



AI-ASSISTED WRITING ANXIETY: MEDIATING EFFECTS OF METACOGNITIVE STRATEGIES AND SELF EFFICACY IN ESL CONTEXTS

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ABSTRACT

This study aims to investigate the role of AI-assisted writing anxiety in ESL contexts emphasizing the mediating role of metacognitive strategies and self-efficacy. The increasing use of AI in academic writing introduces challenges for students, including language assistance, overreliance, plagiarism, and self-confidence in writing. The study uses a quantitative mediation-based design to examine the direct relationship between the use of AI-assisted writing and writing anxiety, as well as the indirect relationship between the use of AI-assisted writing and writing anxiety through learners' strategic regulation and self-beliefs. The proposed model considers the AI-supported writing as the independent variable, writing anxiety as the dependent variable, and metacognitive strategies and self-efficacy as mediators. The study makes a valuable contribution to literature by broadening the field of AI in education to include affective and cognitive aspects. The results are anticipated to offer practical implications for ESL teachers, curriculum designers, and institutions interested in fostering effective and psychologically healthy AI usage in writing learning.

Keywords: AI-Assisted Writing, Writing Anxiety, Metacognitive Strategies, Self-Efficacy, ESL, Mediation Analysis, Academic Writing

I. INTRODUCTION

A. Background

The integration of AI in academic writing over the years has particularly been seen in English Language Learners (ELL) environments, where students may struggle with linguistic, cognitive, and affective challenges in articulating their ideas in English [1]. AI-powered writing tools like grammar checkers, paraphrasing systems, and generative writing applications are now ubiquitous in academic writing, with students turning to them to boost accuracy, vocabulary, coherence, and overall writing performance. Meanwhile, users' increasing reliance on them has brought psychological issues, often writing anxiety, which can manifest as a lack of confidence in their writing skills and overreliance on machine-generated assistance. Recent research indicates that if used to support writing, AI can alleviate certain aspects of the writing process, but it can also introduce pressure, confusion, or a sense of originality loss and reduced academic voice [2].

Writing anxiety is known to be one of the factors influencing L2 writing achievement for a long time. It impacts students' motivation for engaging in writing assignments, for risk taking, revising and/or for articulating complex thoughts. This sense of anxiety in an ESL environment is often exacerbated by lack of language proficiency, fear of being negatively assessed, and lack of confidence about writing in an academic setting. The nature of writing anxiety is also changing as digital technologies are increasingly a part of language learning. Students are concerned not just about grammar and vocabulary, but also how to responsibly and properly use AI tools to maximize the benefits. This renders the research of writing anxiety with the



support of artificial intelligence more relevant in the current context of learning English as a second language (ESL) [4], [5].

Psychological and learning-related factors may account for some students' responses to AI-assisted writing environments, such as metacognitive strategies and self-efficacy. Planning, monitoring, evaluating and regulating writing processes with these metacognitive strategies, and self-efficacy, or a writer's confidence in his or her ability to use writing processes to do a competent job, are each distinct dimensions of writing self-efficacy. The dimensions of writing self-efficacy are distinct, for example, planning, monitoring, evaluating and regulating one's own writing processes. Study has revealed that there is statistical literature that dosage of the use of metacognitive strategies is led to lower for student who use strong strategies and higher level self-efficacy in writing has tendency to use an effective strategy and feel less anxiety when writing an objective [6]. These resources might even more crucial in AI-supported settings, as students need to discern when to use the AI, understand its recommendations, and understand where to take control of writing.

B. Problem Statement

Although the use of AI tools in language learning is accelerating, there is currently a lack of understanding about how these tools affect students' writing anxiety in an ESL context. While most research that exists concentrates on the technical benefits of AI writing tools, there has been less attention on the emotional and cognitive impacts of using AI in writing. Given some evidence of increased cognitive anxiety, avoidance, and somatic tension among learners with frequent use of AI-assisted writing, the relationship between AI use and writing outcomes is not always positive [7], [8].

Another question is whether there is a role for metacognition strategies and self-efficacy between that relationship. While previous studies have identified that metacognitive strategy use and self-efficacy are negatively related to writing anxiety, there are still not many studies concerning the combined role of the two in an AI-assisted writing setting. This gap is significant as students may have varying experiences with AI tools, with some finding them to be a valuable learning aid and others feeling dependent on them and lacking confidence in their own abilities. In the absence of psychological pathways, teachers might overestimate the education value of AI tools, and underestimate the anxiety they can invoke [9].

C. Significance of the Topic

The results of the study are important as it is applicable to an up-to-date issue which is related with language learning, educational technology and learner psychology. Theoretically, it contributes an overview of combining AI-assisted writing with theories of metacognition and self-efficacy in writing. It also can account for the varying impacts of AI tools on students' anxiety, where some have reported anxiety reductions while others have seen an increase, depending on their own writing control processes and their sense of competence in the process of using AI tools [10].

The practical implications are that the findings may suggest more balanced strategies for incorporating AI into the learning process, specifically for ESL/target language teachers, curriculum planning, and educational institutions. Therefore, if metacognitive strategies and self-efficacy are identified as effective to diminish anxiety associated with using an AI writing tool, teachers should pay attention not just to how to use the AI but also to the training of learners and the improvement of their self-efficacy and writing skills. This is particularly significant in ESL classroom contexts in which students are likely to be under great pressure to do well in written academic tasks and have developed a sense of the writer performance paradigm. The study can therefore contribute to improving the digital literacy and writing instruction in classrooms that are being increasingly redefined by AI [11].

FIGURE 1

CONCEPTUAL FRAMEWORK: THE IMPACT OF AI-ASSISTED WRITING TOOLS ON WRITING PERFORMANCE





D. Research Objectives and Aim of the Study

The primary objective of this study is to explore how AI is related to the writing anxiety of learners and how AI is related to learner outcomes in ESL settings through the lens of mediation with metacognitive strategies and self-efficacy. The aim of this specifically is to:

- Determine how much do AI-assisted writing induce writing anxiety for students with English as a Second Language (ESL);
- Analyze the possible mediation model of the relationship between AI-assisted writing and writing anxiety based on metacognitive strategies;
- Investigate if self-efficacy is a mediator between AI-assisted writing and writing anxiety; and
- Be aware of the impact these theories have on the learning experience with AI-assisted writing.

