Metacognitive Factors Affecting English as a Foreign Language (EFL) Student-writers' Academic Writing Performance

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Abstract

Academic writing has a significant role in university education and shapes students' academic ability. For English as a foreign language (EFL) students, writing is a communicative, goal-oriented, laborious process with emotive, behavioral, metacognitive, and cognitive components. Previous studies have provided insight into specific aspects of metacognition in writing, but there is a lack of synthesized research integrating these components to understand how they collectively influence the academic writing performance of EFL student writers. To fill this gap, this study investigated how metacognition theory contributes to the academic writing performance of EFL students from the perspectives of metacognitive knowledge, experience, and strategies. A total of 370 Chinese EFL student writers were invited to complete one academic writing test and three questionnaires in a classroom setting. The resulting data were analyzed using PLS-SEM. Metacognitive knowledge, experiences, and strategies were found to be positively related to academic writing performance. The results also revealed that, among 10 parameters of metacognition, academic writing performance was more strongly correlated with procedural knowledge, metacognitive feeling, metacognitive estimate, online metacognitive strategies, monitoring, and evaluating parameters. These findings underscore the importance of developing students' conditional knowledge and promoting effective metacognitive strategies, particularly in evaluating and monitoring, to improve academic writing skills among EFL students.

Keywords: Metacognition, Academic writing, Writing performance, EFL students

1. Introduction

Academic writing is crucial for academic life among university students. It has a significant role in university education and shapes students' academic ability, as well as aiding in the development of vital abilities such as research, organization, and effective communication. These abilities are not only important for academic success but also for future professional endeavors. Many researchers have found that writing, especially for students of English as a foreign language (EFL), is a communicative, goal-oriented, and laborious process with emotive, behavioral, metacognitive, and cognitive components (Huang & Zhang, 2022; Sun, Zhang & Carter, 2021; Teng, 2020; Teng, Wang & Zhang, 2022; J. Zhang & L. Zhang, 2022). Successful English writing requires students not only to focus on language skills, but also to be aware of their own writing processes and make deliberate decisions regarding content, organization, and style. The writing process relies on student writers' comprehension, beliefs, and use of strategies in activities such as planning, editing, drafting, and evaluating (Hughes, Regan & Evmenova, 2019)—that is, it requires students' metacognitive ability.

Metacognition plays a crucial role in influencing the extraction of linguistic knowledge among EFL students, which ultimately enhances their writing performance. According to Flavell (1979), metacognition refers to learners' awareness of their own thinking processes; it includes three subcategories: metacognitive knowledge, experiences, and strategies (Tarricone, 2011). Metacognitive knowledge encompasses an individual's awareness and understanding of their own cognitive processes. Metacognitive strategies involve the planning, monitoring, and evaluation of these processes. The experiences that contribute to the formation of these metacognitive aspects are crucial for effective learning, particularly in the context of writing, which is a complex and cognitively demanding task.

Studies such as those by Sun et al. (2021), Sun and Zhang (2022), Teng (2020), and Teng and Yue (2023) provide insights into specific aspects of metacognition in writing. However, there is a lack of synthesized research integrating these components to understand how they collectively influence writing performance in EFL learners, especially among Chinese students. EFL teaching methodologies and curricula, particularly in China, may not adequately address or leverage these metacognitive components to enhance writing proficiency. This gap in understanding and educational practice may hinder the development of English writing abilities among Chinese EFL students, which could ultimately affect their academic success and global communication abilities.

Despite the growing recognition of the significance of metacognitive knowledge, experiences, and strategies in language acquisition, there is a notable gap in understanding how these factors specifically influence academic writing performance among Chinese EFL students. Research, such as that by Sun et al. (2021), has highlighted the role of metacognition in language acquisition, but its specific impact on different types of writing performance remains under explored. This gap is particularly significant in the context of Chinese EFL students, who often face unique challenges due to the differences between their native language and English. Veenman, Van & Afferbach (2006)

emphasized the important role of metacognitive strategies in academic success, but there is limited research focusing on how these strategies differ in their application and effectiveness in academic writing contexts. Although some researchers have acknowledged that these three metacognitive components (knowledge, experiences, and strategies) are inherently linked and interdependent in controlling the writing process (Lee & Mak, 2018; Sun & Zhang, 2022; Teng, 2020), such studies have tended to focus on writing strategies, while neglecting the metacognitive experiences of the writers and the significant role adjustment strategies play in academic writing.

The objectives of the present study are to (1) evaluate the levels of metacognitive components—metacognitive knowledge, experiences, and strategies—in academic writing performance among Chinese EFL students; (2) understand the effects of metacognitive knowledge in EFL academic writing performance among Chinese university students; (3) explore the effects of metacognitive experiences on EFL academic writing performance among Chinese university students; and (4) examine the effects of metacognitive strategies on EFL academic writing performance among Chinese university students.

