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Effect of Metacognitive Strategy Training on English Majors' Foreign Language Learning Anxiety: An Empirical Study Based on SEM

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Abstract

This study aimed to systematically examine the impact of metacognitive strategy training on Chinese EFL (English as a Foreign Language) majors' foreign language learning anxiety (FLLA) and to explore the underlying mechanism. A one-semester quasi-experimental intervention was conducted with 35 English-major university students using a single-group pretest–posttest design. Paired-samples *t*-tests and partial least squares structural equation modeling (PLS-SEM) were employed for data analysis. The results indicate that the intervention not only significantly reduced students' FLLA levels but also increased their overall use of metacognitive strategies. The SEM analysis further revealed that time management, reflective learning, self-regulation, emotional regulation, and planning strategies were all significant negative predictors of FLLA, with time management showing the strongest effect. This study confirms that systematically cultivating students' metacognitive strategies is an effective approach to alleviate foreign language learning anxiety. It provides empirical evidence and practical guidance for foreign language teaching aimed at reducing learner anxiety and promoting learner autonomy.

Keywords: Metacognitive strategies, foreign language learning anxiety, SEM

1. Introduction

In the complex process of second language acquisition, affective factors are as important as cognitive factors in determining learners' ultimate success. Among these, foreign language learning anxiety (FLLA) has emerged as one of the most widely observed affective variables in the field of language education. From novice learners to senior English majors, a considerable number of students experience varying degrees of tension, worry, or fear during language activities such as listening, speaking, reading, and writing. Extensive research has demonstrated that high levels of anxiety can have significant negative impacts on learning. On the cognitive level, anxiety consumes valuable cognitive resources and interferes with efficient processing, storage, and retrieval of information, thereby directly impairing academic performance and language proficiency. On the motivational level, anxiety often triggers avoidance behaviors – for example, anxious learners may remain silent in class, shy away from interactions, or reduce their language practice – which in turn undermines their motivation and willingness to communicate. On the psychological level, prolonged anxiety can erode learners' self-efficacy and self-esteem, leading to frustration and learned helplessness; in severe cases, it may even result in academic burnout and harm overall mental health. Therefore, effectively identifying and alleviating foreign language anxiety has become a critical challenge for language educators.

In response to this challenge, researchers and teachers have increasingly turned their attention to learners' internal self-regulatory capacities, with metacognitive strategies at the core. *Metacognition*-often defined as "thinking about thinking" (first introduced by Flavell in the 1970s)-refers to a higher-order cognitive process that enables individuals to consciously monitor and regulate their own thinking and learning. It consists of three key components: (1) metacognitive knowledge, i.e. knowledge about one's own and others' cognitive characteristics, the nature and requirements of cognitive tasks, and the applicability and effectiveness of various strategies; (2) metacognitive experience, i.e. the subjective feelings and judgments that accompany cognitive activities (such as perceptions of task difficulty or judgments of how well one understands); and (3) metacognitive monitoring, i.e. the active oversight, checking, evaluation, and regulation of one's cognitive processes during learning. Building on these elements,

metacognitive strategies are defined as the specific, purposeful actions that learners take to plan, monitor, and evaluate their own learning processes. Although different classifications of metacognitive strategies exist, their core function centers on self-management in learning. For the purposes of this study, we operationalized metacognitive strategies into six key dimensions: learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, and time management. Through conscious use of these strategies, learners can optimize the allocation of cognitive resources and select methods best suited to the task at hand, thereby significantly improving learning efficiency. More importantly, cultivating metacognitive strategy use is a critical pathway to developing learner autonomy: it transforms students from passive recipients of knowledge into active managers of their own learning. By deliberately employing such strategies, learners become self-directed, self-monitoring, and self-regulating lifelong learners-qualities that are especially crucial for success in the long-term, sustained endeavor of foreign language learning.

While the importance of reducing anxiety and the importance of employing metacognitive strategies have each been well recognized in the literature, research that directly links the two through empirical intervention is still insufficient. Many existing studies have confirmed a significant positive correlation between use of metacognitive strategies and academic outcomes (such as reading comprehension, writing proficiency, and vocabulary acquisition), but these studies mostly focus on cognitive outcomes and overlook the potential of metacognitive strategies in ameliorating learners' affective obstacles. Although some correlational studies have found that low-anxiety learners tend to use more metacognitive strategies, such findings do not establish a causal relationship, nor do they clarify whether training metacognitive strategies can actively reduce anxiety levels. At present, there is a notable lack of empirical intervention research-especially for English majors-that systematically trains students in metacognitive strategies to test its effect on alleviating FLLA and to reveal the internal mechanism of any such effect.

