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ORIGINAL RESEARCH

Association Between Anxiety Disorders and English Academic Writing Performance Among College Students: The Chain Mediating Role of Learning Motivation and Metacognitive Strategies

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Background: Anxiety disorders have been a challenging problem across all age groups, especially for college students, and they can have detrimental effects on students' academic performance, especially for English learning. However, the underlying mechanisms about the association between anxiety disorders and English writing performance remain undetermined. Based on theoretical and empirical researches, this study develops a chain mediating model to test whether learning motivation and metacognitive strategies mediate the relationship between anxiety disorders and English academic writing performance among college students.

Methods: A cross-sectional study with a sample consisting of 2804 college students was carried out. They all completed a self-report questionnaire with demographic information, anxiety disorders, learning motivation, metacognitive strategies and English academic writing performance. SPSS26 and Mplus8.3 were used to analyze the data.

Results: Anxiety disorders were found to negatively predict English academic writing performance, as well as learning motivation and metacognitive strategies. Both learning motivation and metacognitive strategies mediated the relationship between anxiety disorders and English academic writing performance, separately. Moreover, learning motivation and metacognitive strategies together had a chain mediating effect on this relationship.

Conclusion: Anxiety disorders take a toll on learning motivation and metacognitive strategies, which can eventually lead to poorer English academic writing performance. These findings contribute to the understanding of the potential pathway of how anxiety disorders influence English academic writing performance and provide practical implications for the prevention and intervention of mental health among college students.

Keywords: anxiety disorders, learning motivation, metacognitive strategies, English academic writing performance

Introduction

Anxiety disorders, characterized by disproportionate worrying or avoidance of anxiety-provoking situations leading to functional impairment,[1] are the most prevalent psychiatric illnesses across all age groups, including children, adolescents, and adults.[2–4] These disorders are associated with various negative consequences, such as elevated risk for suicidal thoughts and behaviors,[5] lower educational attainment,[6] higher unemployment rates,[6] and overall diminished quality of life.[7] Among these populations, college students are particularly vulnerable due to the unique academic, social, and developmental challenges they face.[4,8] For instance, a multinational study revealed that 17.2% of college students reported experiencing suicidal ideation within the past year, highlighting the severe implications of anxiety-related distress in this group. Despite extensive research on the health risks associated with anxiety, there has been limited focus on its negative social and functional

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consequences for college students, such as difficulty engaging in normal academic, work, or social activities.[9] These research deficiency leaves many academic and practice problems unsolved for college student population. The college period is in the transition phase of students from campus to society and is a critical period with strong social influences on adolescents, and these influences can have a significant impact on their later life experiences.[10]

Among the difficulties college students encounter, learning English is one of the most challenge.[11] Due to the widespread use of English in the global economy, media, academia, entertainment, mastery of English has become an essential tool for professional success in a globalized marketplace.[12] Specifically, college students who are proficient in English are more likely to find the jobs they want and have significant advantages in terms of career advancement, compensation, and job satisfaction.[13] Because proficiency in English is highly correlated with post-secondary success and career readiness, education in English as a foreign language occupies a pivotal place in today's educational system.[14] Among all language skills in English, writing is commonly regarded as the most difficult of all English skills since it calls for a high degree of logical thought and expression in addition to a strong command of the language.[15–17] Therefore, Writing performance are sometimes seen as a key sign of success in learning English.[18] Studies indicate that strong English writing abilities are closely correlated with academic performance and career readiness, helping college students stand out in both areas.[18]

Self-regulated learning (SRL) theory offers a comprehensive framework for understanding the dynamic interactions among personal, behavioral, and environmental factors in the learning process.[19] It emphasizes how students actively regulate their cognition, motivation, and behavior to enhance academic performance. SRL also highlights the importance of learners intentionally initiating, sustaining, and adjusting their learning strategies to achieve their goals.[20] Developing from this framework, the COPES model elaborates on the cognitive architecture of self-regulated learning by specifying key processes such as task definition, goal setting and planning, strategy implementation, and adaptation through metacognition.[21,22] COPES stands for conditions, operations, products, evaluations, and standards. With the exception of operations, each of these components represents a type of information generated or used by the learner during a learning event.[23] It particularly underscores the dynamic roles of motivation and metacognition in guiding learning in ever-changing environments.

While prior studies have often emphasized the role of motivation and cognitive elements (eg, goal setting, strategy use),[24] metacognition, which as a core component of SRL, has received comparatively less attention.[25,26] In recent years, with the deepening of self-regulated learning research, metacognitive strategies, as an important organizational part of metacognition, have gradually received more attention, especially their important role in explaining learner differences and improving academic performance is being widely recognized.[27]

Importantly, SRL theory also recognizes the dynamic influence of emotional factors, which interact with motivational and metacognitive processes. Negative emotions, such as anxiety and stress, can impair learners' ability to initiate or sustain motivation, and disrupt effective metacognitive monitoring, ultimately hindering learning outcomes.[28,29] This is particularly salient in foreign language learning, where self-regulation is essential and emotional interference can significantly impact performance. Therefore, it is critical and valuable to investigate the complex relationships between generalized anxiety disorders, motivation, metacognitive strategies, and academic performance in foreign language learning context.

Anxiety Disorders and English Academic Writing Performance

The negative impact of anxiety disorders on college students' academic performance has been widely recognized,[30] with numerous studies revealing a negative correlation between anxiety and educational outcomes.[31] Psychological anxiety has been widely recognized as a significant factor contributing to the decline in undergraduates' GPAs, particularly in examination settings.[32] However, while extensive research has examined the detrimental effects of anxiety on academic performance, empirical studies focusing on how anxiety specifically affects English learning, especially writing skills, remain limited. Furthermore, it is worth noting that current research tends to distinguish between different forms of anxiety when examining its effects on academic performance.[33,34]

Researchers differentiate aspects of anxiety into state and trait, respectively defined as a more transient reaction to an adverse situation, and as a more stable personality attribute in experiencing events.[35] Existing researches have primarily

focused on state anxiety, which refers to temporary responses to stressful situations, while less attention has been paid to trait anxiety, which is a more stable personality characteristic and may have a broader impact on students more.[33,36,37] For example, some students may not exhibit noticeable state anxiety (such as test exam), but they may have generalized anxiety disorders, which could similarly impact their English learning. As noticed before, existing literature has relatively less focus on generalized anxiety, which is often considered a manifestation of trait anxiety. Our study will focus on generalized anxiety disorders to provide a more comprehensive understanding of the relationship between anxiety and academic performance. Additionally, previous studies predominantly target English majors, with insufficient attention paid to non-English majors.[38] All in all, this study aims to examine the impact of report more symptoms of generalized anxiety disorders on college students' English writing performance and its underlying mechanisms. Generalized anxiety disorders may indirectly affect students' English writing performance by affecting their academic motivation, cognitive functioning[39] and emotion regulation.[40] Therefore, exploring the effects of generalized anxiety disorders on college students' English writing performance and its mechanisms not only helps to better understand the relationship between generalized anxiety disorders and English academic performance, but also provides an important theoretical basis for future in-depth research in this area.