2. Review of Literature

2.1 Academic Writing

Academic writing is writing do, but this discourse is built differently than when making conversations in daily life. Writing academically involves sharing ideas, but those ideas must be presented in a particular style and must be carefully crafted, supported, rationally arranged, rigorously reasoned, and skillfully woven. Compared with non-academic writing, academic writing adheres strictly to the rules of punctuation and grammar. Achieving fluency and accuracy in academic writing is a particularly complex task for EFL learners (Tahvildar & Zade, 2013), and this difficulty arises because writing is not just a mechanical skill but a form of social engagement. This complexity is further compounded by the fact that writing demands a range of metacognitive and linguistic skills.

Academic writing is a more complex writing genre that requires a high level of metacognitive ability from EFL learners. Several researchers have identified metacognition and the appropriate use of strategies as crucial factors for achieving success in academic writing. For instance, Putri, Kamaluddin & Baharuddin (2023) affirmed that students employ metacognitive strategies as foundational knowledge for idea generation before writing. This approach involves the development of ideas, drafting, and evaluating the quality of students' writing. Teng, Qin and Wang (2022) indicated that metacognitive strategies significantly predict academic writing performance in the EFL context, while Rosdiana et al. (2023) suggested that metacognitive strategies play a substantial role in enhancing students' academic writing skills. These strategies are considered high-level constructs, and previous research has revealed positive correlations among the various dimensions of these strategies.

2.2 Metacognition

The field of metacognition was initially introduced by Flavell (1979), who focused on the development of memory in children and particularly their ability to introspect and manage their memory processes. Prior to Flavell's work, Brown (1987) and Hatton and Smith (1995) noted that Thorndike, as early as 1917, had examined aspects of metacognition by challenging his students to engage in problem-solving through questions about texts they had studied, effectively testing their metacognitive abilities. Significant research, which would be recognized as the foundational work in the field of metacognitive research, had already been conducted by a wide range of scholars (Belmont & Butterfield, 1969; Brown, 1978; Corsini, 1971; Hagen & Kingsley, 1968; Hart, 1965; Markman, 1977).

In the present study, the researcher employed the conception developed by Flavell (1979). Hacker (1998) further divided metacognition into three types of thinking: what one knows (i.e., metacognitive knowledge); what one is currently doing (i.e., metacognitive skills/ strategies); or what one's cognitive or affective state is (i.e., metacognitive experiences). This approach is based on Flavell's model of metacognition and other scholars' contributions to the theory (Efklides, 2006, 2008; Lockl & Schneider, 2006; Paris, Cross & Lipson, 1984; Schraw, 1998; Schraw, 2001; Schraw & Dennison, 1994; Shimamura, 2000; Veenman & Elshout, 1999; Wenden, 1998).

Teng et al. (2022) provided a comprehensive summary of the processes involved in understanding metacognition, which sheds light on its theoretical framework. Two primary components of metacognition were identified: monitoring function and cognitive control. These encompass three key stages that involve an interplay between monitoring and control: acquisition, retention, and retrieval. The monitoring aspect encompasses both metacognitive knowledge and experiences, whereas the control centers on initiating metacognitive skills or strategies. It was also noted that metacognitive strategies—also referred to as metacognitive skills or regulation—guide learners in managing their cognitive processes. This regulation includes planning, monitoring, and evaluating. Reflection is a crucial element of this cycle. Finally, metacognition is described as an individual characteristic that reflects a person's metacognitive knowledge, experiences, and strategies (refer to Figure 1).

