

The relationship between neuroticism and L2 anxiety: A meta-analysis

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ABSTRACT

Over the past twenty-five years, extensive research has examined the relationship between neuroticism and language anxiety. Despite a consensus regarding the plausibility of a positive relationship between the two psychological constructs, contradictory or inconsistent empirical findings have emerged in the literature. To address this issue, a meta-analysis was conducted to determine the degree to which neuroticism and language anxiety are correlated and whether the relationship is positive. A comprehensive literature search yielded 22 valid primary studies published between 1996 and 2023, totaling 26 independent effect sizes for analysis ($N = 8054$). The results revealed a directly positive correlation between neuroticism and language anxiety ($r = 0.32$, 95% CI [0.26, 0.38]). Furthermore, the findings also suggested that neuroticism indirectly impact language achievement through the mediation of language anxiety (β -mediation = 0.12, $p < 0.01$). Finally, the relationship between neuroticism and language anxiety was found to vary significantly across different types of anxiety, measures of language anxiety and personality traits. In light of these empirical findings, the research implications are discussed in context.

1. Introduction

Language anxiety is a widely recognized emotional barrier to language learning. A series of meta-analyses have unanimously indicated that language anxiety is a detrimental factor for language achievement (Botes et al., 2020; Teimouri et al., 2019; Zhang, 2019). Given such significantly negative effects of language anxiety, it is vital to identify the causes or origins of language anxiety to prevent its impact on language learning. Within the context of various contributing factors, numerous studies have pointed to connections between personality traits - potent predictors of academic performance (Chamorro-Premuzic & Furnham, 2003; Chen et al., 2022; Liang & Kelsen, 2018) - and language anxiety (Dewaele, 2013; Dewaele & MacIntyre, 2019; Kelsen, 2019). Among these traits, neuroticism has received significant attention as it is associated with a greater likelihood of experiencing distress (McCrae & John, 1992), anxiousness (Vural, 2019), and negative emotionality (Clark & Watson, 2008). Additionally, individuals with high levels of neuroticism often exhibit diminished self-confidence and self-esteem (McCroskey et al., 2001). This predisposes language learners with high neuroticism to experience a range of unpleasant emotions, including anxiety, uneasiness, and despair. Given this broad spectrum of negative emotions, neuroticism may be seen as encompassing the concept of trait anxiety. Despite the evidence of high test-retest

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correlation between language anxiety and trait anxiety from a recent meta-analysis (Hsiao & Tseng, 2022), caution is warranted in interpreting the strong statistical correlation between language anxiety and trait anxiety. This is because research has indicated that language anxiety can fluctuate according to specific circumstances. This variability points to language anxiety being situation-specific rather than a stable trait (Horwitz, 2010). It is this very nature of language anxiety - its sensitivity to situational variables - that Horwitz (1986) and MacIntyre and Gardner (1989) have captured in their conceptualization. Thus, the relationship between language anxiety and neuroticism, while potentially linked, requires further exploration to understand its complexities and the implications for language learning experiences. Overall, considering the negative traits inherent in neuroticism, neuroticism was found to negatively correlate with academic performance and positively associate with language anxiety (Dewaele, 2013; Dewaele & Al-Saraj, 2015; Kelsen, 2019).

Research examining the relationship between neuroticism and language anxiety, however, has yielded mixed results. On the one hand, studies have varied in their findings regarding the strength of the correlation. Some studies have found strong correlations between the two constructs (Babakhouya & Elkhadiri, 2019; Dewaele & Al-Saraj, 2015), whereas others have documented weak correlations (Asmali, 2017; Dewaele, 2002). On the other hand, the significance of this relationship has also been debated. Certain investigations have identified a significant relationship between neuroticism and language anxiety (Babakhouya, 2019; Liu & Zhang, 2008), but others have failed to obtain significant results (Dewaele, 2002; Khouya, 2018; Köksal et al., 2014).

Given these inconsistent findings, this study seeks to address the gap in the literature through a meta-analysis aimed at synthesizing the relationship between language anxiety and the neuroticism trait. Critically, the current study also aims to investigate the potential mediating role of language anxiety that may connect the relationship between neuroticism and language achievement. The results of this study will benefit both researchers and practitioners, enhancing the understanding of individual differences and fostering the development of effective anxiety-coping strategies for individuals with high levels of neuroticism.

2. Literature review

2.1. Neuroticism and language anxiety

Early research on language anxiety has been embroiled in a prolonged debate regarding its classification as either a trait-like or state-like construct. Trait anxiety refers to a stable disposition towards anxiety experienced consistently across varied situations over time. On the other hand, state anxiety represents a transient emotional state that fluctuates according to distinct circumstances (Spielberger, 1972). Notably, a recent meta-analysis conducted by author (2022) revealed that prevalent language anxiety instruments are inclined more towards trait anxiety than state anxiety. Furthermore, the study emphasized the stability of language anxiety and drew parallels between it and broader personality dimensions.

Within the context of the Big Five personality dimensions, neuroticism is characterized by a susceptibility to experience a broad spectrum of negative emotional states, including anger, anxiety, depression, vulnerability, and self-consciousness (McCrae & John, 1992). Furthermore, recent research revealed a high correlation of up to 0.85 between trait anxiety and neuroticism (Eid et al., 2022). Considering the nature of neuroticism, trait anxiety might be enveloped within one or more facets of the broader construct of neuroticism. This raises the possibility that earlier studies aiming to measure trait anxiety may have inadvertently captured elements inherent to the neuroticism construct. Notably, the literature documented positive correlations between both trait anxiety (Chiang, 2006) and neuroticism (Dewaele & MacIntyre, 2019) with language anxiety, suggesting that individuals with higher levels of trait anxiety or neuroticism tend to experience elevated levels of language anxiety.

Over the past two decades, a significant amount of research has investigated the relationship between neuroticism and language anxiety. Although it is commonly believed that learners with high neuroticism report higher levels of anxiety in the language classroom, there seem to be conflicting or contradictory empirical findings. Some studies reported moderately high or high correlations (e.g. Babakhouya, 2019; Dewaele & MacIntyre, 2019), whereas others reported weak or moderate correlations (e.g. Dewaele, 2002; Kelsen, 2019; Liu & Zhang, 2008; MacIntyre & Charos, 1996), and still others revealed either statistically insignificant or close to null correlations (e.g. Khouya, 2018; Köksal et al., 2014). Therefore, it appears that the primary studies can be categorized into three distinct groups, each with differing research findings.

In the strong interface group of primary studies, Dewaele and MacIntyre (2019) examined the effects of personality traits on language anxiety in a multicultural setting. They used the Multicultural Personality Questionnaire (MPQ) to accommodate the diverse ethnic origins of participants. Their results showed that emotional stability had a moderate negative correlation with language anxiety ($r = -0.528, p < 0.01$). This finding is further supported by a fairly high regression coefficient ($\beta = -0.42$), indicating that language anxiety is predominantly predicted by the Emotional Stability trait. Since emotional stability is the opposite of neuroticism, their research findings indicated that neuroticism was positively associated with language anxiety to a notable degree. In another study, the focus shifted slightly while still aligning with the overarching theme of personality traits and language anxiety. Babakhouya and Elkhadiri (2019) specifically examined the relationship between neuroticism and English listening anxiety in a Moroccan sample of 328 EFL learners. Participants were required to complete the Revised NEO Personality Inventory and the Foreign Language Listening Anxiety Scale. The results demonstrated an even stronger empirical relationship between neuroticism and domain-specific language anxiety ($r = 0.67, p < 0.05$). In a more recent study, Botes et al. (2023) also reported a moderate correlation between neuroticism and foreign language classroom anxiety among 246 adult learners ($r = 0.595, p < 0.001$), reinforcing the pattern observed in previous research.

Conversely, the magnitude of association strength in the weak interface group was significantly lower than the observed strong interface group. For example, in their large-scale survey study of 934 Chinese college students, Liu and Zhang (2008) employed the Eysenck Personality Questionnaire (EPQ) and Horwitz's FLCAS to evaluate the empirical link between neuroticism and general

language anxiety. They found a weaker correlation ($r = 0.38$ for fear of negative evaluation; $r = 0.30$ for communication apprehension; $r = 0.24$ for test anxiety). Similarly, a nearly equivalent degree of link strength was found in a comparable ethnic population (Kelsen, 2019). Kelsen recruited 209 Taiwanese college students to examine the relationships between personality traits and speaking anxiety. In the study, the Big Five Personality Inventory was used to assess neuroticism, and the Personal Report of Public Speaking Anxiety (PRPSA) was used to measure speaking anxiety. Kelsen's investigation yielded a relatively similar result ($r = 0.36$, $p < 0.01$) to that of Liu and Zhang's findings.