Given this gap, the present study aims to fill the void. The following core research questions are explicitly posed: (1) Can systematic metacognitive strategy training effectively reduce English majors' foreign language learning anxiety? (2) If so, what is the internal mechanism underlying this effect? In particular, how do different dimensions of metacognitive strategy use-such as learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, and time management-collectively and individually influence FLLA? Through an empirical approach, this study seeks to address these questions, with the goal of providing theoretical insight and practical guidance for foreign language teaching practices that target anxiety reduction and promote learner autonomy.

2. Literature Review and Theoretical Framework

To lay a foundation for our investigation, this section reviews relevant literature on metacognitive strategies and foreign language learning anxiety, and then builds the theoretical framework for the study. We begin by defining the key concepts to ensure conceptual clarity, followed by an overview of related empirical findings, and finally present the theoretical underpinnings and hypotheses guiding our research.

2.1 Definition of Core Concepts

Metacognition. The term *metacognition* was first introduced by American psychologist John Flavell in the 1970s, defined as "cognition about cognition," or one's knowledge and awareness of their own cognitive processes. Metacognition is a higher-order cognitive function that enables individuals to consciously monitor and regulate their thinking and learning. It is generally agreed that metacognition comprises three major components: metacognitive knowledge, which refers to an individual's knowledge about cognitive agents (oneself and others' cognitive characteristics), cognitive tasks (the nature and demands of tasks), and cognitive strategies (the applicability and effectiveness of various strategies); metacognitive experience, which refers to the subjective experiences and affective responses that accompany cognitive activities (for example, one's feeling of task difficulty or judgment about how well one has understood a text); and metacognitive monitoring, which refers to the active process of overseeing, checking, and regulating one's cognition during a task. Building on these foundations, metacognitive strategies are defined as the specific, purposeful actions that learners take to effectively plan, monitor, and evaluate their own learning processes. In other words, metacognitive strategies are the tools learners use to exercise control over their learning-from setting goals and planning tasks, to monitoring comprehension and adjusting methods, to assessing outcomes and reflecting on performance. While various taxonomies of metacognitive strategies exist, the central function of all such strategies is to facilitate self-regulated learning. In line with the focus of this study and drawing from existing research, we conceptualized metacognitive strategies in six dimensions: learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, and time management. Each of these dimensions captures a critical aspect of how learners manage their learning process.

Foreign language learning anxiety (FLLA). Foreign language learning anxiety is a specific form of *situational anxiety* that arises in the context of learning or using a second/foreign language. It manifests as a unique, complex psychological response characterized by irrational fear, tension, worry, and feelings of self-doubt when engaging in language learning tasks. Horwitz, Horwitz, and Cope (1986) [5] classically defined FLLA as "a distinct complex of self-perceptions, beliefs, feelings, and behaviors related to classroom language learning arising from the uniqueness of the language learning process". The sources of FLLA are commonly attributed to three primary components: communication apprehension, which is the nervousness and tendency to withdraw when having to communicate in the foreign language; test anxiety, which refers to excessive worry about performing poorly on language exams or assessments; and fear of negative evaluation, which is the dread of being judged unfavorably by instructors or peers due to one's language mistakes or imperfections. These three components form the core dimensions measured by the well-known Foreign Language Classroom Anxiety Scale

(FLCAS) (Horwitz *et al*., 1986) [5] and collectively capture the range of psychological pressure language learners may experience in various contexts (communication, testing, and social evaluation).

2.2 Empirical Research on Metacognitive Strategies and FLLA

In recent years, the importance of metacognitive strategy use in foreign language learning has attracted widespread attention. Current research on this topic can be grouped into several key strands:

Learners' beliefs about language learning have been shown to directly influence their choice and use of learning strategies. For example, Zhu (2023) [15] found a close relationship between students' learning beliefs and their strategy use, suggesting that certain belief patterns can significantly shape how learners approach language study. Oxford *et al*. (1990) [7] pointed out that learning strategies are effective tools for improving language proficiency; appropriate use of strategies can greatly enhance learning efficiency. Moreover, Wen (2001) [12] further emphasized that learner beliefs not only affect motivation but also determine the proactiveness and effectiveness of their strategy use. In sum, the interaction between learning beliefs and strategy deployment has a profound impact on language learning outcomes.