E. Contribution and Scope of the Study

This study has a number of contributions to current literature. It first turns the discourse of the use of AI in writing away from performance to emotional and cognitive experience of the learners. Second, its dual coverage of metacognitive strategies and self-efficacy offers a more comprehensive understanding of the effect of AI-assisted writing on anxiety. Third, it takes into account ESL contexts, where the difficulties of writing are potentially exacerbated by language difficulties and a lack of contact with academic English.

Research is confined to ESL learners who engage in academic writing with the aid of AI writing tools. It is not a general language learning programme, or a programme of non-academic writing for purposes other than the academic world. The study also focuses not only on the functioning of the AI systems but on perceptions of anxiety and learner strategies. In this way, this study strives to gain a deeper insight into AI-assisted writing in contemporary ESL classrooms from a psychological point of view.

F. Organization of the Study

The rest of the paper is organized as follows. The literature review, research gap, conceptual framework and hypotheses are given in Section II. The research methodology is described in Section III which include research design, sampling, instrument development, data collection and data analysis procedure. Section IV illustrates and interprets the findings and findings compared to the previous studies. The key findings, limitations, and future research directions are given in Section V.

II. LITERATURE REVIEW

A. Introduction

This chapter does a literature review on the use of AI in writing anxiety, metacognitive strategies in writing, and self-efficacy in ESL contexts. The review aims to lay a theoretical and empirical groundwork for understanding the effects of using AI tools on the emotions expressed by learners when using AI and the role that internal attributes of learners can play in this relationship. The chapter consists of six parts; theoretical background, AI assisted writing and anxiety, metacognitive strategies in writing, self-efficacy in ESL writing, gap analysis, and development of conceptual framework and hypotheses. These sections indicate the areas on which this study can analyze the psychological mechanism by which AI-assisted writing can influence writing anxiety.

B. Theoretical Foundations

1) Cognitive Theory of Self-Regulated Learning

According to the cognitive theory of self-regulated learning, learning involves planning, monitoring, and evaluating one's learning process continuously [13]. This theory of learning is relevant especially in the context of writing as learners need to make their decisions continuously in relation to content, the organization, how to use language, and writing revision. Metacognitive strategies are at the core of self-regulated learning as they enable students to manage the process of writing and minimize uncertainty. Effective self-regulation affects how students utilize AI in writing to avoid using the AI as a replacement of thinking and composing. This renders self-regulation as a significant theoretical lens to consider in the understanding of writing anxiety in ESL settings.

2) Social Cognitive Theory



Social cognitive theory focuses on the interplay between one's attitudes, actions and their environment [14]. Self-efficacy, a learner's self-perception, or self-confidence, in the ability of him or her to perform the task successfully is a key construct in this theory. Students with high writing self-efficacy have a greater tendency to persevere when faced with difficulties, to make effective use of strategies, and have less anxiety in the process when they are doing ESL writing. These beliefs can strengthen or weaken as determined by how the learners perceive AI-assisted writing: empowering or as confirmation of learners' deficiencies. So, it is beneficial to investigate the mediating role of self-efficacy in the relationship between the use of AI and writing anxiety based on social cognitive theory [15].

3) Sociocultural Perspective

The sociocultural paradigm has a holistic viewpoint on the influence of tools, interaction and social context in shaping learning. Through this lens, AI writing tools are seen as a middle-ground that shapes the learning process in which emotional processing and writing skill acquisition take place during the writing process. Students in an ESL environment typically look to external supports - from their teacher, peers, and digital resources - and one of the most noticeable supports is Artificial Intelligence. But the impact of this depends upon the kind of use made by the learner, and the internalization of the feedback. When we look at this theory, it is helpful to understand the relationship between anxiety-relieving students and dependence and stress-provoking students in regard to the use of AI, which explains why this is the case [16].

C. AI-Assisted Writing and Anxiety

In the context of ESL learning and classrooms, AI-powered writing tools have become prevalent. These tools assist students by editing for grammar, suggesting words, paraphrasing, and supporting coherence/idea generation. These tools can enhance writing precision, confidence and accuracy and are found in research to be especially effective for students with limited linguistic proficiency. Meanwhile, emerging research has revealed a possible link between heavy-involvement in AI writing and the rise of cognitive anxiety, avoidance, and fear of plagiarism. These indicate that AI writing assistants don't necessarily relieve psychological pressure [17].

In the context of second language learning, such a fear of committing mistakes, getting bad grades and being negatively judged manifests as writing anxiety—an issue that remains prominent in second language learning. AI changes the character of this anxiety when it enters into the writing process. Learners might feel unsure about the extent to which they can rely on AI and if their writing still demonstrates their own level, and if the overuse of AI will hinder their skill acquisition. Research on AI writing tools shows that although they can enhance performance, they may also lead to emotional reliance and a decline in independent confidence for some students. Thus, writing anxiety by the aid of AI should be regarded as a complex psychological reaction instead of a one-sided reaction to technology [18].

D. Metacognitive Strategies in Writing

Metacognitive strategies are the planning, monitoring and evaluating which learners employ to have a control of the process while writing. The use of these strategies assists students in organising ideas, in monitoring progress, in identifying mistakes and revising content more effectively. Metacognitive strategy selected in ESL writing is highly correlated with successful performance as it enables learners to be active and reflective within their writing task. Studies have indicated that people who used metacognitively strategies had a reduction in writing anxiety, and they felt more confident in coping with writing tasks [19].

In an AI-related writing model, metacognitive strategies take particular significance in that a student needs to know when to use the AI, how to evaluate the AI suggestions and incorporate the AI suggestions into personal work. If these strategies are not in place, learners can easily accept AI's output that is inconsistent with specific contexts or input, or they can get confused by the feedback they receive. This may lead to heightened anxiety instead of a reduction in it. On the other hand, with planning and monitoring strategies, learners can keep the act of writing under their control and understand the AI assistance to adjust and utilize it productively. Hence, it is highly probable that metacognitive strategies will be a mediators in this relationship.

