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RESEARCH ARTICLE

The Moderating Role of Metacognitive Strategies in the relationship between Foreign Language Learning Anxiety and Language Performance

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ABSTRACT

Metacognitive strategies (MLS) play a significant role in foreign language learning by enabling students to plan, monitor, and adjust their acquired strategies. In addition, they also play a crucial role in language acquisition by positively influencing learners' language development. However, foreign language learning anxiety (FLLA) is a negative emotion that exerts multifaceted detrimental effects on learners' metacognitive learning strategies and language outcomes. This study was aimed at investigating the influence of FLLA on MLS, and the moderating Role of MLS in the relationship between FLLA and language performance (LP) among 736 university-level Chinese foreign language learners. A quantitative survey in this study revealed a significant negative correlation between two paths, namely, language confidence (LC) and MLS and academic anxiety (AA) and MLS. However, there was no significant correlation between the two paths of classroom anxiety (CN) and MLS and communication apprehension (CA) and MLS. Moreover, it was also discovered that MLS was a significant moderator of the relationship between FLLA and LP. The implications of the study were discussed.

Keywords: moderating effect; foreign language learning anxiety; metacognitive strategies; language performance

1. Introduction

The impact of language learning anxiety on foreign language acquisition has long been a topic of widespread scholarly interest. Early research on language learning anxiety explored numerous definitions of the concept of anxiety, focusing on whether this emotion has facilitative or debilitative effects on foreign language learning. Scovel[1] divided anxiety into facilitating anxiety and debilitating anxiety, proposing that "*Facilitating anxiety motivates the learner to 'fight' the new learning task; it gears the learner emotionally for approach behaviour. Debilitating anxiety, in contrast, motivates the learner to flee the new learning task…*". In tests conducted by Chastain[2] on students learning French, a profound connection was revealed between their English performance and emotional state. Negative emotions, in particular, significantly impacted the students, inducing anxiety that diminished their motivation and severely undermined their learning attitudes. Furthermore, his studies with German and Spanish learners yielded identical conclusions. Consequently, he posited that excessive anxiety exerts a detrimental effect on student learning. To substantiate this view, he conducted tests on a

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thousand students using the motivational testing theory as a foundation, further confirming anxiety as the primary culprit behind declining performance. Trylon[3] examined the impact and interrelationships of learning ability, attitude, and anxiety on academic performance. He found that anxiety is one of the most detrimental factors affecting English learning, with anxiety levels being inversely proportional to academic achievement. Phyllips[4], using French language students as subjects and analysing data via the foreign language anxiety scale, discovered an inverse relationship between students' oral foreign language performance (LP) and anxiety levels. Matsuda[5] tested 54 Spanish students learning Japanese and observed that there were significant gender differences in anxiety levels, with female students exhibiting higher anxiety levels than males. There were also substantial disparities in their academic performance, ultimately confirming an inverse relationship between foreign language learning anxiety (FLLA) and foreign language learning achievement. Wariyo[6] demonstrated that students' English performance showed a significant positive correlation with individual comprehension abilities, learning motivation, learning attitudes, and parental encouragement, while exhibiting a significant negative correlation with English learning anxiety. Krashen[7] proposed the "affective filter hypothesis", suggesting that learners often acquire less content in the classroom than the language input they receive. This discrepancy stems from the premise that metacognitive strategies (MLS) are influenced by affective factors (such as motivation, confidence, and anxiety) filtering information intake. When anxiety levels are high, the cognitive resources of learners are occupied, reducing the use of MLS, such as self-monitoring. Conversely, when anxiety levels are low, the affective filter weakens, freeing up more cognitive resources for strategic learning. This perspective highlights the critical role of learner anxiety in knowledge acquisition. Benjamin[8] revealed that, from an information processing perspective, high-anxiety learners underperform on tests due to ineffective strategy mobilisation. Against this backdrop, the cognitive mechanisms and learning strategies, particularly the MLS of foreign language learners, have increasingly become the focal points of research. Multiple studies[9-11] have corroborated this perspective, demonstrating that learning anxiety not only impairs language processing efficiency but may also indirectly reduce performance by inhibiting strategy activation. Although the academic community generally agrees that "*strategy use can alleviate learning anxiety*", systematic research on the relationship between foreign language anxiety and MLS remains insufficient. This study proposed the adoption of a mixed-methods approach, combining quantitative and qualitative methods, for an in-depth exploration of the underlying mechanisms between the two to devise intervention pathways for alleviating FLLA at the MLS level, thereby enhancing learning effectiveness.

2. Literature review

2.1. Theoretical framework

The self-regulated learning theory posits that the dynamic interaction of negative emotions, such as anxiety and stress, can undermine learners' ability to initiate or sustain motivation, disrupt effective metacognitive monitoring, and ultimately hinder learning outcomes. Metacognitive strategies (MLS) represent one of the key processes encompassed by the self-regulated learning theory[12,13]. Students need to employ MLS to effectively regulate their learning and mitigate the negative impact of learning anxiety on academic performance[12,13]. Based on this theoretical framework, the research hypothesis was tentatively proposed that metacognitive learning strategies can reduce learning anxiety, or that learning anxiety negatively affects metacognitive learning strategies.