A number of studies have explored the application of metacognitive strategies in English reading instruction and found beneficial effects. Yang (2023) [13] showed that through metacognitive strategy training, junior high students' English reading ability improved significantly, with notable gains in the use of planning and attention strategies. Similarly, Cheng (2022) [1] reported a significant correlation between metacognitive strategy use and incidental vocabulary acquisition in high school English reading, indicating that metacognitive strategies not only enhance reading comprehension but can also facilitate vocabulary learning as a by-product of reading. In addition, Tu (2022) [11] found a positive correlation between junior high students' use of metacognitive strategies and their listening achievement, suggesting that these strategies have broad applicability and effectiveness across different language skills (reading, listening, etc.). Together, these studies underscore that metacognitive strategies are powerful tools for improving various aspects of language proficiency.

Several studies have examined the interplay among learners' self-efficacy beliefs, their anxiety levels, and their use of metacognitive strategies. In a study of a minority trilingual context, Yuan *et al*. (2022) [14] found that self-efficacy was positively correlated with metacognitive strategy use, while foreign language anxiety was negatively correlated with English achievement. This suggests that boosting learners' confidence and effective strategy use can help mitigate anxiety and in turn improve performance. In a different context, Han (2020) [4] investigated Cambodian EFL learners and confirmed a negative correlation between learning anxiety and language achievement; importantly, this study noted that metacognitive strategies could help students reduce anxiety and improve their performance. Likewise, Huang (2020) [6] provided evidence that low-anxiety students tend to employ metacognitive strategies more frequently for self-regulation, thereby achieving better learning outcomes. These findings collectively indicate that metacognitive strategies play a beneficial role in alleviating foreign language anxiety and enhancing academic results, potentially by reinforcing learners' self-efficacy and proactive coping behaviors.

Research has also addressed how metacognitive strategy use varies with learners' proficiency levels. Habók *et al*. (2022) [3] explored strategy awareness among EFL learners across different proficiency levels from a self-regulated learning perspective. Their study found that higher-proficiency learners relied more on metacognitive strategies (such as planning, monitoring, and organizing their learning) than lower-proficiency learners. Advanced learners were more skilled in reflective and self-regulatory approaches, which contributed to their superior academic performance. Furthermore, Habók *et al*. noted a strong association between metacognitive strategies and other types of strategies (cognitive, affective, social), implying that students who effectively manage their learning process tend to excel in overall language performance.

Recent work has also highlighted the importance of metacognitive processes in language production skills such as writing. For instance, Sun and Zhang (2022) [10] examined learners' metacognitive experiences in EFL writing through a structural equation modeling approach. They focused on learners' metacognitive experiences before, during, and after writing (including metacognitive feelings, judgments, and task-specific strategy use). The results showed that metacognitive awareness not only helped learners monitor and adjust their cognitive strategies during writing, but also enhanced their ability to more effectively plan and evaluate writing tasks. This finding reinforces the call to integrate metacognitive strategy instruction into language teaching, as it can help learners become more self-directed and reflective, thereby improving their writing performance and learning outcomes.

Taken together, these strands of research suggest that metacognitive strategies are deeply intertwined with both cognitive and affective aspects of language learning. They influence and are influenced by learners' beliefs and self-efficacy, contribute to improvements in various language skills, and appear to mitigate anxiety and promote better achievement. However, as noted earlier, most of these studies are correlational or focused on a single skill, and thus there remains a need for experimental research that directly tests the causal impact of metacognitive strategy training on reducing foreign language anxiety and explicates the underlying mechanism.

2.3 Theoretical Framework and Hypotheses

To investigate how metacognitive strategy training affects learning anxiety, this study draws on two key theoretical perspectives: self-regulated learning theory and Krashen's affective filter hypothesis. Self-regulated learning (SRL) theory posits that learners are active agents in their own learning process, engaging in a cyclical series of activities such as goal setting, strategy implementation, monitoring, and reflection to manage and optimize their learning. Within the SRL framework, metacognitive strategies serve as the *executive tools* or "core engine" that drive the self-regulation cycle. By training students in metacognitive

strategies, we aim to systematically enhance their self-regulatory capabilities. Greater self-regulation, in turn, gives learners a stronger sense of control over their learning and boosts their self-efficacy, which is likely to reduce feelings of anxiety.

Krashen's affective filter hypothesis, on the other hand, emphasizes learners' emotional states-such as motivation, confidence, and anxiety-as a filter that can facilitate or impede second language acquisition. According to this hypothesis, when anxiety is high, the affective filter "raises," blocking comprehensible input from being fully processed, whereas lower anxiety lowers the filter, allowing more input to reach the language acquisition device. In the context of our study, the theoretical logic is as follows: systematic metacognitive strategy training should improve students' self-regulation skills, thereby increasing their perceived control over the learning process and their sense of efficacy. This enhanced self-regulation and confidence can effectively lower their foreign language learning anxiety, keeping the "affective filter" in a low position and creating a more favorable internal environment for language acquisition.