However, a handful of primary studies also revealed an even weaker association (Dewaele, 2002; Khodamoradi and Rafiee, 2016; Khouya, 2018; MacIntyre & Charos, 1996). MacIntyre and Charos (1996) employed a rarely used personality inventory called the "Transparent Bipolar Inventory" (TBI) (Goldberg, 1992) and a modified version of Gardner and MacIntyre (1993) French classroom anxiety scale and the French language anxiety scale. The results of their study showed a low correlation between neuroticism and French learning anxiety ($r = 0.21$). A similar correlation coefficient ($r = 0.22$) was also found in a study with a sample of 100 Dutch high school students (Dewaele, 2002). Notably, it was also observed that low levels of connection strength were not always statistically significant. Specifically, Khouya (2018) examined the relationships between neuroticism and the four domain-specific types of language anxiety (i.e. fear of negative evaluation, test anxiety, English class anxiety, and communication apprehension). In the study, neuroticism was operationalized using the International Personality Item Pool Big-Five Inventory (IPIP). The results of Khouya's (2018) study showed that neuroticism was significantly correlated with fear of negative evaluation ($r = 0.28$, $p < 0.05$) and English classroom anxiety ($r = 0.27$, $p < 0.05$), but not with test anxiety ($r = 0.21$, $p > 0.05$) and communication apprehension ($r = 0.23$, $p > 0.05$).

Critically, Khouya's (2018) research indicates that the correlations between neuroticism and language anxiety may change depending on the operationalization of language anxiety. In other words, the research implications of Khouya's study may in fact indicate the possibility of the zero-interface regarding the relationship between neuroticism and language anxiety. In a recent study, Hussain et al. (2022) investigated the relationship between personality traits and English language learning anxiety in a study that recruited 400 Pakistani college students. Hussain et al. used the Big Five Inventory (BFI) and the FLCAS, and their results showed only a minuscule correlation ($r = 0.02$ for test anxiety, $p > 0.05$; $r = 0.04$ for fear of negative evaluation, $p > 0.05$; $r = 0.09$ for anxiety of English class, $p > 0.05$). Köksal et al. (2014) reinforced this possibility with their findings, demonstrating no association ($r < 0.001$) between neuroticism, as measured by the Personality Test Based on Adjectives (PTBA) (Bacanli et al., 2009), and language anxiety, as operationalized by the Foreign Language Learning Scale (Doğan, 2008).

2.2. Neuroticism and language achievement

Neuroticism is a construct commonly used to refer to "individual differences in the tendency to experience distress, and in the cognitive and behavioral styles that follow from this tendency" (McCrae & John, 1992, p. 195). Individuals with high levels of neuroticism often experience negative emotions such as dread, sadness, shame, wrath, guilt, and disgust (Costa & McCrae, 1992). Consequently, negative emotionality is often used interchangeably with neuroticism (Clark & Watson, 2008). In addition, neurotic individuals often demonstrate low self-esteem and lack of self-confidence and may experience shame or humiliation in various social settings (Biedron, 2011). Researchers have operationalized neuroticism as a continuum of emotional stability and instability. For example, Goldberg (1993) proposed that emotional stability indicates a low level of neuroticism, which is defined by Dewaele and MacIntyre (2019) as "the tendency to remain calm under stressful conditions" (p. 6). Conversely, emotional instability is characterized by spontaneous impulsivity and anxiety under pressure (Šafranč & Zivlak, 2019). In the context of language acquisition, neurotic language learners may display a range of negative emotions and emotional instability.

Neuroticism has been found to have a negative correlation with language acquisition (Cao & Meng, 2020; Chen et al., 2022; Erfani & Mardan, 2017; Piechurska-Kuciel, 2021). For instance, early studies demonstrated that 23% of the variability in oral examination scores could be attributed to the neuroticism trait (Robinson et al., 1994). Additionally, McCroskey et al. (2001) found that individuals with high levels of neuroticism have difficulty speaking eloquently in public due to their low levels of self-acceptance and nervousness. Similarly, their English-speaking proficiency was less likely to improve due to their reluctance to initiate communication with others (Erfani & Mardan, 2017). However, despite the apparent negative relationship between neuroticism and L2 achievement, a recent meta-analysis revealed that the correlation was not statistically significant, and its strength may be minimal (Chen et al., 2022). In their meta-analysis, Chen et al. analyzed thirty-one primary studies from the scientific literature spanning more than 40 years and found only a weak correlation between neuroticism and L2 performance ($r = -0.04$). It appears that neuroticism does not have a direct impact on linguistic achievement. Nevertheless, the meta-analysis overlooked the possibility of indirect effects that could be mediated by language anxiety. Critically, the plausibility of this research premise has been partly substantiated by the causal link between language anxiety and language achievement. Three recent large-scale meta-analyses (Botes et al., 2020; Teimouri et al., 2019; Zhang, 2019) consistently pointed to the existence of a significant relationship between language anxiety and language achievement, with the strength of the relationship varying from -0.34 to -0.39 . Therefore, the effect of neuroticism may remain in cases where language performance can be indirectly influenced by neuroticism through the mediation of language anxiety.

The array of studies reviewed above point to a significant but variable positive correlation between neuroticism and language anxiety. The variability observed in the strength and significance of their relationship underlines the imperative for a meta-analysis to gain a deeper understanding of how neuroticism and language anxiety correlate. Additionally, in light of the significant link between language anxiety and academic achievement, a meta-analytical exploration of this relationship could shed light on the extent to which language anxiety mediates the effect of neuroticism on language achievement. Notably, the variability in the neuroticism-language anxiety relationship can be attributed to factors such as sample size (e.g. Liu & Zhang, 2008), the use of different types of

personality questionnaires (e.g. Dewaele & MacIntyre, 2019; Köksal et al., 2014), and the specificity of the instrument used to measure language anxiety (e.g. Babakhouya & Elkhadiri, 2019; Liu & Zhang, 2008). Therefore, a meta-analytic approach is necessary to quantitatively synthesize the factors that may modulate the link between neuroticism and language anxiety. However, few empirical studies have been conducted that specifically address this research topic. To contribute to the theoretical foundations of this area of study, three research questions are posed to provide new insights into this field.

Research Question 1: How does neuroticism relate to language anxiety?

Research Question 2: Does language anxiety significantly mediate the effect of neuroticism on language achievement?

Research Question 3: To what extent may salient moderators account for the relationship between neuroticism and language anxiety?

3. Method

3.1. Literature search

In this study, several approaches were taken to identify relevant primary studies. First, relevant articles were searched and collected from a number of well-known online databases, including Linguistics and Language Behavior Abstracts (LLBA), Education Resources Information Center (ERIC), ProQuest Dissertations and Theses, SCOPUS, Web of Science, and Google Scholar. Various combinations of keywords were used for the searches, such as *big five personality*, *personality traits*, *neuroticism*, *emotional stability*, *anxiety*, *language anxiety*, *foreign language anxiety*, *speaking anxiety*, *listening anxiety*, *reading anxiety*, and *writing anxiety*. Second, the following renowned journals published in the field of language learning and teaching were manually and meticulously examined: *Learning and Individual Differences*, *Studies in Second Language Learning and Teaching*, *TESOL Quarterly*, *Studies in English Language Teaching*, *Studies in Second*