2.2. Impact of Metacognitive Learning Strategies (MLS) on Foreign Language Learning Achievement

The metacognitive theory, first proposed by Flavell[14], stands as a pivotal concept within cognitive psychology. It refers to the awareness of individuals and the regulation of their own cognitive processes. The

measures or approaches adopted under metacognitive monitoring and guidance are termed MLS. They represent those processes that assist learners in planning, monitoring, evaluating, and adjusting their learning methods and strategies, thus enabling them to establish reasonable learning plans and objectives based on their individual learning characteristics. O'Malley and Chamot[15] defined MLS as the self-regulation and management of learners of their cognitive learning processes, primarily encompassing strategies such as formulating learning plans, monitoring learning processes, and evaluating learning outcomes. Metacognitive strategies (MLS) are regarded as "higher-order executive skills" within language learning strategies and are also considered crucial for successful language learning[16].

Through long-term tracking studies of learners from diverse linguistic backgrounds, Chamot and O'Malley[17] found that learners who were proficient in applying MLS outperformed those who were less adept in these strategies in terms of language knowledge acquisition, skill application, and overall language proficiency. Metacognitive strategies (MLS) permeate the entire learning process, exerting a regulatory influence on all learning activities. Zhang, Zhang, and Zhang[18] conducted a group experiment involving 120 Chinese university students majoring in non-English disciplines using structural equation modelling. Their findings confirmed that MLS indirectly enhanced oral performance by boosting task self-efficacy. In an experiment involving 168 Kenyan secondary school students, Omare, Aloka, and Ochieng[19] revealed that after an eight-week intervention using MLS, the intervention group scored 18.7% higher on post-test English total scores compared to the control group. Zhang and Teng[20] conducted a three-semester study of Singaporean Secondary 2–4 learners of English-as-a-second-language from public schools. The findings indicated that metacognitive regulation (planning-monitoring-evaluation) alone accounted for 24% of the subsequent improvement in second language writing performance, demonstrating its sustained and significant predictive power for writing advancement. Sur[21] examined the impact of MLS on language skill acquisition in foreign language education using 27 data points from 21 studies. The results indicated that the use of MLS significantly enhanced language learning skills. However, Hodej and Košak Babuder[22] investigated the relationship between reading fluency, reading anxiety, reading comprehension, and reading learning strategies before and after the implementation of a metacognitive reading strategies instructional programme involving nine elementary school students in fifth grade with learning difficulties. No relationship was found between the metacognitive components and learning outcomes, nor was there a negative relationship.

In short, most studies confirmed the role of MLS in foreign language learning. These strategies help students plan, monitor, and adjust their acquired learning approaches, play a crucial role in language acquisition and have a positive influence on the language development of learners. In other words, there is a significant positive correlation between the use of metacognitive learning strategies and language learning outcomes. Students who are adept at employing metacognitive learning strategies are often better able to plan learning objectives, monitor learning processes and promptly adjust learning methods, thereby enhancing their foreign language learning efficiency and effectiveness. However, there were also some discrepancies in the existing research findings. For instance, Hodej and Košak Babuder[22] found that metacognitive learning strategies had no impact on learning outcomes.

2.3. Effect of Language Learning Anxiety on Metacognitive Strategies (MLS)

Language learning anxiety is one of the most significant affective variables constraining foreign language acquisition. While examining the role of affective variables in foreign language learning, Brown[23] proposed that anxiety, as an affective factor, correlates with the success or failure of foreign language learning. Krashen[7] argued that anxiety hinders a learner's ability to process language input and comprehend the meaning expressed in the target language, thereby impeding language "acquisition". Horwitz *et al*.[24]

defined FLLA and developed a foreign language classroom anxiety scale (FLCAS). Thus, language learning anxiety significantly impacts foreign language acquisition.

Language learning anxiety, as a negative emotion, exerts multifaceted detrimental effects on learners' metacognitive learning strategies. First, when it comes to formulating a learning plan, anxious learners often struggle to concentrate, lack a clear understanding and reasonable planning of learning objectives, resulting in unscientific and illogical learning plans. Excessive anxiety may even cause them to abandon planning altogether. Zhang and Ardasheva[25] proposed that the excessive activation of the amygdala in anxious individuals inhibits the prefrontal cortex, causing a sudden increase in working memory cognitive load, making it difficult for learners to rationally plan future studies and decompose learning objectives. Second, during monitoring of the learning process, anxiety disrupts learners' attention allocation, hindering their ability to effectively track their progress and assess learning outcomes. In a study of 103 Lebanese undergraduates, Ghaith[11] found that metacognitive monitoring is crucial for suppressing reading anxiety. Without such monitoring, readers lack the psychological preparedness for unfamiliar vocabulary or culturally loaded information, causing uncertainty to rapidly escalate and anxiety to rise accordingly. Metacognitive monitoring serves as a significant predictor of anxiety levels, demonstrating that as anxiety increases, learners' monitoring capacity correspondingly diminishes.