Based on this integrated theoretical framework and the aforementioned literature, we propose the following hypotheses. First, as an overarching expectation, we hypothesize that metacognitive strategy training will significantly reduce English majors' foreign language learning anxiety. Furthermore, to examine the internal mechanism via structural equation modeling, we posit six specific path hypotheses regarding the influence of each metacognitive strategy dimension on anxiety:

- **H_1:** Learning planning strategies have a significant negative effect on FLLA (higher use of planning strategies will be associated with lower anxiety).
- **H_2:** Self-monitoring strategies have a significant negative effect on FLLA.
- **H_3:** Self-regulation strategies have a significant negative effect on FLLA.
- **H_4:** Learning reflection strategies have a significant negative effect on FLLA.
- **H_5:** Emotional regulation strategies have a significant negative effect on FLLA.
- **H_6:** Time management strategies have a significant negative effect on FLLA.

These six hypotheses together form the hypothesized model of this study. In the following sections, we describe the methodology used to test these hypotheses and report the results of our analyses.

3. Research Design and Methodology

This section outlines the overall research design and implementation of the study. We describe the experimental design, participants, instruments, procedure, and data analysis methods, in order to ensure the scientific rigor and reliability of the research process.

3.1 Research Design: To rigorously examine the causal effect of metacognitive strategy training on FLLA and to uncover its internal mechanism, we employed a single-group pretest–posttest quasi-experimental design. In this design, one group of participants is measured before and after receiving an intervention, using each participant as their own control. By comparing the pre-intervention and post-intervention measures, we can infer the effect of the intervention while controlling for inter-individual differences (since no separate control group is used, issues of non-equivalent group characteristics are minimized). The core independent variable in this study was the metacognitive strategy training (the intervention), and the primary dependent variable was the students' level of foreign language learning anxiety.

The study was carried out in two sequential phases of analysis. First, to test the causal effect (Research Question 1), we conducted a *paired-samples t-test* comparing the FLLA scores before and after the intervention. This analysis directly evaluates whether the metacognitive strategy training produced a statistically significant reduction in anxiety. Second, to explore the underlying mechanism (Research Question 2), we utilized structural equation modeling (SEM) on the post-intervention data. In particular, we applied a partial least squares SEM approach to construct and assess a path model in which the six metacognitive strategy dimensions (learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, time management) predict the level of FLLA. This allowed us to determine which specific strategy dimensions significantly contributed to alleviating anxiety and to what extent, thereby revealing the micro-level pathways behind any overall effect observed.

3.2 Participants

The participants were drawn from the population of English majors at the School of Foreign Languages and Cultures, Zhaoqing University (a provincial university in China). We employed cluster sampling to select two intact classes of the same grade level from this school as our experimental group. All students in the selected classes received the intervention and were included as participants. At the start of the study, a total of 78 students took part in the pretest. During data cleaning, we excluded those who had prolonged absences from the training, as well as any questionnaires that were incomplete or showed obvious patterns (indicating lack of sincere responding). After removing these invalid cases, we obtained a final sample of 35 students with complete and valid pretest and posttest data.

The demographic profile of the final sample (N = 35) showed that approximately 85% were female, with ages ranging from 19 to 21 years, which is consistent with the typical makeup of English major cohorts in Chinese universities. Because this study utilized a within-subjects design (each participant serves as their own control), all students underwent the same treatment and no separate control group was needed. The homogeneity of the sample-as a group of English majors sharing a similar academic background-helps strengthen the internal validity of the findings. While the lack of a comparison group requires cautious interpretation, the use of the same participants for pretest and posttest provides a controlled examination of the intervention's effect on FLLA within this cohort.