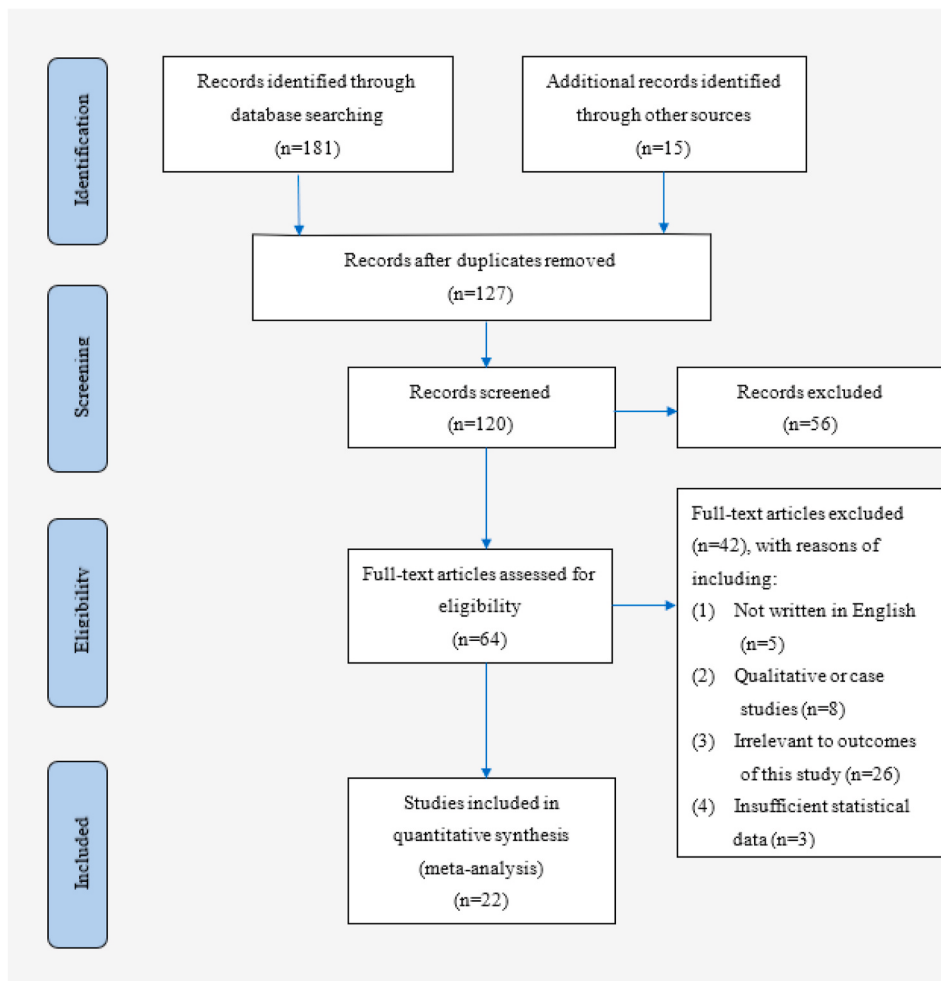


Fig. 1. Process diagram for data selection.

Language Acquisition, and Applied Linguistics. Finally, to ensure that potential articles were not ignored, references in relevant books (Sato & Loewen, 2019), previous publications (Dewaele & Al-Saraj, 2015; Kelsen, 2019), and review articles (Botes et al., 2020; Dewaele, 2017; Li, 2022; Piniel & Zólyomi, 2022; Teimouri et al., 2019; Zhang, 2019) were cross-checked.

3.2. Inclusion and Exclusion criteria

To identify the potential studies for this meta-analysis, the following inclusion criteria were applied:

1. Studies must include quantitative research and be written in English.
2. Studies that examined the relationship between neuroticism trait and language anxiety (there is no time limitation, therefore any appropriate studies published up to 2022 were considered).

Table 1

The summary of the primary studies in the current meta-analysis.

Study	Year	Participants	Total N	<i>r</i>	Instruments		Degree of Specificity
					Anxiety Scale	Personality Scale	
MacIntyre & Charos	1996	Mixed, Canada	92	0.210	LAS ^a	TBI	G
Dewaele – 1	2002	High school, Belgium	100	0.170	CAS ^b	EPQ	S
Dewaele – 2	2002	High school, Belgium	100	0.220	CAS ^b	EPQ	S
Liu & Zhang	2008	University, China	934	0.324	FLCAS ^c	EPQ	G
Dewaele - 1	2013	Mixed, mixed	86	0.293	FLCAS ^d	EPQ	G
Dewaele - 2	2013	Mixed, mixed	62	0.449	FLCAS ^d	EPQ	G
Abu-Rabia et al.	2014	High school, Israel	80	0.445	FLCAS ^d	NEO	G
Köksal et al.	2014	University, Turkey	399	0.000	FLLS ^e	PTBA	G
Dewaele & Al – Saraj	2015	Mixed, Arabic speaking countries	348	0.460	AFLAQ ^c	MPQ	G
Gargalianou et al.	2015	University, Poland	320	0.340	FLCAS ^c	HEXACO	G
Er et al.	2016	Mixed, China	105	0.214	FLA ^f	IPIP	G
Khodamoradi & Rafiee	2016	High school, Iran	143	0.260	TAS ^g	NEO	T
Asmali	2017	University, Turkey	180	0.390	TAS ^g	IPIP	T
Bahrudin & Amir	2018	University, Malaysia	104	0.240	ELSAS ^c	BFI	S
Khouya	2018	University, Morocco	345	0.248	FLCAS ^d	IPIP	G
Babakhouya & Elkhadiri	2019	University, Morocco	328	0.670	FLLAS ^h	NEO	L
Babakhouya – 1	2019	University, Morocco	270	0.280	FLSAS ^c	IPIP	G
Babakhouya – 2	2019	University, Korean	257	0.260	FLSAS ^c	IPIP	G
Dewaele & MacIntyre	2019	University, USA	750	0.528	FLCAS ^c	MPQ	G
Kelsen	2019	University, Taiwan	209	0.360	PRPSA ⁱ	BFI	S
Šafranjanj & Zivlak	2019	University, Serbia	296	0.330	FLCAS ^d	IPIP	G
Vural - 1	2019	University, Turkey	923	0.269	FLCAS ^d	BFI	G
Vural - 2	2019	University, Turkey	922	0.229	FLCAS ^d	BFI	G
Hussain et al.	2022	University, Pakistan	400	0.110	FLCAS ^d	BFI	G
Botes et al.	2023	Mixed, mixed	246	0.595	S-FLCAS ^c	IPIP	G
Pan & Zhang	2023	University, China	55	0.300	FLA ^c	EPQ	G

Note.

Language Anxiety Scale.

Personality Scale.

TBI = The transparent bipolar inventory (Goldberg, 1992).

EPQ = Eysenck Personality Questionnaire (Eysenck et al., 1985).

NEO = NEO Personality Inventory (Costa & McCrae, 1992).

PTBA = Personality Test Based on Adjectives (Bacanli et al., 2009).

MPQ = Multicultural Personality Questionnaire (van der Zee et al., 2013).

HEXACO = HEXACO Personality Inventory (Lee & Ashton, 2004).

IPIP = International Personality Item Pool (Goldberg, 1992; 1999, 2001).

BFI = Big Five Inventory (Benet-Martinez & John, 1998; John & Srivastava, 1999).

Degree of Specificity.

G = General classroom anxiety; L = Listening anxiety; S = Speaking anxiety; T = Test anxiety.

^a Language Anxiety Scale (Gardner & MacIntyre, 1993).

^b Communicative Anxiety Scale (Baker, 1992).

^c Foreign Language Classroom Anxiety Scale (Horwitz, 1986) – Modified version.

^d Foreign Language Classroom Anxiety Scale (Horwitz, 1986) – Original version.

^e Foreign Language Learning Scale (Doğan, 2008).

^f Foreign Language Anxiety Scale - Foreign Language Listening Anxiety Scale (Kim, 2000); Foreign Language Reading Anxiety Scale (Saito et al., 1999); Second Language Writing Anxiety Inventory (Cheng et al., 1999); Foreign Language Speaking Anxiety Scale (Huang, 2004).

^g Test Anxiety Scale (Sarason, 1975; 1984).

^h Foreign Language Listening Anxiety Scale (Kim, 2000).

ⁱ Personal Report of Public Speaking Anxiety (McCroskey, 1970).

3. Studies that provide relevant information to anxiety types (e.g. speaking anxiety, listening anxiety) and instrument uses (e.g. language anxiety scales, personality trait questionnaire).
4. The quantitative results of the study must provide essential statistical data for the meta-analysis including correlation or other statistical information that could be transformed into correlation such as *t*-value or *F*-value.

Studies were excluded if they conform to one of the following criteria:

1. Studies that adopted qualitative research methodology.
2. Studies that fail to provide correlation coefficients between neuroticism and language anxiety.
3. The information pertaining to anxiety types, assessments to measure language anxiety and personality trait were ambiguous or not being presented.
4. The reported statistical tests could not be transformed into correlation.

3.3. Coding procedure

Ultimately, 20 journal articles, 1 book chapter, and 1 conference paper were determined for the final stage of the coding scheme (see Fig. 1 for the flowchart of study extraction). A coding scheme was developed to systematically identify and classify the elements of each selected study. Specifically, the 22 primary studies in the sample were classified into seven broad categories: (a) publication year, (b) learner educational background, (c) sample size, (d) effect size, (e) anxiety scale, (f) personality scale, (g) degree of specificity.