Paterson and Manalo[26] investigated the strategic differences between high-anxiety and low-anxiety learners. Their findings revealed that high-anxiety learners focused less on relevant information processing, employed fewer strategies, and provided more negative self-evaluations regarding their language abilities. In contrast, low-anxiety learners reported more strategic choices and experienced greater ease during language learning. In this researcher's teaching practice, it has been frequently observed that learners become overly fixated on pronunciation details due to concerns about inaccuracy, neglecting other crucial aspects of language learning and leading to an unbalanced development in their learning process. Wakuma[27] examined the relationship between anxiety levels and English academic performance among high school students, particularly ninth graders. The findings revealed that even when their academic progress exceeded 35 points, 58% of anxious students attributed their scores to luck rather than ability. Interviews further highlighted a pattern of excessive self-criticism in their discourse, with statements like "*I didn't do well enough*" or "*This progress is insignificant*", leading to a subsequent rise in anxiety levels. This indicates that in learning outcome assessments, anxious learners often over-criticise themselves, amplifying perceived shortcomings while overlooking progress and strengths. Consequently, their evaluations lack objectivity and accuracy. This inaccurate self-assessment further intensifies anxiety, creating a vicious cycle that impedes the sustained and effective application of metacognitive learning strategies.

2.3.1. Effect of Classroom Anxiety (CN) on Metacognitive Strategies (MLS)

Shen *et al*.[28] investigated the roles of MLS and writing self-efficacy in predicting writing anxiety, particularly in cross-sectional analyses. The findings indicated negative reciprocal correlations between the use of MLS in writing contexts and writing anxiety. This study further revealed that the negative impact of anxiety on MLS exhibited cross-task consistency. For instance, in English writing contexts, anxiety not only diminishes writing self-efficacy but also reduces students' metacognitive monitoring and regulation of the writing process, ultimately leading to poorer writing performance.

Secondly, Xu *et al*.[10] found that anxiety impairs students' use of MLS. A study involving 2804 university students revealed that anxiety disorders significantly and negatively predicted MLS. In other words, higher anxiety levels correlated with poorer frequency and effectiveness of MLS, such as planning,

monitoring, and regulation, during learning. The results indicated that test anxiety, a typical form of academic anxiety (AA), exerted a significant negative effect on the use of MLS.

However, Ölmezer Öztürk[29] examined learners' metacognitive listening strategies, their listening anxiety and whether there was a relationship between these two research matters among 112 university freshman students of English-as-a-foreign-language in Turkey. The findings of this study demonstrated that there was a significantly positive relationship between FLLA levels and the use of MLS among the participants, though on a low level.

Spada, Nikcevic, Moneta, and Ireson[30] explored the relationship between metacognition, test anxiety and surface approach to studying. The study involved the participation of 109 undergraduate students. The findings also displayed significant positive correlations between metacognitive strategies and test anxiety.

Ghaith[11] investigated foreign language reading anxiety and metacognitive reading strategies in the reading comprehension of 103 college-level English-as-a-foreign-language learners. The result showed a non-significant positive correlation between foreign language reading anxiety and metacognitive reading strategies.

In summary, most research findings indicated a significant negative correlation between language learning anxiety and metacognitive learning strategies, although a few results contradicted this pattern. Therefore, this study hypothesised that:

Hypothesis 1: Classroom anxiety (CN) has a significantly negative effect on metacognitive strategies (MLS).

2.3.2. Effect of Communication Apprehension (CA) on Metacognitive Strategies (MLS)

An extensive literature review found limited research on the relationship between foreign language communication anxiety and metacognitive learning strategies. Among these studies, a questionnaire survey by Olam, Arceo, and Rodriguez[31] revealed that there was a significant negative correlation between the levels of communication among English major students and metacognitive learning strategies, including planning, preparation, attention control, and other cognitive/MLS, with higher anxiety levels correlating with a lower frequency of MLS use. Meanwhile, Liu[32] surveyed university-level English learners in China, employing the metacognitive awareness listening questionnaire to measure MLS and the communication apprehension scale to measure CA. A correlation analysis revealed a negative but insignificant relationship between foreign language listening metacognitive learning strategies and foreign language communication anxiety. Therefore, this study hypothesised that:

Hypothesis 2: Communication apprehension (CA) has a significantly negative effect on metacognitive strategies (MLS).

2.3.3. Effect of Academic Anxiety (AA) on Metacognitive Strategies (MLS)

Garcia[33] and Noormohamadi[34] examined differences in language learning strategies among high-anxiety and low-anxiety learners of English-as-a-second-language. They found that high-anxiety learners employed metacognitive and memory strategies most frequently, while low-anxiety learners utilised metacognitive and social strategies most often. Elkhafai[35] demonstrated that anxiety impairs learners' comprehension abilities by distracting their attention and slowing down their information processing, ultimately leading to lower listening scores. King[36] examined the relationship between learning emotions, including anxiety, and MLS use among secondary students and found that those experiencing positive emotions employed MLS more frequently. When students' minds are preoccupied with anxious thoughts, they may struggle to focus on the task at hand. This difficulty intensifies when they attempt to

simultaneously monitor and evaluate their own abilities to complete academic tasks. González *et al*.[37] indicated that the most optimistic and least anxious students employed more MLS than their less optimistic and more anxious peers, thereby enhancing their overall academic performance. Florentine[38] studied 128 students at the University of Calgary, and discovered a significant positive correlation between AA and metacognition, thus indicating that students with higher anxiety levels also reported higher overall metacognitive levels. A further analysis revealed that AA was significantly and positively correlated with both self-reported metacognitive awareness and MLS use. These findings suggest that students with higher anxiety levels demonstrate greater awareness of their knowledge and skills during learning and employ more MLS. Therefore, this study hypothesised that:

Hypothesis 3: Academic anxiety (AA) has a significantly negative effect on metacognitive strategies (MLS).