The Mediating Role of Learning Motivation

In addition to the direct effect, anxiety may exert effects on English academic writing performance through third-party factors. One of these factors is the language learning motivation. Motivation is a complex psychological trait and serves as a hidden force that drives individuals to take action.[41] Specifically, learning motivation refers to an internal thought process that encourages learners to pursue specific physiological or psychological goals, devote voluntary effort, and maintain momentum throughout the learning process.[42]

Motivation has also been identified as an important psychological trait associated with anxiety disorders and English academic writing performance.[43,44] For example, an experiment using a mouse model revealed that anxiety could induce reward-seeking motivation via a neuronal coping mechanism.[45] This provides physiological evidence supporting the connection between anxiety and motivation. Meanwhile, the impact of learning motivation on students' academic performance is well-documented.[43] Most studies have shown that students with low learning motivation tend to achieve poor academic results.[46] A quantitative study found that learning motivation, including both instrumental and integrative motivation, significantly influence the English achievement of first-year college students who are non-English majors.[47]

Taken together, existing researches suggest that anxiety disorders may lead to a lack of learning motivation, and the lack of learning motivation may further result in a decline in academic performance. English writing performance, as a key component of overall academic achievement, reflect students' English performance and have significant implications for both academic success and future career development. However, few studies have examined the detailed associations between anxiety, learning motivation, and English academic writing performance. Based on prior findings, this study hypothesizes that language learning motivation mediates the relationship between anxiety and English academic writing performance among college students.

The Mediating Role of Metacognitive Strategies

Metacognitive strategies may control students' thinking activities by regulating cognitive processes in writing based on SRL theory and COPES model.[48] These strategies are considered to be the core components of metacognition and involve higher-order thinking control and learning monitoring skills. Several empirical researches have extensively examined the impact of metacognitive strategies on academic achievement after recognizing their essential role of metacognitive strategies in learning.[27,30] Furthermore, it has been proved that the ability of authors to use metacognitive strategies is directly correlated with their writing levels.[49] This means that the students who are unable to use metacognitive strategies cannot ensure that "the production of meaning is in conformance with what they want to express".[49] In other words, poor English writing performance may be caused by lower use of metacognitive strategies for students. Therefore, our study assumes that metacognitive strategies can have a negative influence on English academic writing performance.

Previous studies find that SRL is closely associated with emotions in that positive emotions (such as enjoyment, hope, and pride) enhance SRL, whereas negative emotions (such as hopelessness, boredom and anxiety) diminish SRL. A quantitative study has shown that foreign language anxiety can negatively predict SRL, suggesting that anxiety may also have a detrimental effect on metacognitive strategies, a key component of SRL.[21] Furthermore, previous studies have shown that highly test anxious students also report higher scores on indicators of general anxiety disorder symptoms including generalized anxiety disorders (GAD)[50] and often meet diagnostic thresholds for generalized anxiety disorders.[51] In contrast to the generalized anxiety disorders we examined, it is important to note that test anxiety and foreign language anxiety are both forms of state anxiety.[30] Therefore, from the possible negative influence of foreign language anxiety or test anxiety on metacognitive strategy, our study hypotheses that generalized anxiety disorder can have a negative influence on metacognitive strategies.

Taken together above literatures, although it can easily induce that anxiety may metacognitive strategy, and finally influence academic performance. However, in the context of English academic writing, the mechanism through which anxiety affects academic achievement via metacognitive strategies remains underexplored. Based on prior findings, this study hypothesizes that metacognitive strategy mediates the relationship between anxiety and English academic writing performance among college students.

Chain Mediating Role of Language Learning Motivation and Metacognitive Strategies

Previous studies have predominantly focused on the independent effects of academic motivation and metacognitive strategies on academic achievement, with less attention given to the relationship between these two factors.[52,53] However, some scholars have argued that academic motivation is significantly related to metacognitive strategies and can positively influence the use of metacognitive strategies.[42,54,55] For example, a quantitative study of elementary school students found that those who valued academic tasks (ie, students with higher motivation to learn) were more likely to use metacognitive or cognitive strategies to enhance their academic performance.[54] This suggests that learning motivation not only motivates willingness to learn, but more importantly, promotes students' use of metacognitive strategies, ultimately improving academic outcomes. Based on these findings, the present study hypothesizes that learning motivation positively influences metacognitive strategies among college students.

Methods

Participants

The study participants are college students in four universities in Hubei province of China from May to August 2024. The students were from different majors, and all of them were English foreign language (EFL) learners who spoke Mandarin Chinese as their first language. The inclusion criteria of participants were as follows. (1) The answer time exceeded the average time (6 min). (2) The answers of items in the questionnaires did not conflict each other. (3) They passed the polygraph test. The setting of polygraph questions was mainly to repeat one item at a certain interval of time (about 30s) to examine whether the choice of the participant is consistent. If the answer of the same item was inconsistent in one participant, the participant would be excluded from this study for the carelessness.

G*Power 3.1 was used to calculate the minimum sample size required for the study. The multiple linear regression analysis method was selected, and the effect size $f2$ value was set to 0.15, the power value was 0.95, the α value was 0.001, and the output of minimum sample size was 238 participants.

Measures

Sociodemographic Information Form

We collected sociodemographic information of the participants through the questionnaire, including gender, age, grade, health status, and other relevant factors.

Anxiety Disorders

The anxiety subscale of GAD-7 (generalized anxiety disorders) questionnaire was used to evaluate anxiety disorders,[56] such as "Worrying too much about different things". There are 7 items in total. Each item has a score of 0 (not at all) –3

(almost every day), with a total score of 0–21. The higher the score, the more serious the anxiety. The total score of 5–9 represents mild anxiety, 10–14 moderate anxiety, and scores greater than 15 represent severe anxiety. The Cronbach's alpha coefficients of this scale in this study was 0.931.