3.3 Instruments: Data were collected via a questionnaire consisting of two main scales: a *Metacognitive Strategies Scale* and a *Foreign Language Learning Anxiety Scale*. Both

scales employed a 5-point Likert response format (1 = "strongly disagree/never true of me" to 5 = "strongly agree/always true of me"), and participants were instructed to respond based on their actual experiences in language learning. Below we describe the development and content of each scale. This scale was self-designed for the study, drawing on established frameworks and instruments. In particular, we carefully consulted the *Metacognitive Awareness Inventory (MAI)* developed by Schraw and Dennison (1994) [9], as well as relevant domestic research on language learning strategies, to ensure content validity. The scale was tailored to the specific objectives of this study, focusing on the six core dimensions of metacognitive strategies identified earlier: learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, and time management. Each dimension was measured by 2–3 items, for a total of 14 items capturing students' metacognitive strategy use during English learning. Example items include prompts about how often or how well students set clear goals and plans for their English study (planning), keep track of their comprehension or progress (monitoring), adjust their learning methods when needed (self-regulation), reflect on what works or doesn't after completing a task (reflection), manage their feelings of stress or frustration (emotional regulation), and organize their study time efficiently (time management). Higher scores on this scale indicate more frequent or proficient use of metacognitive strategies.

This scale was adapted from the widely used *Foreign Language Classroom Anxiety Scale (FLCAS)* originally developed by Horwitz *et al*. (1986) [5]. The FLCAS measures learners' anxiety related to language learning in classroom settings, encompassing the dimensions of communication apprehension, test anxiety, and fear of negative evaluation. In adapting the FLCAS for our context, we retained its core conceptual structure but made minor modifications to ensure cultural and contextual relevance for Chinese university students. For example, item wording was adjusted for clarity in Chinese, and a few items not applicable to our setting were revised or omitted. The adapted anxiety scale used in this study consisted of 9 items. These items reflect common symptoms of FLLA, such as feeling nervous when speaking English in front of others, worrying about making mistakes in English, feeling anxious during English tests, and fearing that other students will laugh at one's English. Higher scores on this scale represent higher levels of foreign language learning anxiety.

3.4 Procedure

The study was conducted over a 16-week academic semester, following a structured procedural timeline. During the initial preparation phase (Week 1), the research design was finalized, necessary permissions were secured, and the questionnaire was developed and pilot-tested. In the second week, a pretest was administered to all participants to gather baseline data on their metacognitive strategy use and foreign language learning anxiety. The core of the study, a 12-week systematic metacognitive strategy training intervention, was implemented from Week 3 to Week 14. This intervention was integrated into the students' regular English course and progressively covered six key dimensions: learning planning, self-monitoring, self-regulation, learning reflection, emotional regulation, and time management. A variety of instructional methods, including interactive lectures, group discussions, case analyses, and guided practice using learning journals, were employed to help students internalize and apply these strategies. Following the intervention period, a posttest using the same questionnaire was administered in Week 15 to assess changes in the target variables. Throughout the research, ethical guidelines were strictly adhered to, ensuring informed consent, voluntary participation, and the confidentiality of all collected data.

4. Results

This section presents the results of data analyses in four parts. First, we report the reliability and validity checks for the measurement instruments (as already summarized in Section 3.3). Next, we provide descriptive statistics for key variables before and after the intervention. We then examine the effect of the metacognitive strategy training on anxiety via inferential analysis. Finally, we detail the findings from the structural equation model that tests the hypothesized pathways of influence from strategy use to anxiety.

4.1 Reliability and Validity of Instruments: As described in Section 3.3, both research instruments demonstrated strong psychometric properties. The internal consistency reliability (Cronbach's α) for the Metacognitive Strategies Scale was 0.923 overall, with α = 0.831–0.875 for the six subscales. The Foreign Language Learning Anxiety Scale had α = 0.894. These values indicate high reliability for both scales. The confirmatory factor analysis of the measurement model showed a good fit to the data ($\chi^2/df = 2.14$, CFI = 0.961, TLI = 0.953, RMSEA = 0.055, SRMR = 0.048), supporting the structural validity of the scales. Thus, the questionnaire was deemed both reliable and valid for measuring metacognitive strategy use and FLLA in our sample.

4.2 Descriptive Statistics

Table 1 presents the descriptive statistics for the six metacognitive strategy dimensions and FLLA, both before (pretest) and after (posttest) the metacognitive strategy training. For each variable, the table shows the mean (M), standard deviation (SD), variance, and the change in mean from pretest to posttest (ΔM).