2.3.4. Effect of Language confidence (LC) on Metacognitive Strategies (MLS)

In the present study, Language confidence (LC) or L2 self-confidence is conceptualized as a dimension of FLLA. MacIntyre, Noels, and Clément[39] proposed that LC constitutes a situation-specific construct which is essential for willingness to speak in target language; that is, it is not a static trait but fluctuates across different communication contexts and temporal states. A student might demonstrate considerable self-assurance within the confines of a classroom, while simultaneously feeling anxious in social contexts, owing to the substantial differences in environmental factors and the perceived probability of achieving success in these distinct scenarios. Following this, MacIntyre, Clément, Dörnyei, and Noels[40] conceptualized L2 self-confidence as "*the overall belief in being able to communicate in the L2 in an adaptive and efficient manner*" (p.548).In other words, the definision of LC refers to language learners' belief in their own foreign language proficiency. This conceptualization bears resemblance to the notion of self-efficacy.

Pajares[41] found that learners' self-efficacy was directly related to the effectiveness of the MLS they employed and their ability to complete assigned language tasks. The quality of the self-regulation skills employed by students partly depended on their beliefs about themselves. Graham and Macaro[42] investigated the impact of strategy guidance on listening performance among low-to-intermediate English learners in post-tests and delayed post-tests, while also examining their confidence levels. Regarding confidence, the high-level group scored higher than both the low-level group and the control group. Sun[43] also noted that learners with greater confidence in English writing were more inclined to employ MLS to organise, monitor, and evaluate both the writing process and outcomes. Conversely, Liu[44] found that students with high self-efficacy exhibited stronger confidence and greater assurance when confronting learning tasks. They adeptly employed learning and MLS, receiving positive feedback from these tasks. This enabled the effective regulation of negative emotions such as anxiety, tension, and depression arising from learning demands. Jones[45] examined the use of MLS in first-year university Spanish classrooms in Canada. The findings revealed that learners with higher confidence in their language abilities were more inclined to proactively plan, monitor, and evaluate their learning processes, thereby employing more MLS. Furthermore, over the four-month action research period, as learners gained confidence, they tended to adopt more self-regulatory behaviours to manage their learning. Thus, metacognition plays a crucial role in enhancing language skills by helping learners build confidence. When learners recognise and can control the cognitive processes involved in language learning, they engage in language learning activities with greater confidence. This confidence, in turn, motivates them to actively participate in language learning activities. Students with high self-efficacy are more likely to adopt effective learning strategies, while those with low self-efficacy may avoid

challenges, lack motivation, give up easily, or even develop learned helplessness. Therefore, this study hypothesised that:

Hypothesis 4: Language confidence (LC) has a significantly positive effect on metacognitive strategies (MLS).

2.3.5. Moderating Effect of Metacognitive Strategies (MLS) on the Correlation between Foreign Language Learning Anxiety (FLLA) and Language Performance (LP)

Spada, Nikcevic, Moneta, and Ireson[30] explored a significant positive correlation between metacognition strategy and test anxiety. Structural equation modelling was used to test a moderating effect in which test anxiety predicted metacognition, which in turn predicted a surface approach to studying. The results supported the moderate model that anxiety predicted MLS, which in turn predicted a surface approach to studying. Moreover, Xu, Xu, Tan, and Yu[10] developed a chain moderating model to test whether learning motivation and MLS moderated the relationship between anxiety disorders and English academic writing performance among 2804 college students. The results indicated that MLS moderated the relationship between anxiety disorders and English academic writing performance. However, Zhan *et al*.[46] explored the correlation between the Chinese foreign language learning achievement, MLS, and learning anxiety of 312 Cambodian middle school and university students. The results showed that there was no significant correlation between their Chinese learning performance and MLS, while a significant negative correlation emerged between their Chinese learning performance and learning anxiety, probably reflecting that FLLA did not have a moderating effect on the correlation between MLS and LP.

The above review revealed that researchers predominantly employed scales and questionnaires supplemented by interviews and other methodologies. The findings indicated that anxiety exerted a mixed and complex influence on foreign language learning outcomes. Most studies revealed a significant negative correlation between language learning anxiety and academic performance, although a few results contradicted this pattern. In other words, integrating metacognitive strategy training into foreign language instruction helps alleviate students' learning anxiety. Practice has demonstrated that through training, learners gain deeper insights into their learning processes, establish clear learning objectives and plans, enhance their learning management capabilities, learn to evaluate their performance accurately, experience reduced learning anxiety and lower self-evaluations, build learning confidence, and consequently improve their foreign language learning outcomes. Therefore, this study hypothesised that:

Hypothesis 5: Metacognitive strategies (MLS) have a significant moderating effect on the correlation between foreign language learning anxiety (FLLA) and language performance (LP).