Learning Motivation

This study used the Attitude/Motivation Test Battery – Chinese Version measures student's learning motivation, including integrative motivation and instrumental motivation, in learning a second or foreign language (FL) among Chinese-speaking populations.[57] Only two subcategories (integrative motivation and instrumental motivation) from the original questionnaire were included, as the others were irrelevant to the design of the current study's focal course. The integrative motivation and instrumental motivation questionnaire consist of 8 items (4 items for integrative motivation and instrumental motivation, separately), such as "Studying English is important because I will be able to interact more easily with speakers of English" and "Studying English is important because it will be useful in getting a good job", separately. Each item is measured using a five-point Likert scale, ranging from "1 = strongly disagree" to "5 = strongly agree". In the present study, the Cronbach alpha coefficient for motivation scale was 0.875, with instrumental motivation and integrative motivation subscales were 0.849 and 0.840, respectively.

Metacognitive Strategies

This study used the Writing Strategies for Self-regulated Learning Questionnaire (WSSRLQ)[58] to investigate EFL students' reported use of metacognitive strategies in the learning to write environment. It should be noted that only metacognitive strategies, one of the three subcategories in the original questionnaire, were included, because the others were irrelevant to the design of the current study's focal course. The metacognitive strategy includes two typical strategies, namely, goal-oriented monitoring that subsumes an arsenal of strategies such as setting up goals to direct writing activities (eg, I read related articles to help me plan) and idea planning that connotes specific idea-generating behavior before writing (eg, I evaluate my mastery of the content in writing courses). Each item is measured using a five-point Likert scale, ranging from "1 = strongly disagree" to "5 = strongly agree". The Cronbach's α coefficient of metacognitive strategies scale is 0.921, with ideal planning and goal-oriented monitoring subscales were 0.885 and 0.935, respectively.

English Academic Writing Performance

Students' writing proficiency was measured by their writing scores on the College English Test Band Four (CET-4). The CET-4 is one of the graduation requirements for college students in China and is also a necessary credential for demonstrating English proficiency in job applications. The CET-4 consists of four sections: writing, listening comprehension, reading comprehension, and translation, with writing and translation accounting for 20% of the total score. The writing section requires students to complete an essay of no less than 120 words within 30 minutes.[59] As a large-scale standardized test administered by the Ministry of Education of China, CET-4 is widely regarded as an authoritative measure of college students' English proficiency. The reliability and validity of its scores have been confirmed through rigorous training and monitoring of raters.[60] Given the strong correlation between CET-4 writing scores and students' performance in college English courses, these scores are considered a reliable indicator of students' English writing performance.

Statistical Analysis

SPSS 26 was used for descriptive statistics, correlation analysis, and Cronbach's a reliability estimate. Mplus8.3 was used for the mediation model analysis, and the indirect effects were computed using a bias corrected bootstrapping procedure with 5000 bootstrap samples. The $p < 0.05$ is considered statistically significant. Criteria for goodness-of-fit indices included: the ratio of chi-square to degrees of freedom (x^2/df) should be less than 3, comparative fit index (CFI) ≥ 0.90, Tucker-Lewis index (TLI) ≥ 0.90, Standardized Root Mean Square Residual ≤ 0.08, and root mean square error of approximation (RMSEA) ≤ 0.08.[61,62]

Procedure

The survey was performed by online self-administered and anonymous questionnaire. All questionnaires were translated from English into Chinese, checked for linguistic and cultural idiom suitability by a team of experts and researchers, and then back translated into English for confirmation. Prior to distributing the survey, we sent the survey link to the relevant professional teachers, several colleagues, college students from non-sampled universities for trial use and asked for their feedback on the content and layout of the survey. After a series of adjustments, the teacher in sampled universities forwarded the link and QR code to the class group and asked the students to fill in the questionnaire on their own. To ensure the smoothness and high quality of the responses, research assistants were assigned to each school to conduct online Q&A sessions for college students within the time frame of the responses. In total, 2911 participations were approached in our study. About 2804 college students were included in the final analysis after discarding incomplete and invalid responses mentioned above were eliminated, resulting in an effective response rate of 96.32% for this stage of the study.

Results

Common Method Biases Tests

To examine common method biases and systematic errors due to self-rating questionnaires, the study conducted Harman's single-factor test[63] and an exploratory factor analysis for all items containing four variables. The results showed that the first factor accounted for 31.42% of the total variation, lower than the threshold of 40% proposed by Podsakoff et al.[64] Thus, there was no significant common method bias.

Descriptive Statistics

The demographic data of the cases is presented in Table 1. Among all the participants, 34.84% are males and 65.16% are females. The participants' ages ranged from 18 to 30 years old (mean = 20.15, SD = 1.21). Nearly half of participants (44.01%) experienced anxiety disorders. More details can be found in Table 1.

Table 1 Characteristics of the Study Sample (Full Sample=2804)

Variables	Categories	N or mean	% or SD	P
Gender	Male	966	34.84%	<0.001
	Female	1827	65.16%	
Age	Mean (SD)	20.15	1.21	<0.05
Health status	Very bad	29	1.03%	<0.001
	Bad	79	2.82%	
	Normal	909	32.42%	
	Good	1104	39.37%	
	Very good	683	24.36%	
Grade	Third-year	1280	45.65%	<0.001
	Fourth-year	1524	54.35%	
Major	Arts	2060	73.47%	<0.001
	Science	744	26.53%	
Anxiety status	Normal	1570	55.99%	<0.001
	Abnormal	1234	44.01%	
	Mild	342	12.20%	
	Moderate	823	29.35%	
	Severe	51	1.82%	
	Extremely severe	18	0.64%	

Analysis of the Correlation Between Overall Variables

The results indicate that anxiety disorder is negatively associated with English academic writing performance (r = −0.089, P < 0.01), learning motivation (r = −0.143, P < 0.01) and metacognitive strategies (r = −0.243, P < 0.01). Learning motivation (r = 0.215, P < 0.01) and metacognitive strategies (r = 0.192, P < 0.01) are positively correlated with English academic writing performance. In addition, learning motivation is positively correlated with metacognitive strategies (r = 0.601, P < 0.01). Furthermore, we found that the two sub-components of learning motivation have the same correlations as each of them in this model (Table 2).

