.

Students with underdeveloped critical thinking skills reported similar experiences. Instead of analysing AI responses, identifying potential issues and adjusting their approach, these students disengaged from using ChatGPT entirely. They seemed unwilling or unable to invest the effort needed to critically assess the tool's outputs and integrate ChatGPT responses meaningfully into their writing process. Consequently, they concluded that the time and effort required to use ChatGPT effectively outweighed any poten-

tial benefits.

#### 4.6 | Cognitive Efforts Are Essential to the Use of ChatGPT for Writing

Interview data revealed that students with high metacognitive awareness can identify and adapt to the cognitive challenges posed by new technologies like ChatGPT. This capability enables them to harness the AI's potential effectively while maintaining control over their learning and writing processes. One student shared

I've discovered that using ChatGPT for writing assignments can be quite mentally demanding, even though the AI offers a lot of useful outputs. I need to consistently monitor the quality and relevance of what it generates, check for factual inaccuracies or logical errors, and then integrate that feedback meaningfully into my writing. It requires significant cognitive effort from me as the writer. I can't just accept ChatGPT's responses without thought—I have to actively engage to use it effectively.

This student's remarks illustrate a high level of cognitive effort in using ChatGPT for writing tasks. The student clearly understands the substantial cognitive load involved in leveraging ChatGPT productively. Cognitive efforts are crucial to recognising the demands of using ChatGPT, rather than assuming the AI will do all the work. The student likely realises that effective use of the technology still demands considerable mental processing and decision-making.

Other students with high metacognitive awareness also expressed the need to engage in various cognitive efforts, such as “carefully evaluating the quality and relevance of the AI's outputs,” “identifying potential issues like factual inaccuracies or logical flaws” and “integrating the AI's feedback into their own writing.” Rather than passively accepting ChatGPT's responses, these students emphasised the importance of active, critical engagement. This requires a substantial investment of cognitive resources and mental effort. This awareness of the cognitive load involved likely helped students better manage their mental resources and regulate their approach. They might, for instance, adjust their use of ChatGPT to

prevent cognitive overload.

In contrast, students lacking metacognitive awareness reported missing opportunities to develop more advanced writing skills and strategies, as well as the cognitive efforts needed to regulate their learning and cognitive processes when using ChatGPT. One student commented

I tried using ChatGPT for a writing assignment a few times. ChatGPT would generate responses, but I felt like I wasn't learning or improving my writing skills. It was easier to just copy everything from ChatGPT.

This student's comments indicate a lack of cognitive effort in using ChatGPT for writing tasks, leading to a tendency to copy directly from ChatGPT. The student showed an inability to recognise the cognitive efforts involved in using ChatGPT for writing. Initially, the student attempted to use ChatGPT but found the experience unsatisfactory. The student felt disconnected from the AI's thought process and unsure of how to incorporate the generated content into their writing meaningfully.

Other students with low metacognitive awareness also reported a lack of cognitive effort in tasks such as “evaluating the AI's outputs,” “identifying their limitations” and “thoughtfully integrating them into their own writing.” These students perceived the writing process as “a passive, unrewarding experience.” Consequently, they opted to copy directly from ChatGPT because it required less “mental work.” Without a clear understanding of their own thought processes and the cognitive efforts involved in writing, these students may struggle to leverage the AI's capabilities and end up avoiding its use or using it ineffectively.

## 5 | Discussion

### 5.1 | ChatGPT on Writing Experiences and Metacognitive Awareness

The findings demonstrated a notable influence of using ChatGPT in writing courses on improving EFL students' writing self-efficacy, engagement, collaborative writing inclination and motivation. These outcomes align with Teng (2024a), which observed a significant interaction effect between time and group. The variations between groups using ChatGPT and those not using it for writing were particularly pronounced towards the course's conclusion. Analyses comparing pre- and post-test scores revealed a substantial impact of ChatGPT on writing motivation, self-efficacy, engagement and collaborative writing tendency. These results also add to the existing literature supporting ChatGPT for writing assessment (Mizumoto and Eguchi 2023; Mizumoto et al. 2024) and performance (Shen and Teng 2024). Overall, the findings underscore the supportive role of AI (e.g., ChatGPT) in writing (Teng 2024b). Insights from the present study highlight the positive effects of ChatGPT on writing engagement and motivation. These findings enhance our understanding of the potential advantages of integrating AI technologies like ChatGPT in writing instruction, boosting confidence, efficacy, motivation and collaborative writing.