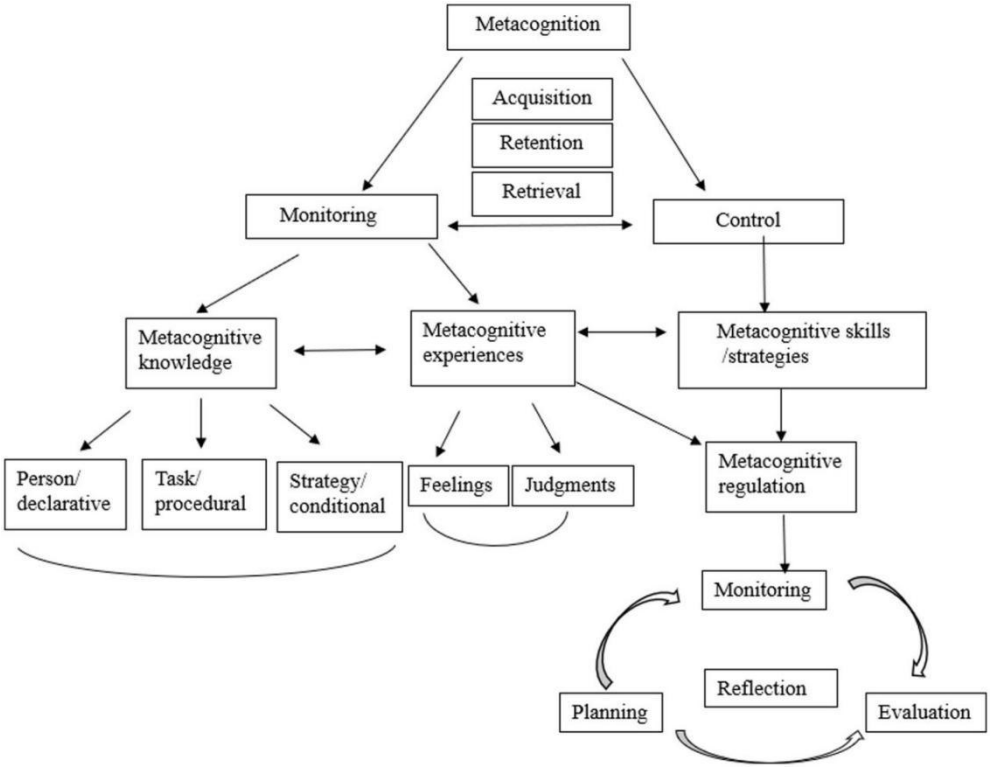

Figure 1. Elements of metacognition

Source: Teng, Qin, and Wang (2022). Validation of metacognitive academic writing strategies and the predictive effects on academic writing performance in a foreign language context (pp. 167–190). *Metacognitive Learn.*

2.3 Research on Metacognition in EFL Writing

Prior research has established a link between metacognition and the act of writing. According to Vygotsky (1987), writing is a constructive process that requires the writer to engage in thoughtful and analytical actions. This process involves condensing internal thoughts into a coherent form, as well as weaving together past, present, and new knowledge to create a meaningful narrative. Flower (1989) characterized writing as a generative process for meaning construction, while Pugalee (2001) suggested that this process of creating meaning and knowledge is a crucial part of the development of metacognition. Ramadhanti and Yanda (2021) found a robust association between writing proficiency and the characteristics of metacognitive awareness. The interconnection of metacognition and writing is thus widely acknowledged, with the regulation of mental activities being crucial for applying effective strategies in producing the desired written content. There has been much research on the role of metacognition in EFL writing (Bai, Hu & Gu, 2013; Ching, 2002; Graham & Harris, 2000; Hwang & Lee, 2017; Negretti, 2012; Teng et al., 2022), and these studies have revealed a connection between metacognitive knowledge, experiences, strategies, and EFL writing performance. The following paragraphs provide a detailed explanation of relevant research.

Metacognitive knowledge, or knowing about knowledge, improves learners' performance and academic success (Hartman, 2001; McCormick, Dimmitt & Sullivan, 2012; Wenden, 2014). Writing has also been demonstrated to benefit from metacognitive knowledge. For instance, Kasper (1997) identified a substantial positive link between ESL students' metacognitive knowledge (the person, the task, and strategies) and their actual performance on a writing assessment by employing a questionnaire. Karlen and Compagnoni (2017) further discovered that learners with higher levels of knowledge about metacognitive strategy show higher quality work in academic writing than learners with lower metacognitive abilities. Knospe (2018) has discussed the significance of metacognitive knowledge in EFL writing and its positive influence on the quality and effectiveness of learning, while Feng Teng (2020) and Farahian (2022) have discussed the mediation of writing performance by metacognitive knowledge and regulation. Basaffar and Bukhari (2023) investigated the application of metacognitive knowledge in EFL writing in a Saudi context, while Goh (2019) made the case for integrating the acquisition of metacognitive knowledge and strategy learning into routine language learning activities.

Metacognitive experiences in EFL writing have been the focus of several recent studies, which have used multiple research methods to illustrate the role of metacognitive experience in writing. For example, Dong and Zhan (2019) explored the EFL writing experiences of undergraduates in the context of metacognitive instruction. To study this connection, Sun et al. (2021) created the Writing Metacognitive

Experiences Questionnaire (EFLLWMEQ), while Sun and Zhang (2022) indicated that metacognitive experiences of EFL writing positively contributed to writing performance in terms of lexical complexity, fluency, and writing accuracy. Based on the framework of Efklides (2002b, 2006, 2009), Sun, Pan & Zhang (2023) looked into the connection between the writing proficiency of EFL learners and their metacognitive experiences when writing in English. Students with varying levels of writing proficiency had varied experiences: those with higher proficiency levels tended to have richer metacognitive writing experiences.

Effective foreign language writing performance may be attributed, in large part, to metacognitive strategies (Silva & Graham, 2015; Victori, 1999). Researchers in language education have recognized the importance of metacognitive techniques in the development of writing abilities in a foreign language (Bui & Kong, 2019), and evidence on this point has come from different studies in different contexts. For instance, Qin, Zhang and Xiao (2022) conducted a study with Chinese university students and found that metacognitive writing strategies significantly affected writing performance, particularly in the areas of planning, monitoring, and evaluating. Rodr guez, Alvarado and Calaforra (2018) indicated that employing metacognitive strategies positively influenced the quality of academic writing among Spanish students. Fitrianti and Susanti (2021) found that the more metacognitive strategies students use, the higher the quality of their writing, while Alamri (2019) investigated the degree to which students understood the value of these tactics as well as the connection between their language proficiency and the frequency with which they employed metacognitive techniques. Similarly, Hartina, Vianty and Inderawati (2018) indicated that students' performance in writing essays was significantly correlated with their use of metacognitive strategies. In a quasi-experimental study, Nurbayti, Anita and Kheryadi (2020) found that the students' writing skills improved significantly when metacognitive strategies were applied through. Bayat and Uyumaz (2021) also identified a notable link between writing proficiency and the application of metacognitive strategies, which not only reduced writing anxiety but also enhanced learners' confidence in their writing skills. Khan and Kumar (2023) discussed the application of metacognitive techniques in online instruction to enhance the writing abilities of EFL students.