Test of the Mediating Effect

The fit indices for the modified model were acceptable: $\chi 2 = 2.345$, CFI = 0.921, TLI = 0.923, SRMR = 0.042, RMSEA = 0.041. After controlling for gender, age, health status, grade and major, the mediating model shows that all of them were not significant. The results from Table 3 show that anxiety disorders had a significant negative effect on English academic writing performance (β=−0.046, P < 0.05), learning motivation (β=−0.144, P < 0.001) and metacognitive strategies (β=−0.159, P < 0.001). Learning motivation and metacognitive strategies had significant positive effects on English academic writing performance (β= 0.157, P < 0.001; β = 0.086, P < 0.05), respectively. Learning motivation had a significant positive effect on metacognitive strategies (β = 0.580, P < 0.001). As shown in Table 4, the total mediating effects of anxiety disorders on English academic writing performance were made up of direct and indirect effects. The 95% CI corresponding to the direct path of anxiety disorders to English academic writing performance was [−0.089, −0.007], did not contain 0, indicating that the direct effects were significant (effect size =−0.046, accounting for 51.69% of the total effect). The indirect effects mainly have three paths: anxiety disorders→ learning motivation→ English

Table 2 Mean Scores and Correlation Analysis of Anxiety Disorders, Learning Motivation, Metacognitive Strategies and English Academic Writing Performance

	Mean	SD	Anxiety Disorders	Learning Motivation	Metacognitive Strategies	English Academic Writing Performance
Anxiety disorders	7.05	5.26	**0.875**			
Learning motivation	3.30	0.66	−0.143**	**0.733**		
Metacognitive strategies	3.61	0.66	−0.243**	0.601**	**0.844**	
English academic writing performance	65.60	11.96	−0.089**	0.215**	0.192**	**1**

Notes: **P < 0.05, values in bold on the diagonal represent the Average Variance Extracted (AVE).
Abbreviations: M, Mean; SD, standard deviation.

Table 3 Pathway Coefficients of the Moderated Mediation Model

Path	β	SE	95% CI	P value
Anxiety disorders → English academic writing performance	−0.046	0.021	[−0.089, −0.007]	0.033
Anxiety disorders → learning motivation	−0.144	0.02	[−0.183, −0.105]	0
Learning motivation → English academic writing performance	0.157	0.03	[0.097, 0.21]	0
Anxiety disorders → metacognitive strategies	−0.159	0.017	[−0.194, −0.127]	0
Metacognitive strategies → English academic writing performance	0.086	0.028	[0.031, 0.138]	0.002
Learning motivation → metacognitive strategies	0.580	0.020	[0.543, 0.618]	0

Abbreviations: β, standardized regression coefficient; SE, standard error; 95% CI, the lower and upper limit of 95% confidence interval.

Table 4 Standardized Bootstrap Estimates and 95% Confidence Intervals for Direct, Indirect, and Total Effects

Relationships	Effect	Boot SE	95% CI		Mediation Proportion
			LLCI	ULCI	
Total effect: Indirect effect + Direct effect	−0.089	0.02	−0.129	−0.054	100%
Direct effect: Anxiety disorders → English academic writing performance	−0.046	0.021	−0.089	−0.007	51.69%
Total indirect effect: Anxiety disorder → English academic writing performance	−0.043	0.007	−0.058	−0.031	48.31%
Ind1: Anxiety disorders → learning motivation → English academic writing performance	−0.023	0.005	−0.034	−0.013	25.84%
Ind2: Anxiety disorders → metacognitive strategies → English academic writing performance	−0.014	0.005	−0.024	−0.005	15.73%
Ind3: Anxiety disorders → learning motivation → metacognitive strategies → English academic writing performance	−0.007	0.003	−0.012	−0.003	7.87%

Notes: Ind1, Ind2, and Ind3 is the specific indirect effect of the path. All the path coefficients were standardized.
Abbreviations: SE, standard error; LLCI, the lower limit of 95% confidence interval; ULCI, the upper limit of 95% confidence interval.

academic writing performance (path 1), anxiety disorders→ metacognitive strategies→ English academic writing performance (path 2), and the mediation chain of basic anxiety disorder → learning motivation →metacognitive strategies → English academic writing performance (path 3). The 95% CI corresponding to the three indirect paths were [−0.034, −0.013], [−0.024, −0.005], [−0.012, −0.003], respectively, and both of them did not contain 0, indicating that the mediating effects of the three paths were significant. The indirect effect size of three indirect paths were −0.023, −0.014, and −0.007, accounting for 25.84%, 15.73%, and 7.87% of the total effects, respectively. These results indicate that learning motivation and metacognitive strategies not only partially mediate the relationship between anxiety disorders and English academic writing performance, but also have a chain mediating effect on them (Table 3 and 4, Figure 1). In addition, we found that the two sub-components of metacognitive strategies and two sub-components of learning motivation have the same mediating effects as metacognitive strategies and learning motivation in this model (Supplementary Tables S1.1–S8.2, Tables S9–S11 and Figures S1–S8).

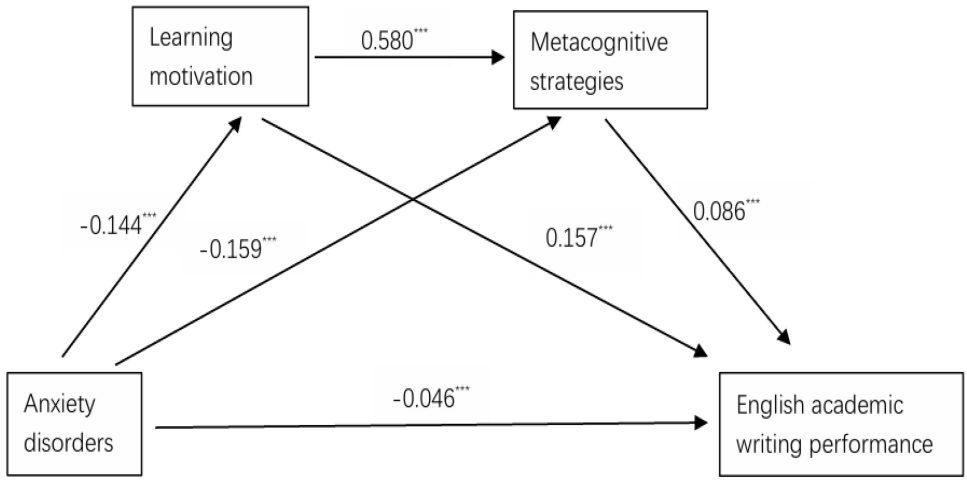

Figure 1 The chain mediation model for anxiety disorders, learning motivation, metacognitive strategies and English academic writing performance.
Note: All the path coefficients were standardized. ***p < 0.001.

Discussion

Current Status and Characteristics of Anxiety Disorders Among College Students

According to our findings, 44.01% of college students reported having anxiety disorders, with mild, moderate, severe, and extreme anxiety rates being 12.20%, 29.35%, 1.82% and 0.64% of college students, respectively. A recent meta-analysis and systematic review, which included 13 studies investigating anxiety symptoms among college students (N = 144, 010), reported a pooled prevalence of 31% (95% CI = [23%, 39%]).[65] In contrast, the prevalence of anxiety disorders in our study is even higher than what was reported in that review. All of these studies show that the status of college students' anxiety is not optimistic. Since anxiety disorders are highly prevalent and becoming increasingly serious among Chinese college students, it is valuable to investigate the influence of anxiety disorders on students.