Table 1 provides a descriptive summary of the coding information extracted from each primary study. To ensure the reliability of the coding scheme (see Appendix A), the primary studies were thoroughly reviewed by the researchers in several rounds. First, all studies were coded by the first and second researchers. The second round of coding was performed separately by the other two researchers who also specialized in second language acquisition. Finally, the coding results were strictly compared with the inter-coder reliability of 0.89.

3.4. Data analysis

This meta-analysis used the correlation coefficient (*r*) as the fundamental statistical unit of analysis to answer RQ1, which concerned the direction and size of the link between neuroticism and language anxiety. Individual effect sizes were determined for all 22 primary studies based on sample sizes, correlation coefficients, or other convertible statistical tests such as *t*-value or *F*-value. Of note, some primary studies reported multiple correlations between neuroticism and general classroom language anxiety or four different skill-specific anxiety types. To prevent potential bias, all effect sizes within a study corresponding to the same sample were averaged. Individual effect sizes from studies with numerous independent samples (Babakhouya, 2019; Dewaele, 2002, 2013; Vural, 2019) were classified as distinct and independent of one another. Statistical analyses were conducted using three R packages – “meta”, “metafor”, and “metasens” – within the R 4.2.1 statistical software environment (see Appendix B). The second research question (RQ2) focused on examining the mediating effect of anxiety. We used the average correlation coefficients among neuroticism, language anxiety, and language achievement from three meta-analytic studies to answer RQ2: (1) Teimouri et al. (2019), (2) Chen et al. (2022), and (3) the current meta-analysis. A matrix containing the three correlation coefficients was constructed and utilized to conduct a path modeling study in order to objectively evaluate the indirect effect of neuroticism on language ability. The path modeling analysis was carried out using Mplus 8.8 statistical software. In this meta-analysis, a Q-test was used to answer RQ3 regarding potential moderators that may influence the connection between neuroticism and language anxiety.

To ensure that our findings are reliable and not skewed by publication bias, we employed two approaches: a funnel plot with shrunken estimates from the limit meta-analysis and a Doi plot with the LFK index. The two approaches allow us to examine the symmetry of the distribution of effect sizes and identify any potential sources of bias. A symmetrical funnel plot and a Doi plot with an LFK index value within the range of -1 and $+1$ indicate that there is no publication bias (Khan, 2020). Conversely, an asymmetrical funnel plot or a Doi plot with an index value outside this range suggests that publication bias may be present. Additionally, we examined the gap between the original effect size and the shrunken estimate, which provides an indication of the probability of publication bias. A narrow gap between these values suggests that the probability of publication bias is low, while a wider gap may indicate a higher likelihood of bias. The limit meta-analysis approach, as proposed by Rücker et al. (2011), considers small-study bias to yield shrunken estimates of individual study effects. This method aims to correct for the potential overestimation of effect sizes in small studies, ultimately improving the accuracy of the overall effect size estimate. Unless publication bias is present, the original and adjusted effect sizes are equivalent. Applying the limit meta-analysis method to our data enabled us to obtain a more precise estimate of the overall effect size while also examining the potential for publication bias. These tools enable a thorough assessment of our results, safeguarding against potential biases and reinforcing the credibility of our findings.

4. Result

4.1. Publication bias

Based on the results of the limit meta-analysis in Fig. 2, the unadjusted overall effect size ($r = 0.32$) closely matched the adjusted estimate ($r = 0.36$) after the “shrinking” process. This finding suggests that while there may be a slight potential for publication bias in

our sample, it is likely to be minimal and insignificant. Additionally, the Doi plot in Fig. 3 displays only minor unevenness, and the LFK index of -0.90 aligns within the statistically established acceptable range. All things considered, while there is a possibility of publication bias in the current meta-analysis, the evidence suggests that it is low and insignificant.

Research Question 1: How does neuroticism relate to language anxiety?

The 22 primary studies included in this meta-analysis were conducted between 1996 and 2023. A total of 26 independent samples of different nationalities (e.g., China, Turkey, Korea, and Morocco) ($N = 8054$) were recruited. To answer RQ1, which addressed the overall association between neuroticism and language anxiety, a weighted mean of all effect sizes, a 95 percent confidence interval (CI), and a heterogeneity test were computed. As shown in Table 2, neuroticism positively related to language anxiety with $r = 0.32$, based on the result of the weighted mean of all effect sizes. In addition, the 95 percent confidence intervals were above zero (95% CI = $[0.26, 0.38]$), indicating a significant relationship between the two. The results further showed a significant amount of heterogeneity ($Q = 310.94, p < 0.001$) across the primary studies. Fig. 4 displays the distribution of individual effect sizes and weights for each primary study.

Research Question 2: Does language anxiety significantly mediate the effect of neuroticism on language achievement?

In principle, we conducted this investigation in a meta-analytic framework. To this end, we used the average correlation coefficients from three meta-analytic studies (1) Teimouri et al. (2019) for the correlation coefficient between language anxiety and language performance, (2) Chen et al. (2022) for the correlation coefficient between neuroticism and language performance, and (3) the current meta-analysis for the correlation coefficient between neuroticism and language anxiety. The reason for choosing the meta-analysis by Teimouri et al. was that it included the largest number of primary studies compared to other similar meta-analyses (Botes et al., 2020; Zhang, 2019). Fig. 5 depicts the configured correlation model with the three focal variables.

As indicated in Fig. 5, the correlation between neuroticism and language achievement was near-zero and statistically insignificant (Chen et al., 2022, $r = -0.04$), in contrast to the moderate and significant correlations found between neuroticism and language anxiety (the current meta-analysis, $r = 0.32$), and between language anxiety and language achievement (Teimouri et al., 2019, $r = -0.36$). This suggests a potential indirect effect of neuroticism on language achievement via mediation of language anxiety. This is in line with the mediation analysis principle that a mediator can transmit the influence of an independent variable to a dependent variable, even if the direct correlation between the independent and dependent variables is weak or non-significant. Hence, we further examined whether neuroticism would indirectly affect language performance via the mediation of language anxiety.

Based on the correlation matrix translated directly from the configured model, the path model could then be further formulated and analyzed. The outcome of the path model was shown in Fig. 6. The results showed that the direct effect of neuroticism on language performance did not reach statistical significance ($\beta = -0.05, p > 0.05$), whereas both the direct effects of neuroticism on language anxiety ($\beta = 0.32, p < 0.01$) and language anxiety on language performance ($\beta = -0.39, p < 0.01$) were statistically significant. The values 0.89 and 0.86 in the model indicate unexplained variances in language anxiety and language achievement, respectively, suggesting other factors at play beyond the scope of the path model. Of note, the indirect effect of neuroticism on language performance via mediation of language anxiety was also statistically significant (β -mediation = $0.32 \times -0.39 = -0.12, p < 0.01$), and the effect size of the indirect effect was in the range between small and moderate. By comparison, importantly, the indirect effect (-0.12) that neuroticism could negatively affect language performance was larger than its direct effect (-0.05).

Research Question 3: To what extent may salient moderators account for the relationship between neuroticism and language anxiety?

4.1.1. Anxiety types

As indicated in Table 3, this moderator analysis revealed a significant variation ($Q = 87.802, df = 3, p < 0.001$). Neuroticism was

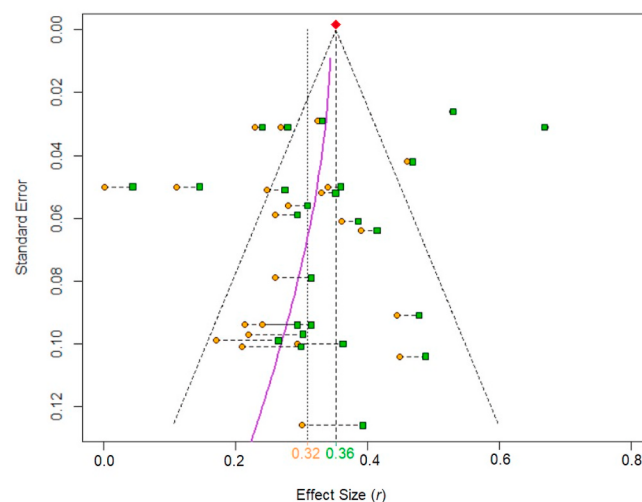


Fig. 2. The funnel plot evaluating publication bias.