Existing studies on metacognition in writing thus robustly suggest that metacognitive elements (knowledge, experiences, and strategies) play a significant role in enhancing writing skills. However, despite some focus on metacognition in EFL writing, its exploration within Chinese contexts—where English is infrequently used in daily life—is still not extensive. This particular setting, arguably one of the most challenging for language learning, demands attention due to the enormous number of students engaged in EFL environments. Understanding the interplay between metacognitive knowledge, experiences, and strategies is also crucial for a holistic view of metacognition in EFL academic writing. Although these components have been explored separately, research integrating these aspects—especially in the context of EFL academic writing—remains limited. This gap highlights the need for studies that explore how metacognition theory contributes to EFL students' academic writing proficiency from the perspectives of metacognitive knowledge, experience, and strategies.

3. Method

3.1 Research Design

This study adopted a quantitative approach to explore the relationship between various elements of metacognition and academic writing performance. The quantitative approach included a series of questionnaires and writing tests. First, a pilot study was conducted with a small sample to determine the reliability and validity of the research instruments. Second, the main study participants were selected according to the stratified random sampling method. Third, the participants' academic writing level was tested using an academic writing test, and the levels of their metacognitive knowledge, experiences and strategies were investigated using the three questionnaires discussed in the previous section (Appendices A–C). Finally, the partial least squares structural equation modeling (PLS-SEM) technique in SmartPLS 4.0 was used to evaluate the relationships between the different variables.

3.2 Participants

EFL university students in mainland China formed the population for the present study. A total of 370 students from a university located in the southwest area of China were randomly selected as the research participants. The sample for this study was chosen using stratified random sampling in an effort to attain the study's objectives.

3.3 Instruments

Questionnaires are a popular tool for assessing metacognition (Wirth & Leutner, 2008) and have been used in studies by Chen, Zhang and Wang (2021), Zhang and Qin (2018), and Karlen (2017) to gather comprehensive and extensive data regarding learners' metacognitive activity. Language learners can also use questionnaires to inspire and elicit personal perceptions and interpretations about their own educational experiences, which allows data collection that provides insights into the motivations behind their activities (Dörnyei, 2011; Iwaniec, 2019).

Three questionnaires were employed in this study to measure the metacognitive factors. The Writing Strategies Questionnaire (MWSQ) was created by (Teng, 2020) to measure two metacognitive components: knowledge and strategies. The present study takes this questionnaire as a reference and further clarifies the two variables as follows: the Metacognitive Writing Knowledge Questionnaire (MWKQ) (Appendix A) and the Metacognitive Writing Strategies Questionnaire (MWSQ) (Appendix B). This aligns more closely with the theoretical paradigm for metacognition followed in this study. The EFL Learners' Writing Metacognitive Experiences Questionnaire (Appendix C), created by Sun et al. (2021), was modified for this study to gauge EFL learners' reported metacognitive experiences while

writing in English. The metacognitive experience frameworks developed by Sun et al. (2021) and Efklides (2002a, 2002b) provided guidance for the adaptation of the questionnaire.

Academic writing tests are an assessment tool used to evaluate a student writer's proficiency in writing in an academic context. This kind of test typically measures various aspects of writing, such as the ability to formulate arguments, use appropriate and effective language, organize ideas logically, and adhere to the conventions of academic writing. The academic writing test from the College English Test (CET) was adapted to assess the academic writing proficiency of Chinese EFL students in this study.

3.4 Data Collection Procedures

The data collection procedure was divided into two stages. First, participants were given one hour to complete the test in a writing system (http://www.pigai.org/), where essays can be scored automatically. To ensure fairness, accuracy, and comprehensiveness in essay scoring, teachers reviewed the students' essays after the automatic scoring and were able to verify or adjust the scores of the essays based on the scoring rubric.

Following the writing test, participants were asked to complete three metacognitive questionnaires by scanning a code. The researcher received a message from the website (https://www.wjx.cn/) when each participant submitted the questionnaires online. Given the complexity of metacognition, which is a multifaceted concept that encompasses metacognitive knowledge, experiences, and strategies, a pilot test was undertaken to avoid the limitations of using questionnaires. The pilot study involved 35 Chinese EFL student writers.