2.4. Research Questions

1. Does Classroom anxiety (CN) have a significant negative effect on metacognitive learning strategies (MLS)?

2. Does communication apprehension (CA) have a significantly negative effect on metacognitive learning strategies (MLS)?

3. Does academic anxiety (AA) have a significantly negative effect on metacognitive learning strategies (MLS)?

4. Does language confidence (LC) have a significantly positive effect on metacognitive learning strategies (MLS)?

5. Do metacognitive learning strategies (MLS) have a significant moderating effect on the correlation between LE and foreign language learning performance (LP)?

2.5. Research Hypotheses

Hypothesis 1: Classroom anxiety (CN) has a significantly negative effect on metacognitive strategies (MLS).

Hypothesis 2: Communication apprehension (CA) has a significantly negative effect on metacognitive strategies (MLS).

Hypothesis 3: Academic anxiety (AA) has a significantly negative effect on metacognitive strategies (MLS).

Hypothesis 4: Language confidence (LC) has a significantly positive effect on metacognitive strategies (MLS).

Hypothesis 5: Metacognitive strategies (MLS) have a significant moderating effect on the correlation between foreign language learning anxiety (FLLA) and language performance (LP) (**Figure 1**).

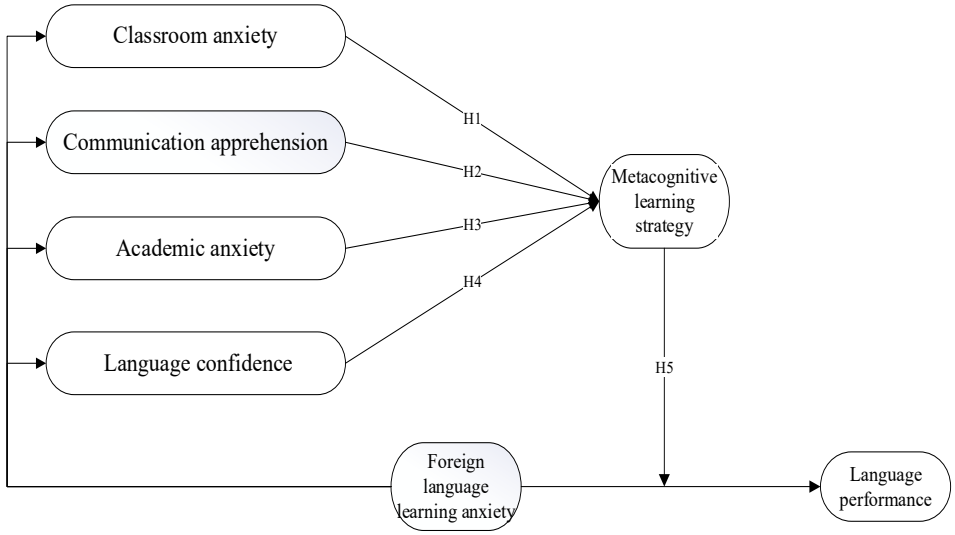


Figure 1. Modelling the research's hypotheses.

3. Research Methodologyethod

3.1. Participants

The data obtained from the questionnaires collected from 736 university-level foreign language learners. The participants, all of whom were adults, were informed that the information from the questionnaires would be strictly confidential and used solely for research purposes. They were also advised that they could withdraw from the survey at any time.

3.2. Instruments

The questionnaire developed by Horwitz et al.[7] and based on the FLCAS was employed to examine FLLA and foreign language learning achievement among university-level foreign language learners in China. The FLCAS was selected due to its high internal consistency ($\alpha = 0.93$)[7]. The questionnaire comprised two sections: Part 1 collected demographic information, including (1) gender, (2) academic year, (3) major, and (4) final exam scores for the previous semester. Part 2 comprised 33 items from the FLCAS.

3.3. Procedure

The teaching assistants delivered this questionnaire to students majoring in foreign languages via the internet platform. The study and the objective of the questionnaire were succinctly conveyed to the students during class, and they were promised that all information provided would remain confidential and utilized solely for research purposes, thereby encouraging meticulous completion. Participation in this questionnaire was optional, and students who opted not to participate could forgo it. A total of 736 valid surveys were obtained following the initial screening phase.

3.4. Data Analysis

Descriptive statistics were analyzed using Statistical Product and Service Solutions® (SPSS®) version 22. The validation study demonstrated distinct factor structures for the FLCAS. Furthermore, measurement and structural models were evaluated utilizing Amos.

4. Results

The results of the Kaiser-Meyer-Olkin test and Bartlett's test of sphericity indicated that the FLLA was suitable for a factor analysis (Kaiser-Meyer-Olkin = 0.964, $p < 0.001$). According to Xuan[47], there are four dimensions of FLLA, namely CA, AA, LC, and CN. The Cronbach alpha for the questionnaire ranged between 0.715–0.935, indicating good internal consistency and reliability. Therefore, the verified questionnaire can be further used by future studies on this topic.