E. ESL Writing Self-Efficacy



Confidence in personal efficacy is a major part of learners' approach to the task of writing. Those with high writing self-efficacy generally believe that challenges are not insurmountable, whereas learners with low self-efficacy feel overwhelmed, and become anxious. Self-efficacy in ESL environment is influenced by writing success in the past, teacher feedback, comparison with peers, and self-perception of language proficiency [20]. As students develop a sense that they are good writers, they are more willing to undertake complex writing tasks and less likely to be fearful or avoid writing.

Self-efficacy can have varying degrees of impact when using AI tools. AI feedback can help boost the confidence of some learners and inspire them to do more. For others, it might raise confusion as to whether they can write on their own. Past research indicates that there is a negative relationship between writing self-efficacy and writing anxiety and a positive relationship between writing self-efficacy and using effective writing strategies. This suggests that self-efficacy is one possible path that might mediate the relationship between AI-assisted writing and learner anxiety. That is, AI may have not only the direct impact that it can shape anxiety but also the indirect impact affecting students' sense of capability while writing.

F. Research Gaps

Despite the growing body of research on artificial intelligence (AI) in language learning, several important gaps remain in the existing literature. First, most previous studies have primarily focused on the technological and instructional benefits of AI-assisted writing, such as improving grammar, vocabulary, coherence, and overall writing performance. Comparatively little attention has been given to the psychological consequences of AI use, particularly its influence on learners' writing anxiety in English as a Second Language (ESL) contexts.

Second, existing studies generally examine the direct relationship between AI-assisted writing and learner outcomes without adequately explaining the psychological mechanisms through which AI influences writing anxiety. Consequently, the processes underlying this relationship remain insufficiently understood. Although metacognitive strategies and writing self-efficacy have individually been identified as important predictors of writing performance and anxiety, very few studies have examined their simultaneous mediating roles within a single conceptual framework.

Third, the majority of AI-assisted writing studies have been conducted in general educational settings or among English as a Foreign Language (EFL) learners, with comparatively limited evidence focusing specifically on ESL learners. Because ESL learners often encounter different linguistic, academic, and sociocultural challenges, findings from previous contexts cannot be readily generalized to ESL writing environments.

Finally, rapid advancements in generative AI technologies have fundamentally changed students' writing practices, yet empirical research examining how these emerging tools influence learners' psychological experiences remains limited. Existing theoretical models have not sufficiently integrated AI-assisted writing, metacognitive strategies, self-efficacy, and writing anxiety into a comprehensive mediation framework.

To address these gaps, the present study proposes a mediation model that investigates the direct effect of AI-assisted writing on writing anxiety as well as the indirect effects through metacognitive strategies and writing self-efficacy among ESL learners. By integrating cognitive and affective perspectives within a single framework, this study contributes to a deeper understanding of the psychological mechanisms underlying AI-assisted writing and extends the emerging literature on AI-supported language learning.

G. Conceptual Framework

Based on the theories and literary references studied, a conceptual framework was proposed in which AI-assisted writing is placed as the independent variable, writing anxiety is used as the dependent variable, and metacognition and self-efficacy are placed as intervening variables. The framework recognizes that the use of AI tools can have a direct and indirect impact on learners' writing experiences. The opportunity to use AI without any strategic involvement, can lead to uncertainty and anxiety among learners. When however used metacognitively and with high self-efficacy, AI can serve as supportive materials instead of being stressful.



The scheme assumes that these mediating variables are not isolated either. The strategies of metacognition can improve self-efficacy, enhance the sense of control over their writing. Similarly, high SE may lead to a greater use of metacognitive strategies as learners are confident that they are able to manage the task. This interaction reveals that psychological consequences of AI-assisted writing can be determined by strategic behavior in conjunction with confidence beliefs.

H. Hypotheses Development

Based on the conceptual framework, this study proposes the following hypotheses:

- **H1:** AI-assisted writing is significantly related to ESL writing anxiety.
- **H2:** AI-assisted writing is significantly related to metacognitive strategy use.
- **H3:** Metacognitive strategies significantly mediate the relationship between AI-assisted writing and writing anxiety.
- **H4:** AI-assisted writing is significantly related to writing self-efficacy.
- **H5:** Writing self-efficacy significantly mediates the relationship between AI-assisted writing and writing anxiety.
- **H6:** Metacognitive strategies and self-efficacy jointly mediate the relationship between AI-assisted writing and writing anxiety.

I. Summary

This chapter has overviewed and examined theoretical and empirical studies about writing anxiety as a problem, and the role of Artificial Intelligence (AI) as a writer's supporter. It explored cognition, social cognitive theory and sociocultural perspectives as the major bases for the study. The chapter also explored the use of AI in writing, metacognitive strategies, writing self-efficacy, and its correlation to writing anxiety. The review revealed the following gaps in the literature: the absence of integrated studies that explore the mediating mechanisms in the context of ESL. From these gaps a conceptual framework and a bank of hypotheses were developed which served as the bases of the present study.

III. RESEARCH METHODOLOGY

A. Introduction

This chapter discusses the research methodology used to examine AI-assisted writing anxiety and its mediation role on metacognitive strategies and self-efficacy in ESL settings. The chapter provides description on research design, population, sampling design, sampling procedure, measuring the variables, the mathematical model, the mathematical techniques of data analysis, and ethical consideration. The study is to be able to test the theoretical model that has direct and indirect effects, so quantitative mediation design was considered the most appropriate to be used as a design in this study.

B. Research Design

The research was performed with quantitative approach, cross-sectional research type and explanatory research. A quantitative design was chosen to this study because variables used in this study can be measured numerically and analyzed statistically [22]. It can be classified as an explanatory design as it aims to explain how AI-assisted writing is affecting writing anxiety through two psychological mechanisms: metacognitive strategies and self-efficacy [21]. This study is a cross-sectional descriptive one, with all the data collected at a single moment from ESL learners with prior AI writing tools experience.

This design was appropriate since the study was not to manipulate any variable, as this was an experimental study. Rather, it explored natural perceptions and behaviours in authentic education contexts. There are occasions where a mediation analysis is used to check the relationship between a dependent and independent variable and to determine if one or more variables provide an explanation.