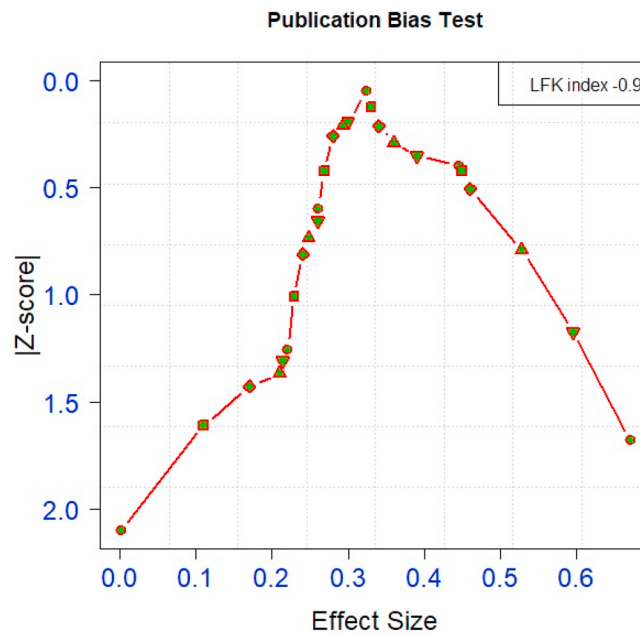


Fig. 3. The Doi plot evaluating publication bias.

Table 2

The overall average correlation between neuroticism and language anxiety.

Model	Effect size			95% CI		Heterogeneity		
	<i>k</i>	<i>N</i>	<i>r</i>	Lower	Upper	<i>Q</i> - value	<i>df</i>	<i>p</i> -value
Random-effects	26	8054	0.32	0.26	0.38	310.94	25	<0.001

Note: *k* = the number of pooled effect sizes; *N* = the total number of participants; CI = confidence interval; ****p* < 0.001.

found to correlate most strongly with fear of listening anxiety ($r = 0.670$, [0.606,0.726], $k = 1$, $p < 0.001$); conversely, speaking anxiety had the lowest correlation ($r = 0.257$, [0.223,0.291], $k = 8$, $p < 0.001$). However, given the scarcity of primary studies on listening anxiety, these findings should be interpreted with caution. Furthermore, test anxiety was modestly associated with neuroticism, with confidence intervals excluding zero, indicating a significant effect ($r = 0.331$, [0.199,0.451], $k = 2$, $p < 0.001$). Similarly, there was a medium effect between neuroticism and general classroom anxiety ($r = 0.331$, [0.235,0.421], $k = 15$, $p < 0.001$). In short, these results suggest that neurotic learners may experience varying levels of anxiety in different language learning environments.

4.1.2. Language anxiety measure

A total of 11 different tools were employed to measure language anxiety in the various settings in the primary research. The results showed that there was a significant difference between these anxiety scales ($Q = 136.419$, $df = 10$, $p < 0.001$). A closer look at the individual measures revealed a moderately significant effect size for the FLCAS, which is the most favorable anxiety scale in this domain ($r = 0.346$, [0.265, 0.422], $k = 13$, $p < 0.001$). In addition, the effect of the FLCAS-based questionnaires (AFLAQ, ELSAS, FLSAS) appeared to be different. More specifically, the Arabic AFLAQ ($r = 0.460$, [0.373, 0.539], $k = 1$, $p < 0.001$) showed greater effects than the FLSAS ($r = 0.270$, [0.189, 0.348], $k = 2$, $p < 0.001$) and ELSAS ($r = 0.240$, [0.050, 0.413], $k = 1$, $p < 0.05$). In addition to the FLCAS, several newly developed measures of language anxiety have emerged in the field. The effect of these assessments ranged from near zero to moderately high. A larger effect was found for studies using the FLLAS developed by Kim (2000) ($r = 0.670$, [0.606, 0.726], $k = 1$, $p < 0.001$), a moderate effect for studies using TAS developed by Sarason (1975, 1984) ($r = 0.331$, [0.199, 0.451], $k = 2$, $p < 0.001$) and PRPSA developed by McCroskey (1970) ($r = 0.360$, [0.236, 0.473], $k = 1$, $p < 0.001$), a small effect size for studies in which FLA developed by integrating multiple scales (see in Er et al., 2016) ($r = 0.214$, [0.023, 0.390], $k = 1$, $p < 0.05$), LAS developed by Gardner and MacIntyre (1993) ($r = 0.210$, [0.005, 0.398], $k = 1$, $p < 0.05$), and CAS developed by Baker (1992) ($r = 0.195$, [0.057, 0.326], $k = 2$, $p < 0.01$). Finally, the study with FLLS introduced by Doğan (2008) showed a negligible effect ($r = 0.001$, [-0.097, 0.099], $k = 1$, $p > 0.05$).

4.1.3. Personality scale

Collectively, the results of meta-analysis showed that neuroticism had been operationalized by up to 8 different personality

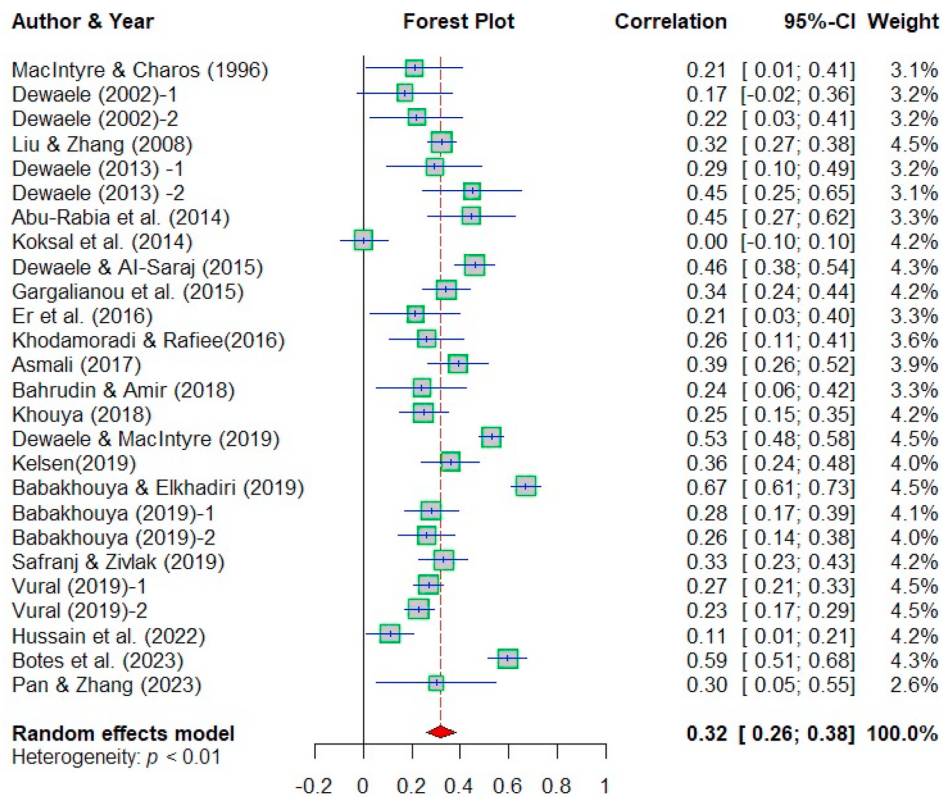


Fig. 4. Forest plot of the distribution of effect sizes underlying the primary studies.