Relationship Between Anxiety Disorders and English Academic Writing Performance

Consistent with previous studies,[66,67] our findings support a negative association between anxiety disorders and English academic writing performance among college students ($\beta=-0.046$, $P < 0.05$), suggesting that anxiety is a predictor of writing performance. Previous studies have explained that students with mental health issues such as anxiety or depression often struggle with social interactions and may fail to engage in classroom activities, which leads to a decline in academic performance.[68] Most existing studies focus on state anxiety, such as language anxiety, classroom anxiety, and exam anxiety, which are typically triggered in specific contexts and negatively impact students' learning outcomes.[69] In contrast, our study focuses on generalized anxiety disorders, which are included in trait anxiety, a type of personality traits characterized by persistent worry and anxiety across various situations. The impact of anxiety disorders is higher in this study ($\beta=-0.089$, $P < 0.05$) than in one aforementioned quantitative study, which revealed that state anxiety significantly harmed the writing performance of English-major students ($\beta=-0.26$, $P < 0.05$).[30] This observed difference may be attributed to variations in study subjects and the types of anxiety examined. Exploring the relationship between generalized anxiety disorder and English academic writing performance enhances our understanding of the impact of general psychological anxiety on college students' academic performance, and allows us to offer recommendations to universities and related organizations for alleviating excessive anxiety among students.

Mediating Effects of Learning Motivation Between Anxiety Disorders and English Academic Writing Performance

One important finding of this study is that language learning motivation mediates the relationship between anxiety disorder and English academic writing performance (Effect=−0.023, 95% CI = [−0.034, −0.013]). Our results indicate that anxiety disorder serves as a predictor of learning motivation ($\beta=-0.144$, $P < 0.05$), suggesting that increased anxiety significantly reduces learning motivation. This finding is consistent with previous studies, one of which showed that state anxiety in biology students negatively impacted their learning motivation in an anatomy course.[37] While the impact of individual emotions on learning motivation has been extensively studied, research has often focused on positive emotions, such as interest, whereas the effect of negative emotions, such as anxiety and depression, has received less attention.[37] More importantly, unlike most existing studies, this research emphasizes the impact of generalized anxiety disorder on learning motivation.[37,43] Our study demonstrates that general psychological anxiety, rather than specific state anxieties such as test or classroom anxiety, can directly predict college students' learning motivation. This finding not only expands the research scope on anxiety's effects on learning motivation but also provides new insights into how to more comprehensively understand and intervene in college students' anxiety. It is a common knowledge that learning motivation for students can influence their academic performance and directly reflected in their test scores.[70] Our study results support these knowledge that language learning motivation has a direct impact on English academic writing performance ($\beta= 0.157$, $P<0.05$).[71]

It is noticeable that few studies have been conducted on learning motivation as a mediator between anxiety disorders and academic writing performance in English, making direct comparisons with existing studies challenging. Our findings indicate that anxiety disorders indirectly impair English academic writing performance by weakening language learning motivation. This phenomenon may be attributed to the "self-regulation mechanism" triggered by prolonged or excessive negative emotions.[72] Specifically, when individuals experience heightened

anxiety, they may unconsciously reduce their aspirations or engagement in certain goals or activities as a coping strategy to alleviate psychological stress. While this regulatory adjustment may offer short-term relief, it can significantly diminish motivations such as behavior motivations, learning motivations and so on.[73] Consequently, reduced motivation leads to a decline in learning behaviors, which is directly reflected in academic performance. These findings not only highlight the intricate relationship between anxiety disorders and academic outcomes but also provide a new perspective on the indirect pathways through which anxiety disorders can affect students' academic achievements.

The Mediating Role of Metacognitive Strategies Between Anxiety Disorders and English Academic Writing Performance

Our study also revealed that the association between anxiety and English writing performance is mediated by metacognitive strategies, which is a core component of self-regulated learning (SRL) and typically emphasized in COPES model.[74] In particular, our research found that students with severe anxiety disorders tend to employ fewer metacognitive strategies, leading to a decrease in their ability to write in English.

This finding is consistent with previous research, which suggests that self-regulated learning (SRL), including metacognitive strategies, is closely related to emotions.[29] In details, studies show that positive emotions (such as pride, happiness, and hope) enhance SRL, while negative emotions (such as boredom, hopelessness, and worry) suppress SRL.[29] In the context of EFL writing, metacognitive strategies were found to directly contribute to improved performance ($\beta=0.086$, $P<0.05$), which aligns with existing literature emphasizing the role of metacognitive strategies in optimizing academic achievement.[27] Conversely, a lack of self-regulatory strategies negatively impacts foreign language writing, as fewer strategies are employed to meet academic demands.[27,28] In addition, while existing research has largely focused on the relationship between reading anxiety and metacognitive strategies, showing that reading anxiety impairs metacognitive processing in foreign language contexts, our study extends these findings to writing and generalized anxiety disorders.[75] We demonstrate that general psychological anxiety disorders negatively affect the use of metacognitive strategies in English writing ($\beta=-0.159$, $P<0.05$).

The main way that anxiety disorders have detrimental effects on college students' English learning performance through metacognitive strategies is that long-term anxiety can affect a person's capacity for self-regulation, which makes it harder for them to use or recognize metacognitive strategies during learning and ultimately result in a drop in academic performance.[76]

Chain Mediating Role of Learning Motivation and Metacognitive Strategies

Learning motivation and metacognitive strategies are seen as essential elements of self-regulated learning in the COPES model proposed by self-regulated learning theory.[19,74] In details, prior researches have demonstrated a positive causal relationship between motivation and metacognitive strategies, suggesting that highly motivated students are more likely to engage in autonomous learning and adopt control-oriented strategies.[77,78] For example, a study on Mexican university students found that those with stronger learning motivation were more inclined to use complex metacognitive strategies such as self-regulation and critical thinking ($\beta=0.207$, $p<0.05$).[79] In comparison, our study revealed a stronger association between learning motivation and metacognitive strategies among Chinese students. This difference can likely be attributed to the variation in the types of metacognitive strategies examined, as well as cross-national differences in educational practices and the emphasis on English academic writing in different cultural contexts. Our study further reinforces the existing theory by showing that learning motivation and metacognitive strategies are particularly important in the context of English academic writing, where motivated students are more likely to employ effective metacognitive strategies, thus improving their writing outcomes. It consolidates the theoretical framework that students with strong learning motivation can more effectively conduct autonomous learning and adopt control-oriented strategies. More importantly, this study expands the applicability of the theory in different cultural and educational contexts, provides new support for the universality of self-regulated learning theory, and provides important evidence for further deepening and expansion of the theory.