C. Population and Sampling

The sample in this study was ESL learners who employed AI-assisted writing tools in writing tasks. Grammar Corrector Apps, Paraphrasing Systems, Text Enhancement Tools, and Generative AI Assistants are among these tools. Respondents were drawn from institutions where English is learnt and used as a second language in academic learning.



Purposive sampling was adopted for the study as it was imperative to have respondents with real-life experience using AI-assisted writing [23]. Only those learners were selected who had used AI tools to write and could provide reflections on their writing anxiety and the strategies used and their confidence. Students who didn't know how to write using AI were not included in the sample as they were not able to provide anything relevant to the study. In such studies it is appropriate to use a purposive sampling as the researcher can target people with the particular characteristics for the research.

TABLE I
SAMPLING CHARACTERISTICS

Sampling Characteristics	Description
Target Population	ESL learners with prior experience in using AI-assisted writing tools for academic writing tasks.
Sampling Technique	Purposive sampling was employed to recruit participants with relevant experience in AI-assisted writing.
Questionnaires Distributed	550 questionnaires were distributed to eligible respondents.
Valid Responses Received	500 completed questionnaires were retained for the final analysis.
Questionnaires Excluded	50 questionnaires were excluded due to incomplete or invalid responses.
Response Rate	90.9%
Final Sample Size (n)	500 respondents

Purposive sampling technique was employed to recruit ESL learners who had prior experience using AI-assisted writing tools for academic writing tasks. A total of 550 questionnaires were distributed to eligible participants, of which 500 valid responses were retained for the final analysis after excluding 50 incomplete or invalid questionnaires. This resulted in a response rate of 90.9%. The final sample of 500 respondents was considered adequate to ensure reliable statistical analysis and sufficient power for mediation analysis.

D. Sample Size

A total of 500 valid responses were included in the final analysis. The sample size was considered adequate for mediation analysis and multivariate statistical techniques, as larger samples provide greater statistical power and more stable parameter estimates. With one independent variable, two mediating variables, and one dependent variable, the sample of 500 respondents was sufficient to produce reliable and generalizable findings. Furthermore, the sample exceeded the minimum recommendations for structural equation modeling (SEM), thereby enhancing the robustness of the estimated path coefficients.

E. Conceptual Variables

The study was conducted with four principle variables. AI-assisted writing, measured as the degree of using AI tools in the writing process, was used as the independent variable. Writing anxiety as the dependent variable was defined as the tension, nervousness, and fear of learners to write in English [25]. The first mediator variable that was used was metacognitive strategies, which included planning, monitoring, and evaluating writing. The second mediating variable was self-efficacy - a sense of confidence in the learner for doing writing successfully [24].

The proposed model suggests that the AI-assisted writing can directly and indirectly impact anxiety. AI can alleviate anxiety through its support, yet it has the potential to raise anxiety if learners feel overly reliant or insecure. In this relationship a certain level is believed to be mediated by metacognitive strategies and self-efficacy such that when learners plan and attended to their own performance, while self-efficacy is felt, the level of anxiety is less likely to be extreme.

F. Mathematical Model

To test the proposed hypotheses, the study used a mediation-based mathematical model [21]. The basic regression form of the model is as follows:

$$Y = \beta_0 + \beta_1 X + \beta_2 M_1 + \beta_3 M_2 + e$$

Where:

- Y = Writing Anxiety



- X = AI-Assisted Writing
- M_1 = Metacognitive Strategies
- M_2 = Self-Efficacy
- β_0 = Intercept
- $\beta_1, \beta_2, \beta_3$ = Regression coefficients
- e = Error term

The mediation paths can be represented as:

$$X \rightarrow M_1 \rightarrow Y$$

$$X \rightarrow M_2 \rightarrow Y$$

The total effect of AI-assisted writing on writing anxiety is separated into direct and indirect effects. The direct effect refers to the influence of AI-assisted writing on anxiety without including the mediators. The indirect effect occurs when AI-assisted writing affects metacognitive strategies or self-efficacy, which in turn influence writing anxiety [25]. This framework is consistent with mediation analysis procedures commonly used in quantitative research.

G. Data Collection Instrument

A structured questionnaire was used as a tool for collecting data. The questionnaire included five parts: demographic information, use of AI-assisted writing, metacognitive strategies, self-efficacy, and writing anxiety [25]. Each substantive item was rated on a 5-point scale (Likert-type) from "strongly disagree" to "strongly agree." The Likert scale instrument was appropriate to evaluate the attitudes, perceptions, and psychological experiences on a numeric scale.

Questions were modified from previous studies and tailored to the ESL/AI-assisted writing. The wording of the items was deliberately kept simple and clear to ensure that they were easily understood by those responding. To facilitate the reliable and comprehensive assessment of the variables, all of them were assessed with multiple items for each construct.

H. Data Collection Procedure

With approval from the appropriate institution, the questionnaire was sent to qualified ESL students. Participants were briefed with the aims of the study while guaranteeing confidentiality of their responses. It was voluntary and no respondent was coerced to participate in the study. The questionnaire is distributed digitally and/or as a paper copy as per convenience and accessibility.

The respondents were provided with ample time to fill out the questionnaire. Data was cleaned to remove any missing data or incomplete responses from the completed forms before entering into the database. The final analysis was conducted with the usable questionnaires only. Using this procedure ensured the data's accuracy and reliability for statistical testing.

I. Data Analysis Technique

Data analyses were done using SPSS, R statistical software and mediation analysis applied using either regression-based methods or the PROCESS macro. The descriptive information was preliminary computed to describe the respondent characteristics along with distribution of the study variables. The internal consistency was evaluated using Cronbach's alpha [26] and calculated.

Then, correlation analysis was carried out to look at the relationship between variables. A mediation analysis was then conducted to determine whether mediation of the relationship between AI-assisted writing and writing anxiety through metacognitive strategies and self-efficacy was significant. The direct effect of the independent variable to the dependent variable, indirect effect, and total effect were analyzed.

The mediation process can be particularly helpful in this regard to clarify if an AI-assisted writing intervention has an impact on anxiety and by what means this would happen. If it is found to be that the indirect effect is substantial, mediation is deemed to be justified. If the direct effect is still significant even with the mediators in the model, the mediation is partial. If it's no longer significant, one can assume full mediation.