The results also emphasised the role of ChatGPT in EFL students' metacognitive awareness. Building on Abdelhalim (2024),

it seems that EFL students who effectively utilised ChatGPT for writing feedback were more likely to improve their metacognitive awareness, including crafting effective prompts, applying systematic thinking and implementing self-regulation strategies. In contrast, students who did not use ChatGPT might struggle to fully leverage AI capabilities, hindering their development in seeking and providing feedback for writing.

### 5.2 | The Relationship Between Metacognitive Awareness and Perceptions and Practices in Using ChatGPT for Writing

Quantitative analysis revealed that the level of metacognitive awareness significantly predicted students' perceptions and experiences when using ChatGPT for writing. The findings indicated that students with higher metacognitive awareness in writing had a statistically significant advantage over those with lower awareness in perceiving ChatGPT's effectiveness as a writing tool. Building on Abdelhalim (2024), these results provide valuable insights into the crucial role of metacognitive awareness in shaping EFL students' perceptions of ChatGPT for obtaining feedback on writing. While Abdelhalim (2024) did not find significant differences in reported practices between groups, the current study did observe notable differences. The differences observed between the current study and Abdelhalim (2024) can be attributed to several factors. First, the complexity of assessing metacognitive awareness through a survey alone may not provide a comprehensive picture of learners' metacognitive development (Flavell 1987). Additionally, while Abdelhalim (2024) focused on learners' research competency, the present study concentrated on writing. These different tasks may require varying levels of metacognition. Furthermore, Abdelhalim (2024) did not take into account learners' confidence and self-efficacy. In contrast, the present study suggests that higher metacognitive awareness may be linked to increased confidence and self-efficacy, encouraging students to use ChatGPT as a resource and perceive it as an opportunity for growth rather than a critique of their abilities. Hence, metacognitive awareness, encompassing declarative, procedural and conditional knowledge, as well as planning, monitoring and evaluating, is essential to students' writing experiences and their perceptions of ChatGPT as a writing aid.

Similar studies have emphasised the need for students to critically engage with ChatGPT (e.g., Javier and Moorhouse 2023) and foster metacognitive awareness in data-driven learning (Mizumoto 2023). EFL students with higher metacognitive awareness are more likely to use ChatGPT as a resource for writing consultation and evaluation. Rather than depending on ChatGPT for passive answers, they actively contribute their input and seek validation or guidance. Conversely, EFL students with lower metacognitive awareness tend to rely heavily on ChatGPT for direct answers. Metacognitive strategies, such as planning, monitoring and evaluating, influence EFL students' willingness to manage ChatGPT outputs and track their progress in using the tool. A lack of self-regulation limits students' understanding of ChatGPT for writing and hinders deeper engagement with AI-assisted writing. These findings align with the role of metacognitive awareness in fostering learner autonomy in digital environments (Chen and Hapgood 2021; Teng 2024c).

Consistent with earlier studies (e.g., Teng 2020), the results highlight an intriguing relationship between EFL students' knowledge and regulation of cognition. Together, these aspects influence students' perceptions and use of ChatGPT for writing. Metacognitive awareness of cognitive abilities and goals, along with the knowledge gained about using ChatGPT during the writing course, allowed EFL students to view ChatGPT as a learning resource that supports self-directed learning. The understanding of the practical nature of writing and its tasks led the learners to realise that completing writing assignments is not solely for course purposes but also for critically evaluating generated content and drawing inspiration from ChatGPT for writing.

### 5.3 | Factors Contributed to the Use of ChatGPT for Writing

Qualitative analysis identified several factors—metacognitive awareness, critical thinking skills and cognitive efforts—that may influence how ChatGPT is used for writing. EFL students with elevated levels of these attributes were more adept at perceiving ChatGPT as an engaging resource that enriched their personalised and interactive learning experiences in writing. This enriched their writing experience and satisfied their willingness to develop competency in seeking feedback. Conversely, students with lower levels of metacognitive awareness, critical thinking skills and cognitive efforts tended to see ChatGPT merely as a means to obtain direct answers. Wang and Xue (2024) noted that students' perceptions of using ChatGPT varied based on how prompts were formulated, underscoring the importance of critical thinking skills for meaningful engagement with the tool.

