

Journal of International Students
Volume 16, Issue 1 (2026), pp. 127-140
ISSN: 2162-3104 (Print), 2166-3750 (Online)
jistudents.org
<https://doi.org/10.32674/kb71w355>



Untangling the Influence of Anxiety and Motivation on Cognitive Performance of International University Students

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ABSTRACT

International students often experience heightened anxiety while adapting to study abroad, which can impact academic performance, yet the role of motivation in buffering anxiety-related cognitive challenges remains underexplored. The current study aimed to examine the relationship between anxiety, motivation and real-world cognitive performance of international students while studying in Australia. A cross-sectional design was used, and data were collected via an online self-report questionnaire. Participants were 144 international students (aged 18-48 years) enrolled at an Australian university during 2021. Trait and state anxiety were measured using the State-Trait Inventory for Cognitive and Somatic Anxiety. Internal and external motivation were captured using the Work Preference Inventory, and real-world cognitive performance was assessed using the Cognitive Failures Questionnaire. Predictions were premised on attentional control theory. Separate moderated multiple regression models revealed that: at higher internal motivation, higher trait anxiety predicted poorer cognitive performance, whereas at lower internal motivation, higher state anxiety predicted poorer cognitive performance. At lower external motivation, higher trait anxiety predicted poorer cognitive performance at lower state anxiety, and at higher external motivation, higher trait anxiety predicted poorer cognitive performance

at higher state anxiety. Findings highlight the role of motivation in the relationship between anxiety and cognitive performance in international students and provide important implications for university support services tasked with assisting students during times of elevated anxiety. Tailored strategies that address both emotional and motivational factors may help students manage cognitive demands more effectively, and in turn address academic needs. Directions for future research are also discussed.

Keywords: anxiety, attentional control theory, cognitive performance, motivation

Received: June 7, 2025 | **Revised:** July 27, 2025 | **Accepted:** December 10, 2025

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How to Cite (APA): Chu, K. L., Edwards, E. J., & Vaughan, R. S. (2025). Untangling the influence of anxiety and motivation on cognitive performance of international university students. *Journal of International Students*, 16(1), 127-140. <https://doi.org/10.32674/kb71w355>

INTRODUCTION

For international students, the process of studying abroad, adapting culturally and academically to the host country and maintaining and developing social contacts can exacerbate distress (Yun & Greenwood, 2022). Elevated anxiety can compromise the ability to meet academic demands and be the precursor for other mental health issues (Conley et al., 2020). Motivation is another key factor influencing how international students cope with academic demands (Cho et al., 2021; Muthuswamy, 2023), yet its role in buffering anxiety-related cognitive challenges has received limited attention. The current work sought to understand the interrelations between anxiety, motivation and real-world cognitive performance of international students while studying in Australia.

Attentional control theory (Eysenck et al., 2007) proposes that elevated anxiety impairs cognitive processes, such that highly anxious individuals preferentially allocate attentional resources to irrelevant, worrying thoughts at the expense of task performance. The theory suggests that individuals high in trait (dispositional) and state (situational) anxiety become aware of their performance shortfalls and recruit additional cognitive resources to overcome performance deficits. Laboratory research has identified mental effort (Edwards et al., 2015) and motivation (Edwards et al., 2016) as potential buffers against the detrimental effects of anxiety, yet little research has examined whether these findings translate into everyday cognitive tasks.

Literature examining the interplay of anxiety, motivation, and academic performance shows mixed results. For example, Hayat et al. (2018) found that

higher motivation was related to greater academic performance. Yet, Conti (2000) reported no relationship between motivation and academic performance. Given that neither Hayat et al. (2018) nor Conti (2000) captured anxiety, it is possible that differences in their findings might be due to anxiety confounding these results; that is, anxiety influencing motivation and academic performance in different ways.