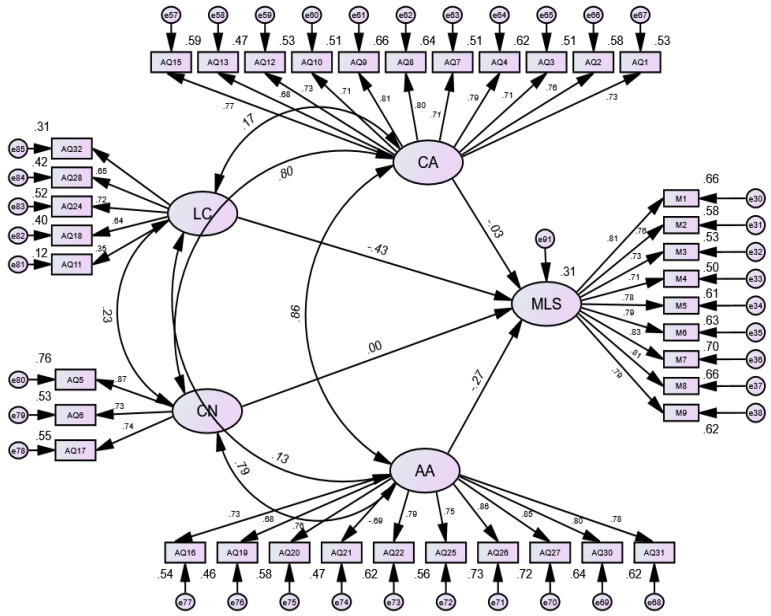
4.1. Hypothesis Testing

The paths of the influence of FLLA on MLS are shown in **Figure 2**, as depicted in **Table 1**. The path coefficient of LC on MLS was -0.435 with $p < 0.05$, indicating the significantly negative effect of LC on MLS. The path coefficient of AA on MLS was -0.275, again with $p < 0.05$, indicating the significantly negative effect of AA on MLS. The path coefficient of CA on MLS, however, was -0.033, with $p > 0.05$, indicating the insignificantly negative effect of CA on MLS. The path coefficient of CN on MLS was 0.004, with $p > 0.05$, indicating the insignificant correlation between CN and MLS. As such, Hypotheses 1, 2 and 4 were rejected, while Hypotheses 3 was supported (**Figure 2**).

Table 1. The results of the hypothesis testing.

Hypothesis	Paths	Estimate	SE	CR(*t*)	*P*
2	MLS<--CA	-0.033	0.077	-0.376	0.707
4	MLS<--LC	-0.435	0.136	-6.741	***
1	MLS<--CN	0.004	0.075	0.053	0.957
3	MLS<--AA	-0.275	0.081	-3.146	0.002

Note: *CA = Communication apprehension; AA = Academic anxiety; LC = Language confidence; CN = Classroom anxiety; MLS=Metacognitive Strategies*



Minimum was achieved. Chi-square = 2672.400 Degrees of freedom = 655 Probability level = 0.000

Figure 2. The influence of FLLA on MLS.

4.2. Do MLS have a significant moderating effect on the correlation between FLLA and LP?

Table 2. MLS' moderating effect on the correlation between FLLA and LP.

Model	Coeff	SE	*t*	*p*	LLCI	ULCI
MLS' moderating effect on FLLA and LP	0.0006	0.0002	2.999	0.0028	0.0002	0.0010

Note: *MLS=Metacognitive learning strategies; FLLA=Foreign language learning anxiety; LP=Language performance*

A PROCESS 3.0 Macro regression analysis was used to investigate the hypothesis regarding MLS as a moderating variable in the relationship between FLLA and LP. According to **Table 2**, MLS was a significant moderator of the relationship between FLLA and LP ($\beta = 0.0006$, SE = 0.0002, $p < 0.05$), the FLLA on LP in foreign language acquisition are mitigated by MLS. Therefore, Hypothesis 5 was supported (**Figure 3**).

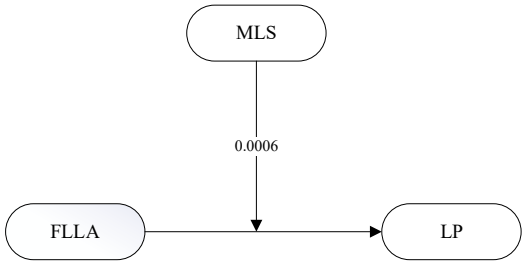


Figure 3. The moderating effect of MLS on FLLA and LP.