Metacognitive awareness, encompassing elements such as cognition, metacognition and motivation, is thought to be intricately connected to the process of self-regulated learning (Brown 1987). This awareness involves not only understanding one's cognitive processes but also being able to regulate them effectively. The interplay between cognitive functions, metacognitive strategies and motivational factors plays a pivotal role in cultivating advanced thinking skills and enhancing cognitive efforts (Flavell 1979). This dynamic interaction enables learners to plan, monitor and evaluate their learning strategies, ultimately fostering a more autonomous and effective learning experience. Therefore, it is plausible that students with low metacognitive awareness may struggle to use ChatGPT effectively for writing due to a lack of metacognitive skills that hinder self-regulated learning. In contrast, students with higher metacognitive awareness are likely more conscious of the risks associated with excessive reliance on ChatGPT. It may be possible for them to seek cognitive efforts and critical thinking skills to mitigate these risks. While ChatGPT offers valuable resources for receiving feedback on writing, excessive dependence on it without engaging in critical thinking may hinder the development of higher-order cognitive skills, such as creativity and problem-solving (Abdelhalim 2024). This reliance can diminish the motivation for independent thought and exploration (Kohnke, Moorhouse, and Zou 2023). By not actively engaging with the material and relying solely on automated feedback, learners might miss opportunities to cultivate their own analytical and innovative capabilities, which are essential for personal

and academic growth. EFL learners need to cultivate a comprehensive understanding of ChatGPT's functionalities to use it effectively for writing. This includes mastering how to interact with the tool efficiently, honing their critical thinking skills and recognising its limitations. By doing so, learners can maximise the benefits of ChatGPT, ensuring that it serves as a valuable aid in their writing process rather than a crutch. Developing these skills will enable them to engage more deeply with the content, apply thoughtful analysis and use the tool as a complement to their independent learning efforts.

## 6 | Conclusion

This mixed method study explored EFL students' experiences with writing and their perceptions of using ChatGPT as a writing tool, while also examining how their levels of MA correlate with ChatGPT usage. The findings highlighted the possibility of using ChatGPT to enhance EFL students' writing experiences and metacognitive awareness. They also revealed the predictive influence of MA levels on students' perceptions and experiences in utilising ChatGPT for writing. Essential factors such as metacognitive awareness, critical thinking skills and cognitive efforts play a crucial role in shaping writing experiences and the use of ChatGPT for writing.

However, the study had some limitations. First, the specific context of a Chinese sample with a limited number of participants may not support the generalisability of the findings. Second, self-report questionnaires and interviews may not fully capture learners' inner feelings; therefore, think-aloud measures and classroom observations are recommended. Third, the present study did not consider longitudinal development of metacognitive awareness in the context of ChatGPT usage. Finally, the present study did not include a writing test, which could provide insights into EFL learners' actual writing performance.

Despite these limitations, the findings offer valuable theoretical and pedagogical implications into EFL learners' experiences and perceptions of using ChatGPT for writing, particularly from a metacognitive standpoint. With regard to theoretical implication, the present study contributes to the existing body of knowledge by highlighting the role of metacognitive awareness in the effective use of AI tools like ChatGPT. It underscores the importance of integrating metacognitive strategies into theoretical models of writing and AI interaction. By demonstrating that higher metacognitive awareness enhances learners' ability to critically engage with AI feedback, the study suggests that metacognitive processes should be considered a central component in theories of digital literacy. In terms of pedagogical implications, the findings illuminate EFL students' cognitive processes, strategic approaches and reflective practices. First, the integration of ChatGPT into writing instruction can significantly boost students' self-efficacy and motivation. Educators should consider incorporating AI tools like ChatGPT to provide immediate feedback and support, thereby encouraging students to engage more actively in their writing tasks. Moreover, ChatGPT has been shown to increase students' inclination towards collaborative writing and overall engagement. Teachers can design activities that leverage ChatGPT to facilitate collaborative projects, where students can use the tool to brainstorm ideas, draft



collaboratively and refine their work through peer and AI feedback. Second, the present study also highlights the importance of metacognitive awareness in effectively using ChatGPT for writing. Educators should emphasize metacognitive strategies in their teaching, such as planning, monitoring and evaluating writing tasks. By doing so, students can become more aware of their cognitive processes and learn to regulate them effectively, leading to improved writing outcomes and a deeper understanding of how to use AI tools critically and reflectively. Finally, to maximise the benefits of ChatGPT, students need to develop strong critical thinking skills and be encouraged to exert cognitive effort when interacting with the tool. Teachers should guide students in crafting effective prompts and critically evaluating the feedback provided by ChatGPT.

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## Acknowledgements

ChatGPT has been used for proofreading the language in this article. However, it should be noted that ChatGPT was not involved in generating any ideas. Any errors, if present, are solely mine.

## Ethics Statement

The study was approved by an ethical committee with ID: RP-02/2023.

## Consent

Informed consent was obtained from all participants, and their privacy rights were strictly observed.

## Conflicts of Interest

The author declares no conflicts of interest.

## Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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