3.5 Data Analysis

Data analysis was done using Smart PLS Version 4.0. Prior to conducting PLS-SEM, all missing data, suspicious response patterns, and outliers were examined, and the erroneous data components were removed from analysis. This yielded a final sample size of 370.

The three elements—metacognitive knowledge, experiences, and strategies—were simultaneously specified as exogenous variables in the model created using PLS-SEM, which predicted the academic writing ability of EFL students. According to Hair, Risher, Sarstedt and Ringle (2019), researchers can estimate complex models with several constructs, indicator variables, and structural paths using the PLS-SEM approach. Therefore, this method, which is ideally suited for the current study, was used to examine the intricate interactions between metacognitive knowledge, strategies, and experiences as well as to evaluate the exterior measurement model and the inner structural model.

4. Results and Discussion

4.1 Descriptive Statistics of Metacognitive Knowledge, Experiences, and Strategies

We analyzed the data to identify the levels of metacognitive knowledge, experiences, and strategies among Chinese EFL students in EFL academic writing performance. The data indicate that there were differences in the metacognitive levels of the participants (refer to Table 1), which were reflected in the following aspects: first, in the mastery of metacognitive knowledge, Chinese EFL students demonstrated slightly higher mean scores in conditional knowledge, with a mean value of 3.40 compared to declarative and procedural knowledge. Second, in the application of metacognitive experience, the mean value for online metacognitive knowledge was 3.55, which was higher than the other three aspects of metacognitive experience. Third, in the use of metacognitive strategies, the monitoring strategy scored significantly higher than the other two strategies (planning and evaluating), with a mean value of 3.44.

Table 1. Descriptive Statistics for Metacognitive Knowledge, Experiences, and Strategies

	Variable Name	N	Mean	Std. Deviation
Metacognitive Knowledge	Declarative Knowledge	370	3.3101	.59042
	Procedural Knowledge	370	3.2930	.61172
	Conditional Knowledge	370	3.4050	.60045
Metacognitive Experiences	Metacognitive Feelings	370	3.1804	.64999
	Metacognitive Estimates	370	3.4303	.67744
	Online Metacognitive Knowledge	370	3.5586	.69434
	Online Metacognitive Strategies	370	3.3534	.71114
Metacognitive Strategies	Planning	370	3.3437	.64343
	Monitoring	370	3.4453	.60281
	Evaluating	370	3.3595	.64378
	Academic Writing	370	3.67	.772

The data revealed higher mean scores in conditional knowledge and online metacognitive knowledge, which implies that students are more aware of when and why to use certain strategies in the EFL academic writing context. The students' level of procedural knowledge for academic writing was low, which indicates that Chinese students do not have a sufficient grasp of this information. For example, the means score for question Q6 ("I have explicit purposes for each writing topic") was only 3.25. In terms of the use of metacognitive strategies, monitoring strategies were the most commonly used. Monitoring strategies often occur during the writing process, which shows that students pay more attention to monitoring their own process when writing. The level of planning strategies before writing was low, as was the level of assessment strategies after writing. For example, in response to question Q21 ("At the end of the writing, I ask someone else to read it and gives me feedback") the mean score was 3.16, which indicates an insufficient use of strategies before and after writing.

4.2 Evaluation of PLS-SEM Results

The assessment of the measurement model (outer model) was the first stage in the PLS-SEM analysis, because it ensures that the constructs are measured reliably and validly before assessing the relationships between them in the structural model. As illustrated in Figure 2, the measurement model established appears to measure the components in the current study accurately. Examination of PLS-SEM estimates enable the researcher to evaluate the validity and reliability of the construct measures (Hair et al., 2021). The measurement model evaluation is critical to confirm that the indicators used to measure the latent variables are appropriate and accurate, which lays the foundation for a trustworthy analysis of the structural model.