In other work, Putwain and Symes (2018) examined anxiety, motivational effort and exam performance. They found that greater motivational effort was related to better performance, and higher test anxiety was related to poorer performance. They also noted that motivation moderated the link between anxiety and performance, such that at higher motivation, the positive relationship was weakened, and at lower motivation, the negative relationship was strengthened. Putwain and Symes (2018), however, did not differentiate between trait and state anxiety. Hoshino and Tanno (2017) examined the effects of trait and state anxiety on cognitive performance in a laboratory setting. They found that at lower motivation, highly trait-anxious individuals exhibited poorer performance. They also noted that state anxiety was unrelated to motivation or performance. Hancock (2001) examined trait and state anxiety, motivation and grade point average in university students. They found that for students reporting lower motivation and higher trait anxiety, performing under higher situational stress (state anxiety), demonstrated poorer academic achievement. Putwain and Symes (2018), Hoshino and Tanno (2017) and Hancock (2001), however, captured motivation broadly, whereas research suggests that motivation is both internal (i.e., self-determination, competence, task involvement, curiosity, enjoyment, and interest) and external (i.e., competition, evaluation, recognition, money/incentives, and constraint by others).

In recent work, Wu et al. (2022) examined the link between anxiety, internal and external motivation and English language performance. They found that those reporting lower internal (but not external) motivation and higher anxiety demonstrated poorer performance. Yet, Wu et al., (2022) operationalized anxiety as a single construct rather than separating trait and state dimensions. Majali (2020) investigated the relationship between anxiety (trait and state), motivation (internal and external), and academic performance. Majali's (2020) study affords some useful information on unique relationships, for example, higher trait anxiety and state anxiety (separately) were linked with higher internal motivation and higher academic performance. However, examining any combined relationships was outside the scope of their work.

Taken together, empirical studies suggest a complex interplay between anxiety, motivation, and performance. The existing literature highlights the need for research that simultaneously consider trait and state anxiety, internal and external motivation, and real-world cognitive outcomes. This need is particularly salient for international students, who often experience heightened anxiety due to multiple, overlapping stressors from daily academic demands and acculturation.

The current study aimed to untangle the influence anxiety (trait and state) and motivation (internal and external) on cognitive performance of international students studying in Australia. The findings of this preliminary work can be used

to guide future, larger projects investigating the unique and combined influence of anxiety and motivation on cognitive performance in international students. A nuanced understanding of these relationships has practical implications for developing tailored strategies and psychological support services that enhance students' preparedness and resilience during their studies abroad. The study addressed the following research questions: (i) How do trait and state anxiety separately and interactively affect cognitive performance? (ii) How do internal and external motivation relate to cognitive performance? (iii) Does motivation (internal and external) moderate the relationship between anxiety (trait and state anxiety) and cognitive performance? Following attentional control theory (Eysenck et al., 2007) we predicted that individuals reporting higher trait and state anxiety, would report poorer cognitive performance and that this relationship would be moderated by motivation. We anticipated a similar pattern for internal and external motivation.

METHOD

Participants

A medium-large effect size (Cohen's $f^2 = .20$) was adopted, based on previous research by Edwards et al. (2015, 2016). Using G*Power we estimated the required sample at 114 ($\alpha = .05$, $1-\beta = .95$). One hundred and fifty-three international university students, enrolled at The University of Queensland in Brisbane, Australia, participated. After removing cases where volunteers had not reported their demographic information ($n = 9$; $<5\%$), the final sample comprised 144 participants. Table 1 shows the demographic characteristics of the sample.

Measures

Anxiety

Cognitive trait and state anxiety were measured using the cognitive anxiety subscales of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008). Respondents rated 10 items (e.g., *I think that others won't approve of me*) on a 4-point Likert scale (1 = *not at all* to 4 = *very much so*). Cronbach's alphas in the current sample were State-Cognitive $\alpha = .91$; Trait-Cognitive $\alpha = .92$.