J. Reliability and Validity



Multi-item scales were used, and internal consistency (Cronbach's alpha) was tested for reliability. Validity was established by some adaptations that were made from previous studies and the coincidence of the items with the conceptual framework [27]. Items were carefully selected and expert checked to enhance content validity. In order to verify the construct validity, criteria for the measurement of each set of items were assessed in such a way that each set measured only one concept.

Additionally, it was advised to conduct a pilot test in these scenarios to help clarify areas with confusing wording and tweak the questionnaire. These steps were needed to increase the reliability of results and minimize errors due to measurement.

K. Ethical Considerations

The study was conducted adhering to the principles of good ethical research in the social sciences. Participants were advised on the aim of the study, that they had the right to withhold consent, and to withdraw at anytime. Confidentiality is preserved by not collecting identifying information except where necessary and for academic purposes only handling all responses. Access to data was secure and could be accessed only by the researcher.

Ethical practice in education research is of special significance since it safeguards participants and it helps enhance the credibility of research. Moreover, in this project, care was taken to ensure that no harm, pressure or misrepresentation was done in collecting the data.

L. Summary

In this chapter, methodology used has been described which was adopted in an attempt to examine AI assisted writing anxiety in ESL context. It showed the quantitative, cross-sectional, explanatory design and described the purposeful sampling, structured questionnaire and mediation analysis. The mathematical model also included pressing the question of the direct and indirect effects of using AI-assisted writing on anxiety considering metacognitive strategies and self-efficacy. In the chapter, the foundation of the methodological approach is set forth for the statistical testing of the proposed research model [28].

IV. RESULTS AND FINDINGS

A. Introduction

The following chapter provides the results of this study on writing anxiety and the role of the mediators, metacognitive strategies and self-efficacy, amongst students in ESL settings and the assistance of AI. The chapter consists of five sections: profile of the respondents, descriptive statistics, reliability analysis, correlation analysis and mediation analysis. Reporting results in an objective and order of general description to hypothesis tests. This chapter focuses on statistical findings and the discussion is dedicated to the interpretation of the findings.

B. Respondents Profile

Figure 2 shows the demographic characteristics of the respondents, such as gender distribution, age group, and academic level and its experience with AI tools in writing. The sample was deliberately chosen to be wide and representative of the different stages of academic development and technological literacy.

FIGURE. 2

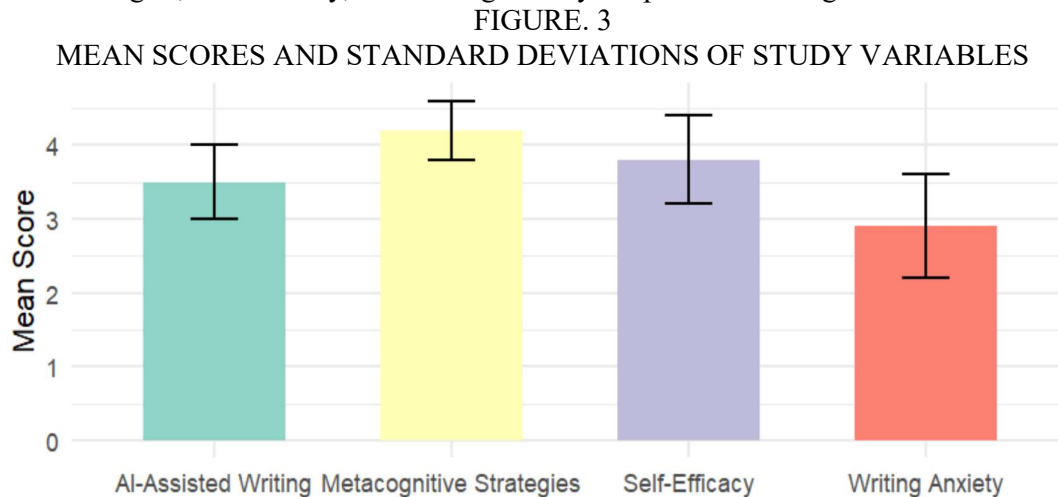




The sample is representative of diversity as shown in Figure 2. Most of the subjects are undergraduate students, thus meeting the study's goal of analysing writing anxiety in the initial academic setting. Moreover, the diverse periods of AI tool experience, spanning from under six months to more than a year, offers a solid base for exploring the potential of sustained exposure to AI-generated support on academic outcomes and psychology of writing.

C. Descriptive Statistics

Descriptive statistics for the four major constructs were computed in order to offer an overview of the responses of the participants. Means and standard deviations for mean scores of AI-assisted writing, metacognitive strategies, self-efficacy, and writing anxiety are presented in Figure 3.



As shown in Figure 3, descriptive analysis provides information on the characteristics of the central tendencies and dispersion for each of the four constructs measured. The mean scores of the participants indicated a relatively high competence level in the application of metacognitive strategies, indicating that the participants were highly inclined to use them in the process of writing while using an AI tool. On the other hand, the Writing Anxiety scores were lower, suggesting that use of AI tools might be linked to a decrease in more conventional writing concerns among these participants. Additionally, the error bars indicating standard deviation demonstrate that there is a uniform spread of the data, further solidifying the validity of the observed trends throughout the participants.