Conclusion

Our findings contribute to the integration of psychological and educational theories, emphasizing the complex relationship between anxiety disorders and English academic writing performance. In particular, this study offers new insights into how anxiety disorders affect English writing among college students within the Chinese context. We found that anxiety disorders not only directly lower English academic writing performance, but they also have an indirect negative effect by diminishing students' learning motivation and the use of metacognitive strategies. These results highlight that tutors and parents should be aware that persistent anxiety status not only has a negative impact on students' academic performance, but also on their motivation, learning strategies, and ability to learn. Tutors and parents need to pay attention to the student's psychological status as well as his/her academic performance. College students need to pay attention to their own psychological state and make timely adjustments in order to cope with future challenges in life. By using a chain mediating model, this study not only underscores the importance of addressing anxiety disorders in educational settings but also offers practical recommendations for interventions aimed at improving English writing performance through enhancing learning motivation and the use of metacognitive strategies. In practice, when students exhibit declining motivation and academic performance, educators and policymakers should recognize that general psychological anxiety may be an underlying contributing factor. In response, college institutions should allocate full-time psychological counselors to provide timely support in both emotional regulation and metacognitive strategy development. Such interventions can help students identify psychological challenges and adopt effective coping mechanisms to restore academic engagement and performance.

Limitation and Future Research Directions

Honestly speaking, this study has the following limitations. Firstly, this study is primarily based on a cross-sectional survey, making it difficult to infer causal relationships between anxiety, learning motivation, metacognitive strategies, and English academic writing performance. There may be other significant mediating factors between anxiety and English academic writing performance. Future research should incorporate longitudinal studies and latent variable analysis to refine the theoretical model. Secondly, the data for this study were collected in a province in central China, while cultural or educational context is to some extent different from other areas, so caution is needed when generalizing the results to other regions within China or abroad. Thirdly, the sample in this study only consists of junior or senior college students from a specific population in China. It remains unclear whether the results can be extended to other groups, such as freshmen or sophomores, who may experience different levels of anxiety or adopt distinct learning strategies. Finally, the study relied entirely on self-reported measures, which could introduce response bias and social desirability bias.

Data Sharing Statement

The data sets generated and/or analyzed during this study are available from the corresponding author on reasonable request.

Ethics Statement

All methods were performed in accordance with the relevant guidelines and regulations or in accordance with the Declaration of Helsinki. This study was approved by the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (2021-S063), and online informed consent was required from each participant. Participation was voluntary and students were informed about the purpose of the study.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Tomasi J, Zai CC, Zai G. Investigating the association of anxiety disorders with heart rate variability measured using a wearable device. *J Affect Disord*. 2024;351:569–578. doi:10.1016/j.jad.2024.01.137
2. Bayram N, Bilgel N. The prevalence and socio-demographic correlations of depression, anxiety and stress among a group of university students. *Soc Psychiatry Psychiatr Epidemiol*. 2008;43:667–672. doi:10.1007/s00127-008-0345-x
3. Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: a meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *J Child Psychol Psychiatry*. 2015;56:345–365. doi:10.1111/jcpp.12381
4. Wan Z, Chen Y, Wang L, Cheng M. The relationship between interparental conflict and social anxiety among Chinese college students: a moderated mediation model. *PRBM*. 2024;17:3965–3977. doi:10.2147/PRBM.S481086
5. Woodward LJ, Fergusson DM. Life course outcomes of young people with anxiety disorders in adolescence. *J Am Acad Child Adolesc Psychiatry*. 2001;40:1086–1093. doi:10.1097/00004583-200109000-00018
6. Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders, I: educational attainment. *Am J Psychiatry*. 1995;152:1026–1032.
7. Guo T, Cai C, Xu Y, Huang M, Ni Y. Self-esteem and college students' online impulse buying: the independent and interactive moderating role of interdependent self-construal and interpersonal relationships. *PRBM*. 2024;17:4447–4461. doi:10.2147/PRBM.S494636
8. Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on college students' mental health in the United States: interview survey study. *J Med Internet Res*. 2020;22:e21279. doi:10.2196/21279
9. Mercado MC, Holland K, Leemis RW, Stone DM, Wang J. Trends in emergency department visits for nonfatal self-inflicted injuries among youth aged 10 to 24 years in the United States, 2001-2015. *JAMA*. 2017;318:1931–1933. doi:10.1001/jama.2017.13317
10. P AR, Alonso J, G AW, et al. Mental disorders among college students in the world health organization world mental health surveys. *Psychol Med*. 2016;46:2955–2970. doi:10.1017/S0033291716001665
11. Evans S, Morrison B. Meeting the challenges of English-medium higher education: the first-year experience in Hong Kong. *English Specific Purposes*. 2011;30:198–208. doi:10.1016/j.esp.2011.01.001
12. Peltokorpi V. The "Language" of career success: the effects of English language competence on local employees' career outcomes in foreign subsidiaries. *J Int Bus Stud*. 2023;54:258–284. doi:10.1057/s41267-022-00544-4
13. Zainuddin SZB, Pillai S, Dumanig FP, Phillip A. English Language and Graduate Employability. *Educ Train*. 2019;61:79–93. doi:10.1108/ET-06-2017-0089
14. Guilherme M. English as a global language and education for cosmopolitan citizenship. *Lang Intercult Commun*. 2007;7:72–90. doi:10.2167/laic184.0
15. Sasaki M. Effects of study-abroad experiences on EFL writers: a multiple-data analysis. *Mod Lang J*. 2007;91:602–620. doi:10.1111/j.1540-4781.2007.00625.x
16. Zhang LJ. Second language writing as and for second language learning. *J Sec Lang Writ*. 2013;22:446–447. doi:10.1016/j.jslw.2013.08.010
17. Geiser S, Studley R. *UC and the SAT: Predictive Validity and Differential Impact of the SAT I and SAT II at the University of California, the Other Is Benjamin, R, & Chun, M. (2003)*. A new field of dreams: The Collegiate Learning Assessment Project; 2001.
18. Chung HQ, Chen V, Olson CB. The impact of self-assessment, planning and goal setting, and reflection before and after revision on student self-efficacy and writing performance. *Read. Writ*. 2021;34:1885–1913. doi:10.1007/s11145-021-10186-x
19. Zimmerman BJ, Martinez-Pons M. Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology*. 1988;80:284–290. doi:10.1037/0022-0663.80.3.284
20. Zimmerman BJ. Motivational sources and outcomes of self-regulated learning and performance: graduate center of city university of New York. In: *Handbook of Self Regulation of Learning and Performance*. Routledge; 2011:63–78.
21. Winne PH. Studying as self-regulated learning. *Metacognition Educ Theory Pract LEA*. 1998;1998:291–318.
22. Greene JA, Azevedo R. A theoretical review of Winne and Hadwin's model of self-regulated learning: new perspectives and directions. *Rev Educ Res*. 2007;77(3):334–372. doi:10.3102/003465430303953
23. Muenks K, Yan VX. University STEM instructors with stronger failure-as-debilitating mindsets are perceived to engage in fewer mastery-oriented teaching practices by their students: an exploratory study. *Soc Psychol Educ*. 2022;25:1205–1219. doi:10.1007/s11218-022-09718-2
24. Wang Y, Liu H. The mediating roles of boredom and buoyancy in the relationship between autonomous motivation and engagement among Chinese senior high school EFL learners. *Front Psychol*. 2022;13(992279):1–12.
25. Jia X, Li W, Cao L. The role of metacognitive components in creative thinking. *Front Psychol*. 2019;10:2404. doi:10.3389/fpsyg.2019.02404
26. Yan VX, Thai KP, Bjork RA. Habits and beliefs that guide self-regulated learning: do they vary with mindset? *J Appl Res Memory Cognition*. 2014;3:140–152. doi:10.1037/h0101799
27. Teng LS, Zhang LJ. "Effects of motivational regulation strategies on writing performance: a mediation model of self-regulated learning of writing in English as a second/foreign language. *Metacognition and Learning*. 2018;213–240. doi:10.1007/s11409-017-9171-4
28. Shih H-J. L2 anxiety, self-regulatory strategies, self-efficacy, intended effort and academic achievement: a structural equation modeling approach. *Int Educ Stud*. 2019;12(3):24. doi:10.5539/ies.v12n3p24
29. Pekrun R, Goetz T, Frenzel AC, Barchfeld P, Perry RP. Measuring emotions in students' learning and performance: the achievement emotions questionnaire (AEQ). *Contemporary Educ Psychol*. 2011;36(1):36–48. doi:10.1016/j.cedpsych.2010.10.002
30. Wang H. Exploring the relationships of achievement motivation and state anxiety to creative writing performance in English as a foreign language. *Thinking Skills Creativity*. 2021;42:100948. doi:10.1016/j.tsc.2021.100948
31. Owens M, Stevenson J, Norgate R, Hadwin JA. Processing efficiency theory in children: working memory as a mediator between trait anxiety and academic performance. *Anxiety Stress Coping*. 2008;21:417–430. doi:10.1080/10615800701847823