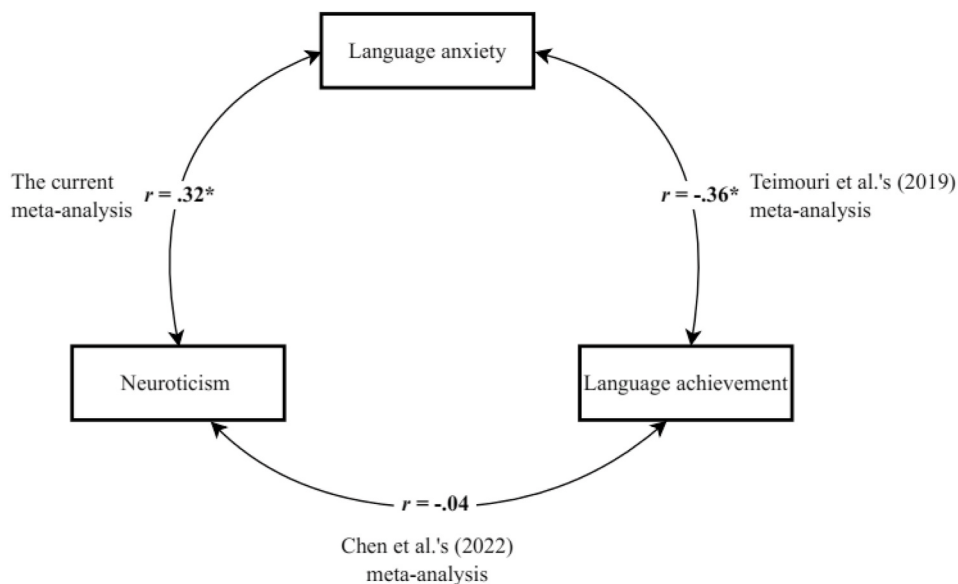


Fig. 5. The intercorrelation among neuroticism, language anxiety, and language achievement. Note: An asterisk (*) denotes statistical significance.

questionnaires. The findings revealed that those studies employing the MPQ and NEO produced a moderately high effect (the MPQ: $r = 0.501$, [0.434, 0.563], $k = 2$, $p < 0.001$; the NEO: $r = 0.480$, [0.157, 0.710], $k = 3$, $p < 0.01$). Following this, a medium effect was found among research applying the HEXACO ($r = 0.340$, [0.239, 0.433], $k = 1$, $p < 0.001$), IPIP ($r = 0.340$; [0.231, 0.441]; $k = 7$; $p < 0.001$), and EPQ ($r = 0.309$, [0.259, 0.357], $k = 6$, $p < 0.001$), respectively. Next, a small effect was observed for the BFI ($r = 0.238$; [0.167,

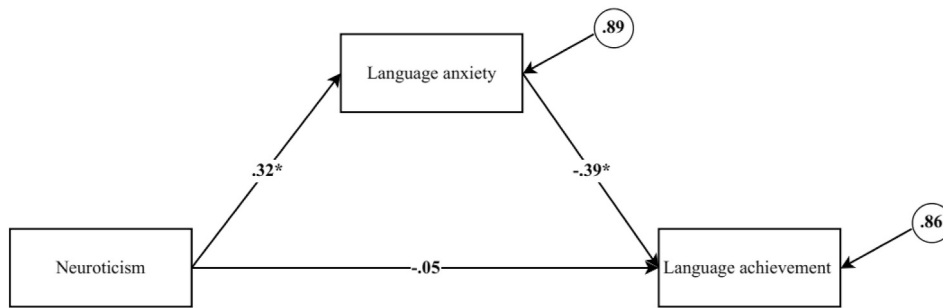


Fig. 6. The meta-analytic path model. Note: An asterisk (*) denotes statistical significance.

Table 3

Results of Moderator Analyses in this meta-analysis.

Category	Effect size			95% CI		Heterogeneity		
	<i>k</i>	<i>r</i>	<i>p</i>	Lower	Upper	<i>Q</i>	<i>df</i>	<i>p</i>
Anxiety type						87.802	3	0.000
1. Listening anxiety	1	0.670	0.000	0.606	0.726			
2. Speaking anxiety	8	0.257	0.000	0.223	0.291			
3. Test anxiety	2	0.331	0.000	0.199	0.451			
4. General classroom anxiety	15	0.331	0.000	0.235	0.421			
Language anxiety measure						136.419	10	0.000
1. FLCAS	13	0.346	0.000	0.265	0.422			
2. AFLAQ	1	0.460	0.000	0.373	0.539			
3. FLSAS	2	0.270	0.000	0.189	0.348			
4. ELSAS	1	0.240	0.014	0.050	0.413			
5. FLLAS	1	0.670	0.000	0.606	0.726			
6. TAS	2	0.331	0.000	0.199	0.451			
7. PRPSA	1	0.360	0.000	0.236	0.473			
8. FLA	1	0.214	0.028	0.023	0.390			
9. LAS	1	0.210	0.044	0.005	0.398			
10. CAS	2	0.195	0.006	0.057	0.326			
11. FLLS	1	0.001	0.984	-0.097	0.099			
Personality scale						74.130	7	0.000
1. MPQ	2	0.501	0.000	0.434	0.563			
2. NEO	3	0.480	0.005	0.157	0.710			
3. HEXACO	1	0.340	0.000	0.239	0.433			
4. IPIP	7	0.340	0.000	0.231	0.441			
5. EPQ	6	0.309	0.000	0.259	0.357			
6. BFI	5	0.238	0.000	0.167	0.306			
7. TBI	1	0.210	0.044	0.005	0.398			
8. PTBA	1	0.001	0.984	-0.097	0.099			

Note. EPQ = Eysenck Personality Questionnaire; NEO = NEO Personality Inventory; PTBA = Personality Test Based on Adjectives; MPQ = Multicultural Personality Questionnaire; HEXACO = HEXACO Personality Inventory; IPIP = International Personality Item Pool; BFI = Big Five Inventory; TBI = The transparent bipolar inventory.

LAS = Language anxiety scale; CAS = Communicative anxiety scale; FLCAS = Foreign language classroom anxiety scale; TAS = Test anxiety scale; FLLA: Foreign language learning anxiety; AFLAQ = Arabic Foreign Language Anxiety Questionnaire; FLA = Foreign language anxiety; ELSAS = English Language Speaking Anxiety Scale; FLSAS = Foreign language speaking anxiety scale; PRPSA = Personal Report of Public Speaking Anxiety.

0.306]; $k = 5$; $p < 0.001$) and TBI ($r = 0.210$; [0.005, 0.398]; $k = 1$; $p < 0.05$). Finally, the study using the PTBA assessment showed a close-zero and nonsignificant effect, evidenced by its CIs including zero ($r = 0.001$, [-0.097, 0.099], $k = 1$; $p = 0.984$). In sum, the results indicated a clear divergence in the correlations between neuroticism and language anxiety across different neuroticism scales ($Q = 74.130$, $df = 7$, $p < 0.001$).

5. Discussion

In the current study, a meta-analysis with 22 qualified primary studies was conducted to examine the connection between neuroticism and language anxiety. Based on the empirical results, Fig. 7 was constructed to present a conceptual model that shows the intricate relationships among neuroticism, language anxiety, and language achievement, along with the significant moderating factors influencing these relations.

At the foundation of the model is neuroticism, which was found to have a direct link with language anxiety ($r = 0.32$), suggesting that neuroticism may account for approximately 10.2% ($=0.32^2$) of the variance in language anxiety. These findings were consistent

with previous primary studies (Gargalianou et al., 2015; Kelsen, 2019; Liu & Zhang, 2008; Šafranĳ & Zivlak, 2019), which also reported effect sizes around 0.33. The meta-analysis results suggest that the relationship between neuroticism and language anxiety is neither as promising as in primary studies with large effect sizes of more than 0.50 (Babakhouya & Elkhadiri, 2019; Botes et al., 2023; Dewaele & MacIntyre, 2019) nor as pessimistic as claimed by primary studies with insignificant or zero effect sizes (Khouya, 2018; Köksal et al., 2014). Importantly, achieving a moderate association may be robust, as primary studies with similar effect sizes to the present meta-analysis recruited large samples (209–934) and used the same or similar instrument for measuring language anxiety (FLCAS and PRPSA). Therefore, the results of the meta-analysis merit credibility and reliability.

The neuroticism – language anxiety relation was further extended to underscore the mediation role of language anxiety, an indication of its potential to bridge the impact of neuroticism on language achievement. Babakhouya (2019) notes that individuals with high levels of neuroticism tend to make impulsive decisions, struggle to remain grounded, and have intense emotional responses, which may lead to high anxiety in language classes where oral discourse in a second language requires interaction with peers or instructors. To counteract the negative indirect effects of neuroticism on language proficiency via language anxiety, effective coping skills should be taught to those who experience high levels of language anxiety as early as possible. This can substantially reduce or erase the negative effects of neuroticism on language achievement from a didactic perspective. The weak-interface hypothesis is the most empirically plausible thesis for describing the relationship between neuroticism and language anxiety. The empirical connection between neuroticism and language anxiety should not be viewed as trivial and negligible, but as manifestly causal and consequential.

To gain a deeper understanding of the underlying relationships among the examined variables, the model also highlights the moderating roles of the three factors that significantly influence the relationship between neuroticism and language anxiety. However, the proposed modeling framework further illustrates that the ways in which the three identified moderators may influence the mediating effect of neuroticism on *language achievement* via the mediation of language anxiety, still remain largely unexplored in this study and warrant further research. The detailed discussion of these findings is presented below.