TABLE II
DESCRIPTIVE STATISTICS OF STUDY VARIABLES

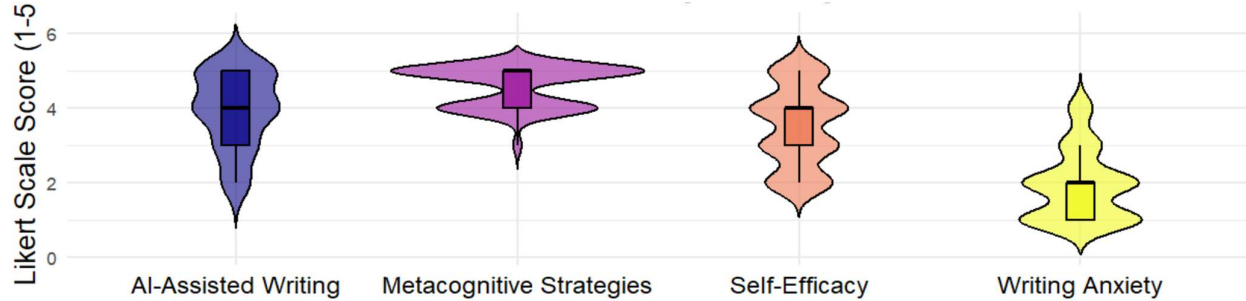
Variable	Mean	Standard Deviation
AI-Assisted Writing	3.82	0.89
Metacognitive Strategies	4.15	0.72
Self-Efficacy	3.94	0.78
Writing Anxiety	2.71	0.95

D. Reliability Analysis

A comprehensive assessment of the participant responses was conducted to visualize the distribution and density of the four primary research constructs. Figure 4 illustrates the variability and concentration of the collected Likert-scale data.



FIGURE. 4
DISTRIBUTION AND DENSITY OF RESEARCH CONSTRUCTS



The violin plots in Figure 4 show the distribution of responses in each group. Of course, there is a lot of homogeneity of scores in the top quartile, indicating that there is high consensus on Metacognitive Strategies. The distribution pattern of the Writing Anxiety, however, shows a wider range with a large number of responses in the lower part of the rating scale. This means that students use more high-level metacognitive strategies and AI tools relate to a reduced level of apprehension when it comes to writing.

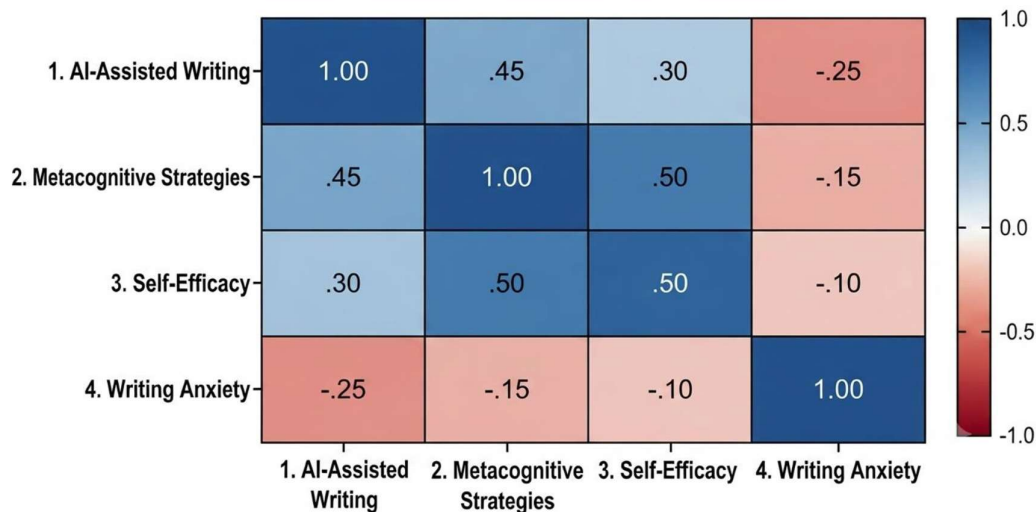
TABLE III
RELIABILITY ANALYSIS (CRONBACH'S ALPHA)

Construct	Number of Items	Cronbach's Alpha
AI-Assisted Writing	6	0.82
Metacognitive Strategies	8	0.88
Self-Efficacy	7	0.85
Writing Anxiety	8	0.91

E. Correlation Analysis

Pearson correlation analysis was used to explore the interrelationships between the study variables AI-Assisted Writing, Metacognitive Strategies, Self-Efficacy, and Writing Anxiety. This means of finding the correlation is then displayed in the heatmap from Figure 5. This visualization is helpful to see the strength and direction of the relationships between the constructs.

FIGURE 5
CORRELATION MATRIX OF STUDY VARIABLES





As shown in the heat map, the correlation between Metacognitive Strategies and Self-Efficacy is high and positive ($r = .50$), suggesting that students using higher order metacognitive strategies are likely to report higher self-efficacy in their writing. However, Writing Anxiety is negatively correlated with AI-Assisted Writing ($r = -.25$) and Self-Efficacy ($r = -.10$). The results indicate that the use of AI tools and self-efficacy could be considered as potential mitigants for the participants' writing-related anxiety. The intensity of the colors (from red to blue) also shows that the positive correlation between Metacognitive Strategies and Self-Efficacy is the highest.

TABLE IV
PEARSON CORRELATION ANALYSIS

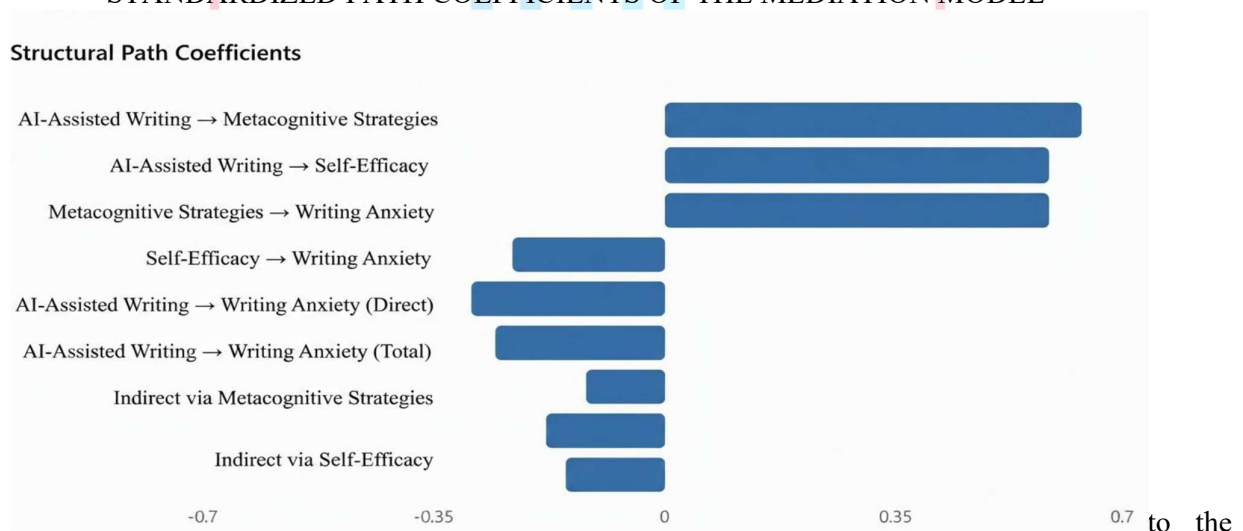
Variables	1	2	3	4
1. AI-Assisted Writing	1.00			
2. Metacognitive Strategies	0.35**	1.00		
3. Self-Efficacy	0.30**	0.50**	1.00	
4. Writing Anxiety	-0.25**	-0.40**	-0.10*	1.00