32. Chapell MS, Blanding ZB, Silverstein ME, et al. Test anxiety and academic performance in undergraduate and graduate students. *J Educ Psychol*. 2005;97:268–274. doi:10.1037/0022-0663.97.2.268
33. Horwitz EK. Foreign and Second Language Anxiety. *Lang Teach*. 2010;43:154–167. doi:10.1017/S026144480999036X
34. Liu H, Zhu Z, Chen B. Unraveling the mediating role of buoyancy in the relationship between anxiety and EFL students' learning engagement. *Perceptual and Motor Skills*. 2024. doi:10.1177/00315125241291639
35. Spielberger CD. *Anxiety: Current Trends in Theory and Research*. Oxford, England: Academic Press; 1972:xvi,237.
36. Balogun AG, Balogun SK, Onyencho CV. Test anxiety and academic performance among undergraduates: the moderating role of achievement motivation. *Span J Psychol*. 2017;20:E14. doi:10.1017/sjp.2017.5
37. Randler C, Wüst-Ackermann P, Vollmer C, Hummel E. The relationship between disgust, state-anxiety and motivation during a dissection task. *Learn Individ Differ*. 2012;22:419–424. doi:10.1016/j.lindif.2012.01.005
38. Shen B, Bai B. Enhancing Chinese university students' writing performance and self-regulated learning (SRL) writing strategy use through a strategy-based intervention. *System*. 2024;122:103249. doi:10.1016/j.system.2024.103249
39. Teng MF, Qin C, Wang C. Validation of metacognitive academic writing strategies and the predictive effects on academic writing performance in a foreign language context. *Metacognition Learning*. 2022;17:167–190. doi:10.1007/s11409-021-09278-4
40. Efklides A. Interactions of metacognition with motivation and affect in self-regulated learning: the MASRL model. *Educ Psychol*. 2011;46:6–25. doi:10.1080/00461520.2011.538645
41. Wu J, Lee MC-L. The relationships between test performance and students' perceptions of learning motivation, test value, and test anxiety in the context of the English benchmark requirement for graduation in Taiwan's Universities. *Lang Testing Asia*. 2017;7:1–21. doi:10.1186/s40468-017-0041-4
42. Stipek D, Feiler R, Daniels D, Milburn S. Effects of different instructional approaches on young children's achievement and motivation. *Child Develop*. 1995;66:209–223. doi:10.2307/1131201
43. Li Q, Cho H, Cosso J, Maeda Y. Relations between students' mathematics anxiety and motivation to learn mathematics: a meta-analysis. *Educ Psychol Rev*. 2021;33:1017–1049. doi:10.1007/s10648-020-09589-z
44. Liu H, Wang Y, Wang H, Ahmadi F, Derakhshideh Z, Asadikalameh Z. Exploring the mediating roles of motivation and boredom in basic psychological needs and behavioural engagement in English learning: a self-determination theory perspective. *BMC Psychology*. 2025;13 (179):1–13. doi:10.1186/s40359-025-02524-3
45. Klenowski PM, Zhao-Shea R, Freels TG, et al. A neuronal coping mechanism linking stress-induced anxiety to motivation for reward. *Sci Adv*. 2023;9:eadh9620. doi:10.1126/sciadv.adh9620
46. Clark MH, Middleton SC, Nguyen D, Zwick LK. Mediating relationships between academic motivation, academic integration and academic performance. *Learn. Individ. Differ*. 2014;33:30–38. doi:10.1016/j.lindif.2014.04.007
47. Chen S, Du H, Wang S, Yang L. Understanding EFL reading anxiety in relation to learning motivation, attitudes and strategies for Chinese and Spanish undergraduates. *System*. 2022;108:102842. doi:10.1016/j.system.2022.102842
48. Shen X, Ismail L, Jeyaraj JJ, Teng MF. Metacognitive strategies, writing self-efficacy and writing anxiety in different learning modes: a two-wave longitudinal model. *System*. 2024;126:103485. doi:10.1016/j.system.2024.103485
49. Li S, Hiver P, Papi M. editors. *The Routledge Handbook of second Language Acquisition and Individual Differences*. New York. Routledge. 2022:1
50. Weems CF, Scott BG, Taylor LK, et al. Test anxiety prevention and intervention programs in schools: program development and rationale. *School Mental Health*. 2010;2:62–71. doi:10.1007/s12310-010-9032-7
51. Beidel DC, Turner SM. Comorbidity of test anxiety and other anxiety disorders in children. *J Abnormal Child Psychol*. 1988;16:275–287. doi:10.1007/BF00913800
52. Han J, Lu Q. A correlation study among achievement motivation, goal-setting and L2 learning strategy in EFL context. *Eng Lang Teach*. 2018;11:5–14. doi:10.5539/elt.v11n2p5
53. Richardson M, Abraham C, Bond R. Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychol Bull*. 2012;138:353–387. doi:10.1037/a0026838
54. Chatzistamatiou M, Dermitzaki I, Efklides A, Leondari A. Motivational and affective determinants of self-regulatory strategy use in elementary school mathematics. *Educ Psychol-uk*. 2015;35:835–850. doi:10.1080/01443410.2013.822960
55. Hong E, Peng Y. Do Chinese students' perceptions of test value affect test performance? mediating role of motivational and metacognitive regulation in test preparation. *Learn Instruction*. 2008;18:499–512. doi:10.1016/j.learninstruc.2007.10.002
56. Löwe B, Decker O, Müller S, et al. Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. *Med Care*. 2008;46:266–274. doi:10.1097/MLR.0b013e318160d093
57. Bernardo A, Amérigo M, García JA. Attitude/motivation test battery--Chinese Version. *J Lang Soc Psychol*. 2016;2016:1.
58. Teng LS, Zhang LJ. A questionnaire-based validation of multidimensional models of self-regulated learning strategies. *Mod. Lang. J*. 2016;100:674–701. doi:10.1111/modl.12339
59. Li H. Are teachers teaching to the test? a case study of the college English test (CET) in China. *Int J Pedagogies Learn*. 2009;5:25–36. doi:10.5172/ijpl.5.1.25
60. Fan J, Frost K. At the intersection of language testing policy, practice, and research: an interview with Yan Jin. *Language Assessment Quarterly*. 2022;19:76–89. doi:10.1080/15434303.2021.1938570
61. M PP, P PN, J WL, et al. Common method bias: it's bad, it's complex, it's widespread, and it's not easy to fix. *Annual Rev Org Psychol Org Behav*. 2024;11:17–61. doi:10.1146/annurev-orgpsych-110721-040030
62. E BT, Cheng G, Duan Y, et al. Data nuggets: a method for reducing big data while preserving data structure. *J Computat Graph Stat*. 2025;34:330–342. doi:10.1080/10618600.2024.2341896
63. Andersen EB, Harman HH. Modern factor analysis. *Revue de l'Institut International de*. 1968;36:355. doi:10.2307/1401485
64. Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol*. 2003;88:879–903. doi:10.1037/0021-9010.88.5.879
65. Chang -J-J, Ji Y, Li Y-H, Pan H-F, Su P-Y. Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: a meta-analysis. *J Affect Disord*. 2021;292:242–254. doi:10.1016/j.jad.2021.05.109
66. Horwitz E. Language anxiety and achievement. *Ann Rev Appl Linguist*. 2001;21:112–126. doi:10.1017/S0267190501000071