Firstly, the modulating effects of different types of language anxiety were found to show varying degrees of significant correlations with competence-specific anxieties. The association between listening anxiety and neuroticism was found to be the greatest ($r = 0.670$, $p < 0.001$), which is understandable as language learners commonly struggle with listening comprehension tasks that require them to take in a large amount of information in a short time with limited repetition of auditory input (Goh, 2000). The connection between neuroticism and foreign language exam anxiety was lower than that of listening anxiety ($r = 0.331$, $p < 0.001$). During an exam where the stakes are high, neuroticism-prone test-takers are typically susceptible to experiencing significant levels of anxiety due to time constraints and teacher monitoring. In contrast, there was only a minor association between speaking anxiety and neuroticism ($r = 0.239$, $p < 0.001$), which is unexpected as initiating a verbal exchange with others is commonly regarded as the most accurate indicator of language anxiety (Phillips, 1992; Young, 1986). The results suggest that neuroticism may have less of an effect on the production form of language anxiety (i.e. speaking anxiety) than on the receptive form (i.e. listening anxiety and test anxiety). However, to calculate the effect size of the link between neuroticism and listening anxiety, only one main study was available, and more primary investigations are urgently needed in this line of inquiry to produce a more robust, solid statistical outcome.

Secondly, the second moderating variable examined was the language anxiety instruments used in the primary studies. The FLCAS was found to be the most commonly utilized questionnaire ($k = 13$). Although the components and validity of the FLCAS have been questioned (Tran, 2012), researchers have not refrained from using the instrument when conducting research in this field. Additionally, numerous language anxiety measures have been developed by extracting or adapting FLCAS items to target specific participants (e.g. AFLAQ by Dewaele & MacIntyre, 2019) and language learning settings (e.g. ELSAS by Bahrudin & Amir, FLLAS by Babakhouya, 2019). Specifically, the modified FLCAS (Botes et al., 2023; Dewaele & Al-Saraj, 2015; Dewaele & MacIntyre, 2019)

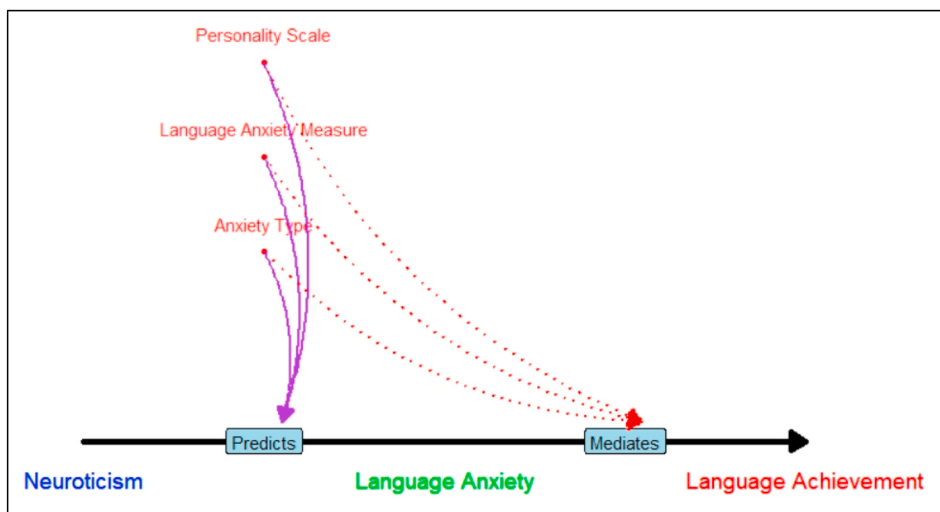


Fig. 7. The Moderated-mediation model of neuroticism-Induced language anxiety on language achievement.

demonstrated greater effect sizes than the original FLCAS (Vural, 2019; Šafranĳ & Zivlak, 2019). This may be due to the fact that the original FLCAS places a greater emphasis on measuring speaking anxiety (known as communication apprehension in FLCAS) than on addressing anxiety related to the other three language skills (Aida, 1994; Mak, 2011; Park, 2014). Table 3 shows that the effect size of the FLCAS ($r = 0.320$) and the effect size of speaking anxiety ($r = 0.257$) are roughly equivalent, rounding to 0.30, lending credence to this likelihood.

Researchers also utilized several newly developed language anxiety questionnaires (e.g. FLLS, PRPSA), which yielded different effect sizes. These disparities can be explained by the specific aims of each questionnaire in measuring anxiety related to particular linguistic skills. Although the majority of studies rely on prior research to measure general language anxiety, they often fail to provide clear justifications for their methods and the construct validity of these measurements remains unexamined. Therefore, justifications for the appropriateness of these measures are often weak (Bahrudin & Amir, 2018; Vural, 2019). Additionally, there are few replication studies employing comparable questionnaires, rendering it difficult to compare quantitative results. Hence, a context-specific anxiety inventory with a high degree of reliability remains elusive. In conclusion, depending on the context of the study, researchers should give greater consideration to selecting a suitable language anxiety questionnaire to achieve relevant and significant results.

Finally, the moderator analysis of the personality assessment suggests that different personality questionnaires may lead to different levels of relationship between neuroticism and language anxiety, ranging from near zero to moderately high correlations. Table 3 summarizes the use of eight different types of scales in the literature. A large effect size was observed for both the MPQ ($r = 0.501$) and NEO ($r = 0.480$). The considerable effect size of the MPQ could be attributed to its specific design to assess personality in a multicultural setting, and its validity being met by a wide range of samples with multicultural backgrounds operationalized in the studies by Dewaele (2015) and Dewaele and MacIntyre (2019). The large effect size of the MPQ in the moderator analysis can therefore be explained by its correspondence with external validity.

Regarding the NEO scale, the extensive usage of trait adjectives to map the trait aspects of neuroticism contained in NEO can be a possible reason. The NEO scale operationalizes six distinct dimensions, namely Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability. Notably, the NEO questionnaire conceptualizes anxiety as a substrate of neuroticism, which logically suggests some overlap between the theoretical constructs of neuroticism and language anxiety. However, from an operational standpoint, the high correlation observed between neuroticism as measured by the NEO Personality Inventory and language anxiety, as indicated by the moderator analysis, may suggest multicollinearity in the theoretical foundations of these two mental dimensions.

The analysis conducted by the moderator on the personality questionnaires unveiled some smaller effect sizes, specifically within the range of 0.20–0.40. These reduced effect sizes were observed in primary studies that employed the use of the EPQ, IPIP, HEXACO, BFI and TBI scales. The observation of the subgroup with lower effect sizes may be due to the fact that most of the primary studies in this subgroup focused on the relationship between neuroticism and general language anxiety, rather than domain-specific language anxiety (e.g. Dewaele, 2013; Er et al., 2016; Gargalianou et al., 2015; Khouya, 2018; Liu & Zhang, 2018; MacIntyre & Charos, 1996; Pan & Zhang, 2023). A possible explanation for the lower effect sizes is that all these personality questionnaires, except for HEXACO, did not include anxiety as a separate construct from neuroticism, as was the case in the NEO questionnaire. In particular, the items measuring neuroticism in the four different inventories consistently use short statements to express negative emotions such as worry and depression. Although the HEXACO questionnaire includes anxiety under the Emotionality factor, it is labeled as “worry tendency” whereas the wording “anxious” is heavily weighted across the four different aspects of neuroticism in the NEO inventory (i.e. Anxiety, Angry Hostility, Depression, and Self-Consciousness). This suggests that there is only one anxiety component in HEXACO, but the NEO inventory has up to four constructs that target the anxiety component indirectly or directly under the heading of neuroticism. Furthermore, the HEXACO Emotionality factor is theoretically linked to kin altruism, which manifests itself in a number of characteristics, including empathy, harm aversion, help-seeking, and prosocial behavior (Ashton et al., 2014; Ashton & Lee, 2007). Therefore, it is reasonable to speculate that the difference in effect magnitude between the NEO neuroticism and the HEXACO Emotionality measures is due to the fact that anxiety may be more expressed under the NEO neuroticism than the HEXACO Emotionality. Overall, the pattern of decreased effect sizes observed in the moderator analysis may be explained by the emphasis on general language anxiety and the consistency in the design of the item statements.