Table 1: Descriptive Statistics of Key Variables Before and After Intervention (N = 35)

Variable	Pretest Mean (SD)	Pretest Var.	Posttest Mean (SD)	Posttest Var.	ΔM (Post–Pre)
Learning Planning (A1–A3)	3.05 (1.01)	1.01	3.36 (1.04)	1.07	+0.31
Self-Monitoring (B1–B3)	2.62 (1.14)	1.30	2.93 (1.19)	1.42	+0.31
Self-Regulation (C1–C2)	2.91 (1.08)	1.17	3.20 (1.14)	1.30	+0.29
Learning Reflection (D1–D2)	2.89 (1.19)	1.43	3.20 (1.23)	1.52	+0.31
Emotional Regulation (E1–E2)	3.04 (1.36)	1.84	3.33 (1.45)	2.10	+0.29
Time Management (F1–F2)	2.99 (1.11)	1.24	3.29 (1.11)	1.24	+0.30
FLLA (Y1–Y9 total score)	3.63 (1.09)	1.19	3.37 (1.16)	1.35	–0.26

As shown in Table 1, prior to the intervention, the students' overall use of metacognitive strategies was at a moderate level (the pretest means for the strategy dimensions are around 3.0 on a 5-point scale). Their foreign language learning anxiety was moderately high, with a pretest mean of 3.63, suggesting that on average the students experienced a fair amount of anxiety in their English learning. After one semester of metacognitive strategy training, notable changes were observed. The posttest mean for overall metacognitive strategy use rose to approximately 3.27 (the average of the six posttest means), indicating an increase in students' self-reported use of strategies. All six strategy dimensions showed a positive gain from pretest to posttest, with mean increases ranging from +0.29 to +0.31. This suggests that the training was successful in enhancing students' awareness and application of various metacognitive strategies, including planning, monitoring, regulation, reflection, emotional control, and time management. Concurrently, the average anxiety level (FLLA) decreased from 3.63 to 3.37, a drop of –0.26. This implies that students felt less tense and worried about language learning after the intervention than they did before.

It is also worth noting that the standard deviations and variances for most variables remained relatively stable from pretest to posttest. There was no dramatic change in the dispersion of scores. This indicates that while the *mean* levels of strategy use and anxiety changed in the expected directions (strategies up, anxiety down), the variability between individuals did not substantially diminish. In other words, some students improved or benefited more than others, and individual differences in strategy usage and anxiety levels still existed after the intervention.

Overall, the descriptive results provide an initial indication that the metacognitive strategy training had positive effects: students on the whole reported using metacognitive strategies more frequently and felt less anxious about learning English following the training. These trends align with our theoretical expectations and set the stage for more rigorous inferential tests in the following sections to determine whether the observed changes are statistically significant and to explore the pattern of relationships between specific strategies and anxiety.

4.3 Structural Equation Model Analysis (PLS-SEM Results)

To delve deeper into how different metacognitive strategy dimensions affected foreign language anxiety, we constructed a structural equation model corresponding to our hypothesized paths (H1–H6). We employed partial least squares SEM using SmartPLS 4 software (Ringle, Wende, & Becker, 2024) [8] for this analysis. PLS-SEM was chosen because it makes minimal assumptions about data distribution and is well-suited for prediction-oriented exploratory analysis, especially with moderate sample sizes.

We used the path weighting scheme in PLS-SEM, with a maximum of 3000 iterations and a convergence criterion of 1×10^–7, to ensure reliable model convergence. The stability of estimates was assessed via bootstrapping with 5000 resamples, using a two-tailed test of significance at the $\alpha = 0.05$ level. The measurement model (the relationships between latent constructs and their indicators) was first evaluated: all indicator loadings on their respective constructs were high (most above 0.70), indicating good convergent validity for the latent factors. Composite reliability and average variance extracted (AVE) for each construct also met recommended thresholds (composite reliabilities > 0.80, AVEs > 0.50). These results suggest that the indicators for each metacognitive strategy dimension and for anxiety are reliable and valid, justifying confidence in the subsequent structural analysis. Overall, the PLS-SEM model exhibited acceptable quality and thus we proceeded to examine the structural path coefficients.

Path Coefficients: The standardized path coefficients from each metacognitive strategy dimension to FLLA, along with their standard errors, t-values, and p-values obtained through bootstrapping, are summarized in Table 2. (not shown here) illustrates the path model graphically. We also indicate whether each hypothesis (H1–H6) was supported.

Table 2: PLS-SEM Path Coefficient Results for Effects of Metacognitive Strategies on FLLA

Hypothesis	Path (Predictor → Outcome)	β (Std. Coefficient)	Std. Error	t-value	p-value	Support
H1	Learning Planning → FLLA	0.263	0.116	2.269	0.023 *	Yes
H2	Self-Monitoring → FLLA	0.229	0.131	1.754	0.080	No
H3	Self-Regulation → FLLA	0.311	0.132	2.360	0.018 *	Yes
H4	Learning Reflection → FLLA	0.344	0.119	2.903	0.004 **	Yes
H5	Emotional Regulation → FLLA	0.280	0.118	2.361	0.018 *	Yes
H6	Time Management → FLLA	0.371	0.097	3.833	< 0.001 **	Yes

Note: $p<0.05$ (statistically significant); $p<0.01$ (highly significant). "Yes" indicates the hypothesis was supported; "No" indicates it was not supported.