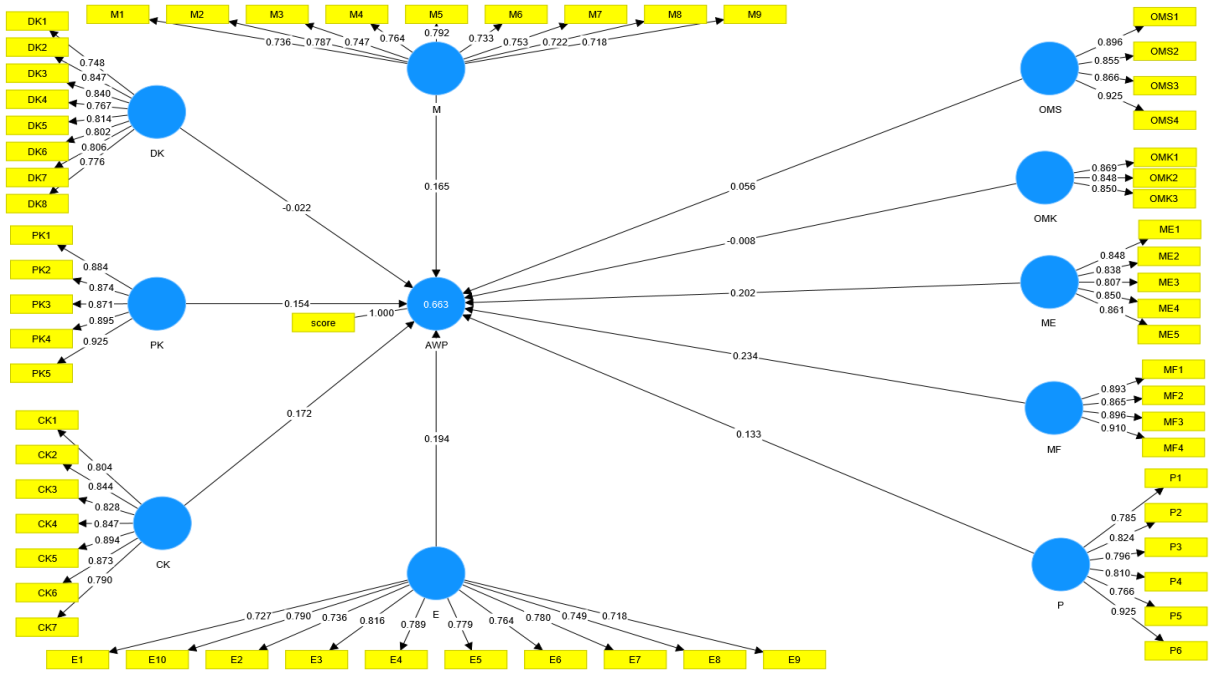

Figure 2. Measurement Model

Note. CK = Conditional Knowledge; DK = Declarative Knowledge; PK = Procedural Knowledge; ME = Metacognitive Estimate; MF = Metacognitive Feelings; OMK = Online Metacognitive Knowledge; OMS = Online Metacognitive Strategies; P = Planning; E = Evaluating; M = Monitoring; AWP = Academic Writing Performance.

The measurement model's appropriateness can be assessed by looking at the following: first, the reliability of each and every item, such as indicator and internal consistency reliability, using composite reliability (CR); second, the instruments' convergent validity related to individual variables using average variance extracted (AVE); and third, the discriminant validity using the Fornell–Larcker principle.

Table 2. Reliability and Average Variance Extracted Values

	Variable Name	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Metacognitive Knowledge	Declarative Knowledge	0.920	0.934	0.610
	Procedural Knowledge	0.934	0.950	0.556
	Conditional Knowledge	0.931	0.944	0.639
Metacognitive Experiences	Metacognitive Estimates	0.896	0.923	0.738
	Metacognitive Feelings	0.913	0.939	0.661
	Online Metacognitive Knowledge	0.818	0.891	0.757
	Online Metacognitive Strategies	0.909	0.936	0.745
Metacognitive Strategies	Planning	0.901	0.924	0.630
	Monitoring	0.903	0.921	0.649
	Evaluating	0.921	0.934	0.628

As shown in Table 2, Cronbach's alpha and CR values were evaluated for all of the variables, and the results show that all values exceeded the recommended benchmark value of 0.70 (Hair et al., 2021; Henseler, Ringle & Sinkovics, 2009). The present investigation thus demonstrated the reliability of the measurement model with Cronbach's alpha values between 0.818 and 0.934 and CR values between 0.891 and 0.944. When the value of a variable's average variance extracted (AVE) approaches 0.50, it is deemed to have good convergent validity, in that the latent variables exhibit good convergent validity and account for at least half of the variation in their items(Hair et al., 2021). The findings showed that all of the variables' AVE values are greater than the 0.50 benchmark value, as they fell into the range of 0.556 and 0.757, thus establishing the variables' convergent validity.

Moreover, one must determine that a concept has discriminant validity, which means that it is distinct and captures phenomena that are not captured by other constructs in the model. According to Hair et al. (2013), the Fornell–Larcker criterion is the most conventional technique for assessing discriminant validity. It contrasts the correlations between the latent variables and the square root of the AVE values. As shown in Table 3, the results of the evaluation of the Fornell–Larcker method indicate that the discriminant validity of the variable has been established.

Table 3. Fornell–Larcker Method for Discriminant Validity

	CK	DK	E	M	ME	MF	OMK	OMS	P	PK
CK	**0.881**									
DK	0.856	**0.745**								
E	0.729	0.695	**0.875**							
M	0.768	0.711	0.874	**0.892**						
ME	0.744	0.692	0.813	0.835	**0.859**					
MF	0.694	0.708	0.697	0.655	0.723	**0.813**				
OMK	0.687	0.619	0.691	0.760	0.766	0.608	**0.87**0			
OMS	0.703	0.680	0.730	0.756	0.801	0.709	0.726	**0.863**		
P	0.717	0.665	0.784	0.813	0.768	0.631	0.680	0.669	**0.793**	
PK	0.877	0.893	0.675	0.702	0.681	0.702	0.622	0.665	0.661	**0.799**

Note. CK = Conditional Knowledge; DK = Declarative Knowledge; PK = Procedural Knowledge; ME = Metacognitive Estimate; MF = Metacognitive Feelings; OMK = Online Metacognitive Knowledge; OMS = Online Metacognitive Strategies; P = Planning; E = Evaluating; M = Monitoring.