Another subset of the effect size in the moderator analysis pertaining to personality questionnaires concerns a primary study that found zero correlation between neuroticism and language anxiety (Köksal et al., 2014). Although only one primary study reported this extreme result, the reason for it might be the use of adjective pairs (e.g. “relaxed-tense” in TBI) or single-word adjectives (e.g. “optimistic” in PTBA) rather than statement-based descriptions (e.g. “I am someone who worries a lot” in BFI). Two personality questionnaires (TBI and PTBA) used word-based adjectives, and the effect sizes derived from them were either very small or zero (Köksal et al., 2014; MacIntyre & Charos, 1996). Compared to statement-based descriptions, the use of adjective pairs provides little contextual information and adds more abstraction to the trait space being measured (Goldberg, 1999). The downside of using word-based adjectives is also reflected in the low reliability observed in the studies by MacIntyre and Charos (1996) ($\alpha = 0.56$) and Köksal et al. (2014) ($\alpha = 0.73$), respectively. Therefore, the present meta-analysis suggests that statement-based personality questionnaires may reveal a stronger relationship between personality traits and language anxiety.

Overall, although the effect of personality assessments on neuroticism and language anxiety was found to be significant, several concerns need to be addressed. First, it is evident that a variety of personality questionnaires were adapted in primary studies. However, few studies have provided a convincing explanation for the choice of using particular scales. Second, although most studies reported Cronbach's α as an indication of internal consistency, construct validity, which can be checked by factor analysis, was rarely established with the adopted personality questionnaires, except in two primary studies (Dewaele, 2015; Köksal et al., 2014). Therefore, for future research to yield more definitive and reliable insights into the relationship between neuroticism and language anxiety, it is

imperative to standardize the choice and validation of personality questionnaires, ensuring both construct validity and consistency in measurement approaches.

Although the three modulating factors (i.e., anxiety type, language anxiety measure, and personality scale) were found to influence the relationship between neuroticism and language anxiety, their specific roles in affecting the relationship between neuroticism and language achievement mediated through language anxiety, have not yet been established in this study. Addressing this research gap arguably hallmark an opportunity for future research to more fully understand the causal dynamics between neuroticism and language achievement.

6. Conclusion

The present study contributes to the current body of literature by providing valuable insights into the relationship between neuroticism and language anxiety through a meta-analysis. The study yields three significant findings. Firstly, it indicates that neuroticism may have a detrimental impact on language achievement, mediated by language anxiety. Secondly, a moderate and significant effect size is found to exist between neuroticism and language anxiety. Finally, the results demonstrate that the weighted average effect size changes in response to various moderating variables. Future meta-analytic research should include additional recent studies to ensure reliable results and enable meaningful comparisons with the present study. Conceivably, drawing reasonable conclusions from a single study likely raise concerns over the representativeness of the case. Such a limited number of primary studies highlights the need for caution in generalizing the findings. Because it is crucial to address this challenge, future research should be oriented to replicating relevant studies. Researchers are strongly encouraged to report descriptive statistics, clearly define participant characteristics, and thoroughly assess the validity of measurement constructs so that the information can become transparent for future meta-analytical research. Critically, these replications are fundamental for not only reinforcing the reliability and generalizability of findings, but also facilitating the understanding of whether existing or more meaningful moderators may drive differential effects.

Pedagogically, the findings of this meta-analysis can provide useful evidence-based guidance for both teachers and students. Firstly, language instructors should consider the unique personality traits and characteristics of their pupils while building curricula and implementing classroom activities. A supportive classroom environment that offers attainable activities, and the encouragement of both teachers and peers, can help students develop self-confidence and self-esteem, ultimately reducing their anxiety levels. Secondly, this meta-analysis has found a significant correlation between neuroticism and both general classroom anxiety and skill-based anxieties (e.g. listening, speaking, and test anxiety). With awareness of the students' personalities, teachers can offer additional support to those who have high anxiety levels about language learning by providing appropriate coping strategies in specific language learning settings. Subsequently, the effects of neuroticism can be offset in a timely manner, and language accomplishment would likely improve. In conclusion, these findings and discussions can contribute to a better understanding of the relationship between neuroticism and foreign language anxiety, thereby enriching existing theories on the topic. Furthermore, the current meta-analysis can help researchers identify understudied areas of research in the light of the findings of moderator analyses.

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Research involving human participants

In this meta-analysis, we gathered data from an array of previously published studies. Before initiating the analysis, we made sure to de-identify all data, upholding the privacy of individuals. Our research approach focused on minimizing potential risks to human participants.

Informed consent

Since our study did not involve direct human participation, the requirement for informed consent was not applicable. We diligently adhered to relevant ethical guidelines and can confirm that all necessary approvals were secured, allowing our study to contribute to the growing body of knowledge.

Data Availability

The datasets analyzed in the current meta-analysis are available from the corresponding author upon reasonable request.

CRedit authorship contribution statement

Thi Hue Dong: Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Sufen Chen:** Resources, Project administration, Investigation. **Wen-Ta Tseng:** Writing – review & editing, Visualization, Supervision, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors have no conflict of interest.

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Appendix A

Coding tables for primary studies

Variable	Subgroups	Codes			
Publication	1. Author's name				
	2. Year of publish				
	3. Type of publication	(a) Journals	(b) Theses	(c) Conference papers	
Research Setting	1. Sample size				
	2. Country				
	3. Methodology	(a) Quantitative	(b) Mixed		
Learner Characteristics	1. Age	(a) Children	(b) Teenager	(c) Adults	(d) Mixed
	2. Language proficiency level	(a) Beginner	(b) Intermediate	(c) Advanced	(d) Mixed
	3. Education level	(a) High school	(b) University	(c) Mixed	(d) Mixed
	4. Native language				
	5. Target language				
Instrument	1. Type	(a) Likert-Scale	(b) Open-ended questions	(c) Mixed	
	2. Language base	(a) General	(b) Specified- language skills		
Foreign language anxiety test	3. Mean				
	4. Standard deviation				
	5. Reliability	(a) Direct reported	(b) Cited from previous studies	(c) Not reported	
Big-Five personality traits test	6. EFA/CFA	(a) Direct reported	(b) Cited from previous studies	(c) Not reported	
	1. Effect size	(a) Reported <i>r</i>	(a) Reported <i>t</i> -value or <i>F</i> -value		
Results					

Appendix B

The R codes used to conduct the meta-analysis in this study:

```

# Combine authors, r values, and r_se values into a data frame for Neuroticism
authors <- c("MacIntyre & Charos (1996)", "Dewaele (2002)-1", "Dewaele (2002)-2",
            "Liu & Zhang (2008)", "Dewaele (2013) -1", "Dewaele (2013) -2",
            "Abu-Rabia et al. (2014)", "Koksal et al. (2014)",
            "Dewaele & Al-Saraj (2015)", "Gargalianou et al. (2015)",
            "Er et al. (2016)", "Khodamoradi & Rafiee(2016)",
            "Asmali (2017)", "Bahrudin & Amir (2018)", "Khouya (2018)",
            "Dewaele & MacIntyre (2019)", "Kelsen(2019)",
            "Babakhouya & Elkhadiri (2019)", "Babakhouya (2019)-1",
            "Babakhouya (2019)-2", "Safranji & Zivlak (2019)",
            "Vural (2019)-1", "Vural (2019)-2", "Hussain et al. (2022)",
            "Botes et al. (2023)", "Pan & Zhang (2023)")

r_values <- c(0.21, 0.17, 0.22, 0.324, 0.293, 0.449, 0.445, 0.001, 0.46, 0.34,
            0.214, 0.26, 0.39, 0.24, 0.248, 0.528, 0.36, 0.67, 0.28, 0.26,
            0.33, 0.269, 0.229, 0.11, 0.595, 0.3)

r_se_values <- c(0.101, 0.099, 0.097, 0.029, 0.1, 0.104, 0.091, 0.05, 0.042, 0.05,
            0.094, 0.079, 0.064, 0.094, 0.051, 0.026, 0.061, 0.031, 0.056,
            0.059, 0.052, 0.031, 0.031, 0.05, 0.041, 0.126)

Neuroticism <- data.frame(Author = authors, r = r_values, r_se = r_se_values)

# Perform meta-analysis using metagen function
Neuroticism_metagen <- metagen(r, r_se, data=Neuroticism, studlab=paste(Author),
                             comb.fixed = FALSE, comb.random = TRUE, hakn = FALSE, sm="COR")

# Generate a forest plot
forest(Neuroticism_metagen)

# Generate a DOI plot
doiplot(Neuroticism_metagen)

# Perform limit meta-analysis and summarize
lmeta <- limitmeta(Neuroticism_metagen)
summary(lmeta)

# Create a funnel plot with limits
funnel.limitmeta(lmeta, xlim = c(0.0, 0.8))

```

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References marked with an asterisk (*) indicate studies that were included in the meta-analysis.

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