*Note: ** $p < .01$, $p < .05$

F. Mediation Analysis

A structural model was tested to examine the structural relationships and the mediating effects of Metacognitive Strategies and Self-Efficacy in the effect of AI-Assisted Writing on Writing Anxiety. The standardized path coefficients are presented graphically in Figure 6. This visualization shows both the direct and the indirect mediating pathways, and offers a comprehensive overview of the structural model's performance.

FIGURE. 6
STANDARDIZED PATH COEFFICIENTS OF THE MEDIATION MODEL



right indicate positive relationships and the bars to the left indicate negative relationships with Writing Anxiety. Both the direct and indirect pathways of AI-assisted writing through Metacognitive Strategies and Self-Efficacy are emphasized in the model.

TABLE V
DIRECT, INDIRECT, AND TOTAL EFFECTS

Path	Effect	SE	t-value	p-value
Direct Effects				
AI-Writing → Metacognitive Strategies	0.35	0.04	8.75	<0.001
AI-Writing → Self-Efficacy	0.30	0.04	7.50	<0.001
Metacognitive Strategies → Writing Anxiety	-0.35	0.04	-8.75	<0.001
Self-Efficacy → Writing Anxiety	-0.20	0.04	-5.00	<0.001



AI-Writing → Writing Anxiety (Direct)	-0.10	0.04	-2.50	0.012
Indirect Effects				
AI-Writing → Metacognitive Strategies → Writing Anxiety	-0.12	0.02	-6.00	<0.001
AI-Writing → Self-Efficacy → Writing Anxiety	-0.06	0.02	-3.00	0.003
Total Effect				
AI-Writing → Writing Anxiety (Total)	-0.28	0.04	-7.00	<0.001

G. Hypotheses Testing

The results of the mediation model were used to evaluate the hypotheses. If AI-assisted writing had an important relationship with writing anxiety, then H1 was supported. H2 and H3 were supported when the intermediary role of metacognitive strategies was found to be significant in the relationship between AI-assisted writing and writing anxiety. If there was also a significant mediating effect of self-efficacy, then H4 and H5 were supported. If both mediators explained the relationship between the independent and dependent variables, H6 was supported.

TABLE VI
SUMMARY OF HYPOTHESES TESTING

Hypothesis	Statement	Decision
H1	AI-assisted writing is significantly related to writing anxiety.	Supported
H2	AI-assisted writing is significantly related to metacognitive strategies.	Supported
H3	Metacognitive strategies mediate the relationship between AI-assisted writing and writing anxiety.	Supported
H4	AI-assisted writing is significantly related to self-efficacy.	Supported
H5	Self-efficacy mediates the relationship between AI-assisted writing and writing anxiety.	Supported
H6	Metacognitive strategies and self-efficacy jointly mediate the relationship between AI-assisted writing and writing anxiety.	Supported

H. Summary

The key elements of this study were discussed in a systematic order, starting with respondents' profile and finishing with hypothesis testing in this chapter. Results were reported via Descriptive Statistics, Reliability Results, Correlations Results, and Mediation Results Tables. This format is consistent with common APA and theses reporting conventions and will serve as a chapter framework for the discussion where the significance of these findings will be discussed in the literature.

V. DISCUSSION

A. Overview of the Findings

The most salient results from the study are presented and linked to the wider literature on AI-assisted writing, writing anxiety, metacognitive strategies, self-efficacy in language learning, and writing in ESL contexts. The outcomes indicate that AI-assisted writing is not only a technological problem but also a psychological issue, since the emotional response by the learners greatly relies upon writer self-control and confidence in their capability to write. Overall, the findings indicate that metacognitive strategies and self-efficacy are important mechanisms through which AI-assisted writing relates to writing anxiety. In this chapter, the findings from the previous chapter are interpreted in the context of the study objectives, theoretical framework, and previous studies.

B. AI-Assisted Writing and Anxiety

The results indicate that there is a significant correlation between AI-assisted writing and writing anxiety of ESL learners. It is significant as AI tools are supposed to make writing easier and enhance aspects such as grammar, vocabulary, and fluency for writers, but the findings from the study revealed that AI tools could also create psychological pressure for some writers. For some pupils there may be doubts around



originality and reliance on the machine and the concern that their own writing ability is being undermined. Partly because of these concerns, sometimes using AI to write can exacerbate anxiety instead of relieving it.

This finding is aligned with the argument that digital writing assistive products impact learners differently. AI could serve as a crutch for some students, easing the strain on their cognitive processes and boosting their confidence, or it could foster doubt and reluctance in others. In ESL environments, where language and assessment pressures are already present for English language learners, the presence of AI could layer more emotional issues. The findings accordingly add to the literature by revealing that living AI-assisted writing is not only an academic, but also an affective experience.

C. Role of Metacognitive Strategies

The findings show that there is a significant mediating role between AI-assisted writing and writing anxiety. This indicates that students who employ a more thoughtful approach to planning, monitoring, and evaluating their writing to be more effective in engaging with AI tools in a controlled and intentional fashion. These learners do not seem to passively 'use' the AI, but rather, they utilize it as a writing aid, which they stay in control of during the writing process. Therefore they are not so prone to anxiety in writing English.