Effects of Metacognitive Knowledges on EFL Academic Writing Performance

As shown in Table 4, among the three factors of metacognitive knowledge, procedural knowledge showed a significant correlation with EFL academic writing performance ($\beta = 0.000$; $t = 6.527$), and declarative knowledge made a relatively weak positive contribution ($\beta = 0.039$; $t = 2.061$). Conditional knowledge made a weak positive contribution to EFL academic writing performance ($\beta = 0.501$; $t = 0.672$).

Table 4. Relationships Between Metacognitive Knowledge and Academic Writing Performance

Relationships	Coefficient	SD	T Statistics	P Values	Decision
PK → AWP	0.264	0.574	6.527	0.000	Significant
DK → AWP	0.009	0.181	2.061	0.039	Not significant
CK → AWP	-0.112	-0.072	0.672	0.501	Not significant

Note. CK = Conditional Knowledge; DK = Declarative Knowledge; PK = Procedural Knowledge; AWP = Academic Writing Performance.

Effects of Metacognitive Experiences on EFL Academic Writing Performance

As shown in Table 5, the relationship between metacognitive experiences and EFL academic writing performance was significant, and all four metacognitive experiences have a positive impact on EFL academic writing performance, while three have a significant impact. Online metacognitive strategies had the highest impact ($\beta = 0.000$; $t = 3.699$), followed by metacognitive feelings ($\beta = 0.000$; $t = 3.936$), metacognitive estimate ($\beta = 0.006$; $t = 2.740$), and online metacognitive knowledge ($\beta = 0.015$; $t = 2.430$).

Table 5. Relationships Between Metacognitive Experiences and Academic Writing Performance

Relationships	Coefficient	SD	T Statistics	P Values	Decision
ME → AWP	0.180	0.066	2.740	0.006	Significant
MF → AWP	0.222	0.056	3.936	0.000	Significant
OMK → AWP	0.145	0.060	2.430	0.015	Not significant
OMS → AWP	0.253	0.068	3.699	0.000	Significant

Note. ME = Metacognitive Estimate; MF = Metacognitive Feelings; OMK = Online Metacognitive Knowledge; OMS = Online Metacognitive Strategies; AWP = Academic Writing Performance.

Effects of Metacognitive Strategies on EFL Academic Writing Performance

The results showed that all three metacognitive strategies (evaluating, monitoring, and planning) had a positive and significant impact on EFL academic writing performance (as refer to Table 6). Specifically, there was a positive impact of metacognitive planning on EFL academic writing performance ($\beta = 0.015$; $t = 2.433$), while metacognitive monitoring also showed a significant positive impact ($\beta = 0.002$; $t = 3.056$). The relationship between metacognitive evaluating and EFL academic writing performance was also significant ($\beta = 0.001$; $t = 3.423$). Evaluating strategies had the highest impact, followed by monitoring and planning strategies.

Table 6. Relationships Between Metacognitive Strategies and Academic Writing Performance

Relationships	Coefficient	SD	T Statistics	P Values	Decision
Evaluating →AWP	0.295	0.086	3.423	0.001	Significant
Monitoring → AWP	0.287	0.094	3.056	0.002	Significant
Planning → AWP	0.176	0.072	2.433	0.015	Significant

Note. AWP = Academic Writing Performance.

In summary, the findings of the present study revealed that, among the 10 parameters of metacognition, Chinese EFL students' academic writing performance was strongly correlated with conditional knowledge, metacognitive feeling, metacognitive estimate, online metacognitive strategies, monitoring, and evaluating parameters. The present study's findings align with several research investigations that have demonstrated a noteworthy correlation between metacognitive knowledge and writing performance (Dong & Zhan, 2019; Knospe, 2018; Schoonen et al., 2003; Teng, 2020). Previous research has established the importance of procedural knowledge in academic writing (Karlen, 2017; Teng et al., 2022), and according to the cognitive process theory developed by Flower and Hayes (1981), proficient writers engage in planning, translating, and reviewing processes. The current study aligns with these findings and demonstrated that Chinese EFL students with a strong understanding of the steps involved in writing—such as pre-writing preparation, drafting, and post-writing review—are more successful in academic writing tasks. The findings also showed that metacognitive feelings and estimates are significantly correlated with academic writing performance among Chinese EFL student writers, with significant positive effects. The current study's findings are in line with those of other investigations (Lee & Mak, 2018; Li, 2022; Sun & Zhang, 2022). The richness of metacognitive experiences varies across EFL learners with varying writing ability levels, in line with Sun et al. (2023), and metacognitive estimates were a major predictor of their writing performance.