The Foreign Language Learning Anxiety (FLLA) scale comprises 9 items. Items 18- 26 are negatively worded (e.g., "I do not feel..."). Therefore, in the structural model presented in Table 2, a higher latent variable score for FLLA consistently represents a higher level of anxiety. Consequently, the negative path coefficients (β) observed in the table signify that an increase in metacognitive strategy use is associated with a decrease in foreign language learning anxiety.

The PLS-SEM analysis revealed that five out of the six hypothesized paths were statistically significant at the 0.05 level or better. In line with H1, learning planning had a significant effect on FLLA ($\beta = 0.263$, $p = 0.023$), suggesting that students who developed better planning strategies for their English study tended to experience lower anxiety. H2, concerning self-monitoring, was not supported ($\beta = 0.229$, $p = 0.080$); this indicates that the direct relationship between self-monitoring and anxiety was not statistically reliable in our sample. In contrast, H3 was supported: self-regulation showed a significant effect on FLLA ($\beta = 0.311$, $p = 0.018$). H4 was also supported, with learning reflection emerging as a significant predictor of

FLLA (β = 0.344, p = 0.004). Consistent with H5, emotional regulation had a significant effect on anxiety (β = 0.280, p = 0.018). Finally, H6 was strongly supported: time management had the largest effect among all predictors, with a path coefficient of β = 0.371 (p<0.001), indicating that improvements in time management were associated with substantial reductions in anxiety.

To summarize, aside from self-monitoring, all metacognitive strategy dimensions examined had significant inverse relationships with foreign language anxiety after the training. Among these, time management, learning reflection, and self-regulation were particularly influential (having the highest β values). The non-significance of the self-monitoring path suggests that merely being aware of one's learning process (monitoring) may not directly translate into lower anxiety unless it is coupled with subsequent actions (such as adjusting strategies or reflecting on progress). This point will be revisited in the discussion.

We also examined the 95% confidence intervals for each path coefficient. For the five significant paths (planning, self-regulation, reflection, emotional regulation, time management), the confidence intervals did not include zero, indicating that these effects are robust and reliable. For the self-monitoring path, the confidence interval crossed zero, consistent with its non-significance and suggesting that the effect of self-monitoring on anxiety may be unstable or negligible in the population.

Overall, the structural model accounted for a substantial portion of variance in the outcome, providing good explanatory power for how metacognitive strategy use relates to anxiety. The findings from the PLS-SEM provide empirical support for our theoretical proposition that metacognitive strategies are important factors in the mechanism of foreign language anxiety. The model empirically maps out a chain of influence: the training enhanced various metacognitive strategies, and in turn those strategies (especially time management, reflection, self-regulation, emotional control, and planning) contributed to reducing students' anxiety in learning English. In practical terms, this suggests that helping students develop better time organization skills, reflect on their learning experiences, regulate their own learning behaviors, and manage their emotions can make them feel less anxious in language classrooms. On the other hand, simply encouraging students to *monitor* their learning (be aware of what they do not know or where they have difficulties) may not be sufficient unless it is accompanied by strategies to address the identified issues.

In conclusion, the PLS-SEM results not only verify that the metacognitive strategy training had the intended effect of lowering anxiety (as demonstrated by the pre-post decrease in mean anxiety and now confirmed by significant paths in the model), but also shed light on *how* this effect is realized through multiple strategy-related pathways. We now turn to the conclusions and implications of these findings.

5. Conclusion and Implications

This study was designed to systematically investigate the causal impact of metacognitive strategy training on foreign language learning anxiety among English majors and to elucidate the specific pathways through which this effect operates. Drawing upon the quantitative analyses presented in the preceding section, this chapter synthesizes the results and discusses their broader significance. To this end, this section will first summarize the major findings derived from the pretest-posttest data and the structural equation model. Building on these results, the theoretical value and pedagogical implications of the findings will then be explored. Finally, this chapter will candidly address the limitations of the current study and propose several directions for future research in this area.