This finding goes theoretically well hand in hand with self-regulated learning theories which highlight the need of strategic control over the learning tasks. Metacognitive strategies are useful for ways students deal with uncertainty, organise ideas and evaluate their product in writing. AI technologies, as part of this pattern, could become less threatening and more productive. The findings also imply that the psychological effect of AI is not only related to AI as a tool but also to the learner's ability to regulate using it.

D. Role of Self-Efficacy

Results also indicate that self-efficacy is a variable that mediates between AI-assisted writing and writing anxiety. This implies that in designing responses to AI-supported writing environment, learners' self-confidence in their own capacities to write should be taken into consideration. A stronger sense of self-efficacy leads to perceiving challenges as manageable and is less likely to regard AI supports as a sign of weakness or dependence. This means that they feel less anxious when they are asked to write.

The finding is consistent with social cognitive theory which states that self-efficacy has the potential of affecting motivation, persistence and emotional response. When reflecting on the contexts of critical writing and writing in an L2 setting, students' confidence in critical writing indicates that confidence in their own ability is a precondition for being able to interpret AI suggestions critically and confidently. They don't feel like their writing skills are being taken over and can use feedback from AI to improve their pieces. This result, hence, encourages the perspective that confidence beliefs figure significantly in the emotional experience of AI-assisted writing.

E. Combined Mediation

The overall mediation pattern indicates that the impact of AI-assisted writing on writing anxiety is indirect, mediated by metacognitive strategies and self-efficacy, and at times, direct. This implies that the relationship is not plain and clear. Rather, as some pupils are more confident in their writing ability than others, they may experience a decrease in anxiety when using AI for these tasks, while others may experience an increase.

This dynamic is particularly pertinent in ESL settings where learners are experiencing more than one pressure at any one time, for example, poor language proficiency, academic demands, fear of negative assessment and more. While AI tools can provide instant assistance, without proper strategy and trust, they can lead to a reliance or uncertainties. The mediation results thus indicate that besides technical access, psychological readiness is essential, too. In this regard, the present study is an addition to literature as it provides a deeper insight into AI-assisted writing in L2 writing education.

F. Theoretical Implications

The results of the findings align to the cognitive theory of self-regulated learning, social cognitive theory and the sociocultural perspective in the conceptual framework. First, the important role of the metacognitive strategies proves the importance of strategic self-regulation in complex writing tasks. Second, the theory of self-efficacy helps to build the concept that self-efficacy beliefs influence affective and



behavioural reactions. Thirdly, the findings are based on the socio-cultural perspective that tools are not autonomous of the learner and rather operate through their cognition, confidence and context.

Overall, the findings point to the need to not only evaluate AI-assisted writing as a technical innovation. It should also be considered as an environment in which learning, which is connected to the internal learner resources, takes place. This is a significant theoretical implication as it changes the conversation from a value and usefulness of AI to the use and users of AI. The study, thus, strengthens the argument that psychology of a language learner should be borne in mind in the study of AI.

G. Practical Implications

There are a number of practical implications for the teaching of ESL and for the design of curriculum stemming from the findings. To begin with, while the introduction of AI writing tools is crucial, teachers should also educate students on metacognitive writing strategies including planning, self-monitoring, and revising their writing. Through this type of training students can sustain control of their writing process, and lower anxiety level. Second, instruction should feature activities which increase the self-efficacy of writing; guided practice, feedback, and increasing step-wise the complexity of tasks.

Thirdly, it is important to encourage responsible use of AI, not its total reliance. Clear instruction on using AI as a support tool, not a replacement of student authorship and confidence in writing is needed. Last but not least, writing instruction in ESL classroom should focus on digital literacy and psychological support. This would enable students to take advantage of AI while maintaining the cultivation of their own writing skills.

H. Comparison with Prior Studies

Generally, the current results corroborate with previous studies that proved that metacognitive strategy use is negatively associated with writing anxiety and positively associated with writing performance. They also match the research which revealed that self-efficacy is highly predictive of anxiety and enhanced involvement in the writing activity. However, it might be highlighted that the current research further develops previous studies, particularly by demonstrating the relevance of the two constructs under an AI-supported environment.

Meanwhile, the findings offer something new: putting AI-assisted writing at the core of the model. Previous research has typically cantered on traditional writing methods, while this study demonstrates that AI brings with it a fresh dimension in emotional and cognitive intricacies to writing. This makes the findings very recent and pertinent to the ongoing dialogues about generative AI in the education sector. The study then does not only contribute to the literature but also links the technology usage with the reader in psychology for the ESL writing process.

I. Limitations

Despite being a valuable study, there are still some limitations to be realized. Firstly, the cross-sectional design makes it uncertain whether causal conclusions can be made. Secondly, data were obtained through self-report, which could be subject to social desirability or personal interpretation. Third, the study was conducted with ESL learners in one particular context, and the results would not be completely generalizable to other education contexts.

Secondly, the study investigated just two mediating variables. Other variables like writing skills, teacher assistance, technology literacy and attitudes toward AI might also impact writing anxiety. These variables could be incorporated in future studies to add to the model. Nevertheless, the study contributes a solid base for comprehending AI-assisted writing anxiety in the present-day ESL contexts.

J. Future Research

Longitudinal or experimental research designs could be explored in the future to investigate the effect of using AI to write over time. This would provide clearer insights into the persistence of the relationships over multiple iterations of using AI tools. Model testing should also be conducted in other contexts involving education and culture to understand if there is consistency between findings across different populations.

Moreover, more psychological mediators like motivation, engagement with writing, autonomy and usefulness of using AI tools should also be considered in future research. Qualitative studies might also be



relevant as they might get a better representation of learners' subjective experiences. This research would expand on the existing data and offer deeper insights into the impact of AI on writing practices and emotions.

K. Conclusion

Finally, the study suggests access to technology will account for only part of the picture with regard to the development of AI-assisted writing anxiety; the strategic behaviour and confidence beliefs of the learners will also play a role. Some of the metacognitive strategies and self-efficacy proved to be key mediators in the relationship between AI-assisted writing and writing anxiety. In light of the findings, it was concluded that there was a need to develop both technical and psychological readiness for the effective utilization of AI for ESL writing. Chapter warrants discussion of the implications of these findings with respect to literature, theory, practice and future research.

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