5. Discussion

5.1. Effect of Classroom Anxiety (CN) on Metacognitive Strategies (MLS)

The path coefficient of CN on MLS indicated a non-significant positive correlation. Teachers' anxiety levels did not significantly predict the use of MLS. This finding was in line with that of Ölmezer Öztürk[29], but differed from Xu *et al*.[10] and Shen *et al*.[28], who reported that anxiety impairs students' metacognitive

strategy use. According to Huang's[48] definition of MLS, these encompass planning (goal setting before learning), monitoring (self-checking during learning), and evaluation (post-learning reflection on effectiveness), which represent a higher-order regulation of cognitive processes rather than direct engagement with learning materials themselves. The core of MLS lies in "regulating or planning attention and learning processes", not in directly processing learning materials. This fundamental distinction explains why they do not overlap with the functional domain of affective anxiety (emotional tension). Anxiety primarily manifests as emotional tension, and CN exhibits significant variations across different teaching contexts (e.g., listening classes, speaking classes, reading classes). As noted by Ölmezer Öztürk[29] in their empirical study of university English listening classes, learners' listening anxiety manifests as physiological responses, such as emotional tension and increased heart rate, during listening sessions. In contrast, reading or speaking classes present distinct anxiety triggers and intensities. Metacognitive strategies (MLS) rely more on cognitive monitoring and planning, and the functional domains of the two do not fully overlap, resulting in a low correlation. In a review of metacognitive strategy research from 2003-2021, Nie[49] summarised that recent studies on learning anxiety and MLS generally found a low correlation between the two. This is because anxiety, being primarily an emotional tension response, while MLS involve cognitive planning and monitoring, differ in their operational mechanisms, often resulting in statistically insignificant correlations. Furthermore, Ölmezer Öztürk[29] proposed that the relationship between learning anxiety and MLS depends on students' anxiety levels. Metacognitive learning strategies only react when students experience high anxiety levels, yet the data from the study indicate that students generally exhibit moderate anxiety levels. On the other hand, Hodej and Košak Babuder[50] also noted in their chapter on reading literacy that the direct impact of anxiety on reading MLS is often masked by other learning factors. Therefore, CN may indirectly influence MLS through mediating variables such as learning motivation and learning self-efficacy. Future research is advised to incorporate mediating variables in relevant studies to achieve more in-depth and valuable findings.

5.2. Effect of Communication Apprehension (CA) on Metacognitive Strategies (MLS)

The study results indicated that CA had a non-significant negative impact on MLS. These findings aligned with Liu[32], but differed from those of Olam *et al*.[51]. Zhao and Sang[52] demonstrated that high-level individuals employ MLS, cognitive strategies, and social/emotional strategies more frequently than low-level individuals. Significant differences emerged in the use of metacognitive and cognitive strategies, while no significant difference was found in social/emotional strategy usage, thus indicating a distinct differentiation in the application of metacognitive and emotional strategies. These findings further validated the functional domain differences between CA (emotion) and MLS (cognitive), potentially explaining the lack of a significant correlation between them. Additionally, similar to classroom anxiety, possible variables may collectively contribute to this non-significant outcome.

5.3. Effect of Academic Anxiety (AA) on Metacognitive Strategies (MLS)

The path coefficient of AA on MLS was -0.275, again with $p < 0.05$, indicating the significantly negative effect of AA on MLS. In the same view, Xu *et al*.[10] indicated that anxiety disorders negatively predict English academic writing performance, as well as MLS. Following this line of reasoning, reducing learning anxiety can effectively enhance metacognitive learning strategies and thereby improve students' language learning outcomes. Jin, Zhang, and MacIntyre[53] proposed that contractually binding students to oral expressions in foreign language classrooms can effectively alleviate CN. A diary analysis revealed that contract-based oral training enhances learning engagement, boosts self-efficacy, promotes self-reflection on learning strengths and weaknesses, and cultivates character strengths and positive emotions, while simultaneously reducing classroom fear, tension, and worry. Secondly, Zheng *et al*. [54] demonstrated that the

large language model, GPT-4, significantly increases students' willingness to engage in English oral communication while markedly reducing foreign language anxiety. An analysis of semi-structured interviews revealed that learners have a positive attitude towards the use of large language models and are willing to continue using them in the future. Therefore, as a widely accepted, user-friendly mainstream tool for current and future use, large artificial intelligence models represent an accessible means of supporting foreign language learning and reducing the associated anxiety and should be widely adopted by foreign language learners.

5.4. Effect of Language Confidence (LC) on Metacognitive Strategies (MLS)

As mentioned earlier, Pajares[55] posited that learners' self-confidence is directly linked to the effectiveness of their MLS and their ability to complete specified language tasks. However, the findings indicated a significant negative impact of LC on MLS. These results inconsisted the research by Graham and Macaro[40], Sun Li[41], and Jones[43], which demonstrating that metacognition can enhance learners' self-confidence.The negative association between LC and MLS indicates that learners with lower language confidence report greater use of metacognitive strategies. This finding supports the compensatory mechanism described in cognitive load theory; learners who lack automaticity in L2 processing depend on explicit regulatory strategies to manage cognitive demands[56]. Moreover, MacIntyre, Noels, and Clément[39] proposed LC is manifested through learners' accurate or positive self-assessments of their linguistic capabilities. Their findings indicate that low-anxiety learners tend to overestimate their abilities, whereas high-anxiety learners tend to underestimate their abilities. This finding illuminates the intricate interplay between perceived competence and anxiety as the two core dimensions of self-confidence, specifically, the dynamic interaction between cognitive evaluation and emotional response.