5. Conclusion

This study investigated multiple dimensions of metacognition, with a focus on metacognitive abilities of EFL students during academic writing. These abilities include the awareness of one's own learning goals, learning strategies and knowledge structures, as well as the awareness and ability to correct one's own cognitive limitations and biases. We found that improved metacognition could help people learn and solve problems more effectively, while maintaining motivation and flexibility in the learning process. Educators should also include the cultivation of metacognition in EFL instruction as one of the educational goals and guide students through diversified learning tasks and projects to promote students' learning and thinking.

These results indicate that researchers and educators must prioritize the role of the three dimensions of metacognition to improve students' academic writing performance. In daily teaching, educators should also strengthen the cultivation of students' knowledge and skills in metacognition, which focus on developing students' conditional knowledge and promoting effective metacognitive strategies, particularly evaluating and monitoring, to foster significant improvements in academic writing skills in addition to cultivating students' language skills. By incorporating these metacognitive components into EFL instruction, students can achieve better writing performance and overall academic success. Our findings indicate that EFL students may be more likely to pay attention to their learning and thinking processes, while focusing on the indispensable role that metacognition plays in language learning. Furthermore, changes in teaching perspectives and effective use of teaching activities can help to improve English writing metacognitive knowledge, develop students' self-monitoring and evaluation abilities, and enrich students' positive metacognitive experiences. First, when teaching academic writing, instructors should help students to familiarize themselves with the English writing process, which would help to improve students' metacognitive knowledge of writing. Teachers need to shift from a teaching method focused on test-taking and adopt the process teaching method, focusing on the learning of writing strategies, such as brainstorming, multiple revisions, and peer assessment.

Second, reading and imitating model writing is a very effective way to develop students' ability to monitor and reflect on their own writing metacognition. Imitation exercises provide opportunities for students to recognize their own deficiencies in language expression. When assigning imitation tasks, teachers need to ask students to use the language of the original author as much as possible, so that it is contrasted with the students' own expressions, and students can draw conclusions about which is better or worse accordingly.

Third, in the writing classroom, activities such as guiding students in the analysis of the writing process, strategies used, reflecting, and summarizing gains and losses can directly train students' metacognitive monitoring and reflective skills. For example, asking students to express their mental activities while writing either orally or in writing would help them to monitor and reflect on their own writing process and strategy use.

Finally, it is important to enrich students' metacognitive experience of writing. Helping students understand themselves as writers and the writing tasks mentioned above, as well as developing the ability to monitor and reflect on their own writing process, are all conducive to students' positive metacognitive experience, because doing these things can help students experience a greater sense of accomplishment in writing. Teachers need to take advantage of opportunities in their teaching to enrich and enhance students' positive experiences, improve the effectiveness of their teaching, and enhance students' writing.

6. Recommendations

This study examined the effect of EFL student writers' metacognition—in terms of metacognitive knowledge, experiences and strategies—on academic writing performance among Chinese EFL university students. PLS-SEM findings revealed that metacognitive knowledge, experiences and strategies had a positive and significant impact on Chinese EFL students' academic writing performance, which provides empirical evidence for metacognition in writing. As stated in earlier research (Lee & Mak, 2018; Negretti, 2012; Sun & Zhang, 2022; Teng, 2020; Teng & Zhang, 2016), metacognition is a crucial aspect related to EFL writing. The current study provides empirical support for the relationship between academic writing performance and several aspects of metacognitive knowledge, experiences, and strategies. Compared to other factors, academic writing performance was more strongly correlated with conditional knowledge, metacognitive feeling, metacognitive estimate, online metacognitive strategies, monitoring, and evaluating parameters.

Although this study conducted a relatively comprehensive examination of metacognition in academic writing, its limitations should be

acknowledged. The sample size may not be large enough to generalize the findings to all EFL learners, so the results should be interpreted only in terms of this particular group of participants. Additionally, most data were based on self-reported measures, which can be subject to bias and inaccuracies in participants' self-assessment of their metacognitive strategies, experiences, and experiences. The study was also limited by its cultural and educational context, which may influence the applicability of the findings to other settings. Data were also captured using a cross-sectional design at a specific moment in time, which prevented the examination of changes over time and the establishment of causality. The focus on academic writing performance alone potentially overlooked how metacognitive strategies, experiences, and knowledge might affect other language skills, further limiting the scope of the findings. The study also lacked strict experimental control, so potential confounding variables may have influenced the results. The range of metacognitive variables considered was also limited, potentially omitting other influential factors that affect writing performance. Finally, the assessment period was short and did not allow for observation of the long-term effects of metacognitive strategies, experiences, and knowledge on academic writing performance.

Considering these limitations, future studies should include more varied and diverse samples, use longitudinal designs, and explore the impact of metacognitive strategies, experiences, and knowledge on other language skills across different cultural and educational settings to provide a more comprehensive understanding of their effects.

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Authors' contributions

Dr.Guangrong Huang was responsible for study design and data collection. Associate Prof. Dr. Rafizah binti Mohd Rawian was responsible for research methods and revising. All authors read and approved the final manuscript.

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