67. Phillips EM. The effects of language anxiety on students' oral test performance and attitudes. *Mod Lang J*. 1992;76:14–26. doi:10.1111/j.1540-4781.1992.tb02573.x
68. Awadalla S, Davies EB, Glazebrook C. A Longitudinal cohort study to explore the relationship between depression, anxiety and academic performance among Emirati university students. *BMC Psychiatry*. 2020;20:1–10. doi:10.1186/s12888-020-02854-z
69. Apridayani A, Han W, Waluyo B. Understanding students' self-regulated learning and anxiety in online English courses in higher education. *Heliyon*. 2023;9(6). doi:10.1016/j.heliyon.2023.e17469
70. Cokley KO. What do we know about the motivation of African American students? challenging the "anti-intellectual" myth. *Harvard Educ Rev*. 2003;73:524–558. doi:10.17763/haer.73.4.3618644850123376
71. Turner EA, Chandler M, Heffer RW. The influence of parenting styles, achievement motivation, and self-efficacy on academic performance in college students. *CSD*. 2009;50:337–346. doi:10.1353/csd.0.0073
72. Shi-xiu S. Moderating and mediating effects of resilience between negative life events and depression symptoms among adolescents following the 2008 Wenchuan earthquake in China. *Chin J Clin Psychol*. 2012;20:514–517.
73. Kocovski NL, Endler NS. Social anxiety, self-regulation, and fear of negative evaluation. *Eur J Personality*. 2000;14:347–358. doi:10.1002/1099-0984(200007/08)14:4<347::AID-PER381>3.0.CO;2-7
74. Winnie, PH, Hadwin, AF. Studying as self-regulated learning. In: editors. *Metacognition in Educational Theory and Practice*. 277–304. ; 1998.
75. Ghaith GM. Foreign language reading anxiety and metacognitive strategies in undergraduates' reading comprehension. *Issues Educ Res*. 2020;30:1310–1328.
76. Kade SA, du Toit SA, Danielson CT, et al. Aberrant cognitive empathy in individuals with elevated social anxiety and regulation with emotional working memory training. *Cogn Emot*. 2024;38:605–623. doi:10.1080/02699931.2024.2314981
77. Xu Q, Zhong C, Tan T, et al. The influence of dietary diversity on anthropometric status among young children ages 12 and 24 months in Wuhan, China. *Maternal Child Nutr*. 2024;20(1):e13563. doi:10.1111/mcn.13563
78. Maruno S, Zhang L. Causal relationships among academic delay of gratification, motivation, and self-regulated learning in elementary school children. *Perceptual Motor Skills*. 2010;111:631–642. doi:10.2466/10.11.20.PMS.111.5.631-642
79. Acosta-Gonzaga E, Ramirez-Arellano A. The influence of motivation, emotions, cognition, and metacognition on students' learning performance: a comparative study in higher education in blended and traditional contexts. *SAGE Open*. 2021;11:215824402110275. doi:10.1177/21582440211027561