5.5. Moderating Effect of Metacognitive Strategies (MLS) on Foreign Language Learning Anxiety (FLLA) and Language Performance (LP)

The findings indicated that MLS significantly moderated the relationship between FLLA and LP. In other words, metacognitive learning strategies mitigates the FLLA on learning performance in foreign language acquisition. When faced with the same level of FLLA, learners who possess high-MLS skills exhibit a less significant decline in learning performance. These results confirmed the findings of Xu *et al*.[10] and Spada *et al*.[30] that MLS moderate the relationship between anxiety and academic performance and further underscored the importance of metacognitive learning strategies in language learning anxiety and foreign language acquisition.

5.6. Implications of the Study

The significance of metacognitive learning strategies in language acquisition has been extensively acknowledged by a variety of groups, and their efficacy is well-established. The integration of metacognitive strategy training into foreign language instruction can help alleviate students' anxiety associated with language learning. First, establish a reasonable learning plan based on clear learning objectives defined by MLS. Plan the components, including the learning goals, review the materials, generate the questions to be answered, and analyse how the learning tasks can be completed. Break down the learning tasks into small, manageable parts and set appropriate timeframes to allow for progressive foreign language learning tailored to individual circumstances, thus reducing anxiety caused by disorganised plans while enabling timely recognition of learning progress and fostering a sense of accomplishment and enjoyment. Second, employ monitoring strategies effectively. Self-monitoring refers to the process by which students actively plan, observe, evaluate, provide feedback, control, and adjust their ongoing learning activities to achieve predetermined goals. Foreign language learners can continually ask themselves questions. Through self-

questioning, they can promptly identify learning issues and shortcomings, maintain vigilance, stimulate motivation, guide themselves in formulating personalised learning tasks for different content, selecting appropriate learning methods, and supervising their progress; and encourage reflection, summarisation, and learning from experience to prepare for future studies. Conscious and effective self-monitoring during learning helps learners consciously eliminate distractions, reduce blindness, impulsiveness, and irrationality in learning, enhance efficiency, and lower anxiety. Within monitoring strategies, an objective evaluation of learning outcomes is also essential. An objective self-assessment effectively cultivates autonomous learning abilities. Sound self-evaluation and self-monitoring not only hold learners accountable for their learning processes but also reveal the gap between their current proficiency and desired outcomes. This clarity regarding their overall capabilities generates greater motivation for learning. Additionally, employing AI tools to aid foreign language learners in working on learning plans based on their strengths and weaknesses, establishing learning objectives, and utilizing suitable learning strategies can significantly enhance students' foreign language proficiency and subsequently alleviate foreign language learning anxiety. For instance, learners can set up "foreign language acquisition SKILL" inside their chosen AI tools, document their educational advancement, such as AI-facilitated Q&A and AI language practice partners, enabling the AI to discern their learning proficiencies and deficiencies. Upon acquiring a comprehensive understanding of the learner, the AI can be instructed to employ metacognitive processes to formulate exact short-term and long-term learning plans and suggest the most appropriate learning approaches by using a Prompt. Finally, learners should also utilise adjustment strategies. Since effective learning cannot be achieved overnight, learners must strengthen their self-directed learning. On encountering unsuitable learning methods or poor outcomes during self-directed study, they must learn to promptly adjust their approach. In language learning, consciously applying MLS enhances learners' autonomy, empowering them to take control of their learning journey. This shift from passive knowledge absorption to active knowledge pursuit effectively reduces learning anxiety.

While academic performance is clearly impacted by excessive anxiety during foreign language learning, learners who proactively use MLS (systematically planning, monitoring, adjusting, and evaluating their learning tasks) can boost motivation and thereby lessen language learning anxiety. Additionally, these study results offer insightful information for developing talent development initiatives and foreign language education policies in higher education establishments. Moreover, individual differences among learners are a crucial factor that educators must never overlook. As mentioned in the previous review, some studies also indicated that FLLA can have a positive effect on students' academic performance and is positively correlated with metacognitive learning strategies. Undeniably, in certain circumstances, appropriate levels of learning anxiety can play a constructive role in learning. Therefore, while these research findings are worthy of consideration, they cannot be directly used as a basis for assessing the impact of anxiety on the general population.

6. Conclusion

Conclusively, the findings of this study affirm the crucial role of MLS in the foreign language learning process. Training in metacognitive learning strategies can reduce students' anxiety in foreign language learning, thereby enhancing their foreign LP. While the present study offers meaningful insights into the examined relationships among MLS, FLLA, and LP, several limitations should be acknowledged. To begin with, the relative sample size was drawn from a specific university in China, which may constrain the extent to which the findings can be generalised to other learner populations. Another consideration concerns the measurement approach, where the data were collected primarily through questionnaires, which may be

subject to response bias and may not fully capture the learners' actual behaviours. Also, cross-sectional data limits causal claims such as we found a negative correlation between LC and MLS, we cannot determine whether low confidence motivates strategy use or effective MLS build confidence, therefore, longitudinal studies suggest for future study. Moreover, the analytical model did not take into account certain potentially influential factors, such as learning motivation or other related variables that could have shaped learning outcomes. Future studies would benefit from employing mixed or experimental designs while integrating multiple data sources and incorporating a wider range of learners and variables to provide a more comprehensive understanding of the mechanisms underlying the present findings.

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Conflict of interest

The authors declare no conflict of interest.

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