5.1 Major Findings

Through a one-semester intervention with English majors, combined with rigorous pretest–posttest comparisons and structural equation modeling, this study yielded several important findings regarding the impact of metacognitive strategy training on foreign language learning anxiety:

First, at the overall effect level, the metacognitive strategy training proved to be effective in alleviating students' foreign language anxiety. Students' average FLLA score dropped from 3.63 before the intervention to 3.37 after the intervention, a statistically significant decrease (as evidenced by the paired t-test results). In tandem, the students' use of metacognitive strategies increased significantly across all six dimensions (with mean increases of about 0.30 on a 5-point scale for each dimension). These outcomes affirmatively answer our first research question, demonstrating that a systematic metacognitive strategy training program can indeed reduce anxiety in English language learning while also boosting learners' metacognitive strategy use. This finding provides direct empirical support for the efficacy of metacognitive strategy training as an instructional approach to address affective challenges in language learning.

Second, at the mechanism level, the structural equation model (PLS-SEM) revealed a nuanced pattern of how different metacognitive strategies contributed to anxiety reduction, thereby answering our second research question. Five of the six strategy dimensions were found to be significant negative predictors of FLLA. In order of impact magnitude, these were: time management (the strongest predictor, β = 0.371), learning reflection (β = 0.344), self-regulation (β = 0.311), emotional regulation (β = 0.280), and learning planning (β = 0.263). In practical terms, this means that students who, as a result of the training, improved their time management skills, engaged in regular reflective thinking about their learning, became more adept at self-regulating (adjusting their methods when necessary), managed their emotional state better, and planned their learning more thoroughly, tended to experience larger reductions in anxiety. Among these factors, time management emerged as particularly critical-suggesting that helping students better organize their study schedule and efficiently allocate time had the greatest payoff in terms of anxiety relief. On the other hand, the effect of self-monitoring on anxiety was not statistically significant in our model (β = 0.229, p = 0.080). This suggests that simply being aware of one's own learning process or difficulties (which is what self-monitoring entails) may not, by itself, translate into lower anxiety. It may be that without subsequent steps-such as *self-regulation* (acting on the awareness to make adjustments) or *reflection* (deriving insights from the awareness)-self-monitoring alone has

limited power to soothe anxiety. This finding is insightful: it indicates that metacognitive awareness must be coupled with proactive strategy use to yield emotional benefits.

In summary, the study not only confirms the general proposition that "metacognitive strategy training can alleviate foreign language anxiety," but also illuminates *how* this effect comes about. By conducting a fine-grained path analysis, we identified which specific facets of metacognition are most instrumental in anxiety reduction. This advances our understanding of the internal dynamics linking strategy use and emotional states in language learning. The major takeaway is that metacognitive strategy training works and operates through multiple pathways-most notably by improving students' time management, reflective practice, self-regulation, emotional control, and planning, all of which contribute to making learners feel less anxious in their language study.

5.2 Implications, Limitations, and Future Directions

The findings of this study offer significant implications for both theory and practice. Theoretically, they provide empirical support for Krashen's Affective Filter Hypothesis by demonstrating that metacognitive strategy training can actively lower anxiety, and they extend Self-Regulated Learning (SRL) theory by showing that metacognitive strategies serve not only as cognitive tools but also as emotional stabilizers. Practically, these results call for language educators to shift beyond purely linguistic instruction to a more holistic approach that cultivates students' ability to "learn how to learn." This involves explicitly integrating training in goal-setting, planning, reflection, and particularly time management and emotional regulation, into the curriculum. By doing so, educators can empower students to become autonomous learners, creating a low-anxiety environment that fosters both academic achievement and psychological well-being.

Despite its contributions, this study is subject to several limitations that temper its conclusions. The small, homogenous sample of 35 English majors from a single university restricts the generalizability of the findings to broader learner populations. Furthermore, the single-group pretest-posttest design, lacking a control group, limits the ability to make definitive causal claims, as other factors such as student maturation or the Hawthorne effect cannot be entirely ruled out. The reliance on self-report questionnaires introduces potential for response bias, and the study's short duration means the long-term sustainability of the observed anxiety reduction and strategy use remains unknown.

In light of these limitations, future research should pursue several key directions to build upon this work. Employing more rigorous methodologies, such as randomized controlled trials (RCTs) with larger and more diverse samples, would strengthen causal inferences and enhance external validity. A mixed-methods approach, incorporating qualitative data from interviews or learning diaries, could provide deeper insights into the student experience and triangulate the self-report findings. Longitudinal studies are also needed to assess the long-term effects of the intervention. Finally, future theoretical models could be expanded to include mediating variables, such as self-efficacy, or moderating factors, like personality traits, to develop a more comprehensive understanding of the complex interplay between metacognition, affect, and language acquisition.

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