Motivation

Internal and external motivation was indexed using the 30-item Work Preference Inventory (WPI; Amabile et al., 1994). The Internal items (e.g., *I enjoy tackling problems that are completely new to me*) and External items (e.g., *I am strongly motivated by the [grades] [money] I can*) were scored on a 4-point Likert scale (1 = *never or almost never true of me* to 4 = *always or almost always true of me*). Items 1, 9, 14, 16, and 22 were reverse scored. The Cronbach's alphas in the present sample were: Internal $\alpha = .83$; External Motivation $\alpha = .74$.

Cognitive performance

Everyday cognitive performance (perception, memory, and motor function failures) was assessed using the 25-item Cognitive Failures Questionnaire (CFQ; Broadbent et al., 1982). Respondents were asked to indicate how frequently they make every day cognitive mistakes, such as lapses in attention, memory, or action, within the past 6-months (e.g., *Do you read something and find you haven't been thinking about it and must read it again?*) on a 5-point scale (4 = *very often* to 0 = *never*). High scores represent high failures. To aid interpretation, cognitive performance was operationalized as an inverse of the total score (100 – total score on the CFQ). The Cronbach's alpha in the current sample was $\alpha = .93$.

Table 1: Demographic Characteristics of Participants (N = 144)

Characteristic		Male	Female
Age	Range 18-48 years ($M = 26.63$ years; $SD = 5.46$ years)	40	104
Type of Study	Undergraduate	10	24
	Post-graduate coursework	25	72
	Post-graduate research	5	8
Discipline of Study	Business, Economics & Law	12	23
	Engineering, Architecture & Information Technology	10	10
	Health & Behavioural Science	3	11
	Humanities & Social Sciences	6	53
	Medicine	2	2
	Science	7	3
	Did not specify	0	2

Note. M = mean, SD = standard deviation.

Procedure

The study was approved by The University of Queensland's Human Research Ethics Committee (2020/HE001918). Recruitment notices and links to the online questionnaire (www.Qualtrics.com) were posted in international university student groups on Facebook, WeChat, and WhatsApp such as the University of Queensland (UQ) 2025 - International & Exchange Students' Facebook group (approximately 3400 members; membership requires university email and student number verification), a private WeChat group for international postgraduate students (around 150 members), and a WhatsApp group comprising international students (approximately 80 members; invitation-only). Participants provided their informed consent and then completed the questionnaire in English, comprising demographics, followed by the measures of trait and state anxiety (STICSA), the

assessment of internal and external motivation (WPI), and the evaluation of cognitive performance (CFQ), which took approximately 15-minutes.

Design and data analysis

A cross-sectional design was used to capture a snapshot of the interrelations among anxiety, motivation, and cognitive performance in a naturalistic academic context, aligning with the study’s exploratory aim and resource constraints. Separate moderated multiple regression models were created comprising trait anxiety and state anxiety as predictor variables, motivation as the moderator variable, and cognitive performance as the criterion variable. The 2-way interaction terms (trait anxiety x state anxiety, trait anxiety x motivation, state anxiety x motivation), and the 3-way interaction term (trait anxiety x state anxiety x motivation) were formed using mean-centered scores. Analyses were conducted using SPSSv27 and the PROCESS macro v3.5 (Hayes, 2017), using Model #3.

RESULTS

Data diagnostics and assumption checking

No univariate outliers were detected using standardized scores and box plots (z -scores > 3.50). No multivariate outliers were identified using two of the three detection methods: computation of Mahalanobis distance, Cook’s distance, and Leverage values. Assumptions of normality, linearity, homogeneity, and homoscedasticity were satisfactory, and tests for skewness and kurtosis were acceptable. The total data set was retained; $N = 144$.

Preliminary analyses

Means and standard deviations of the predictor and criterion variables are shown in Table 2.

Table 2: Means, Standard Deviations, Zero-order and Inter-correlations between Trait and State Anxiety, Internal and External Motivation and Cognitive Performance ($N = 144$)

	<i>M</i>	<i>SD</i>	TA	SA	IM	EM
Trait Anxiety	20.49	6.69				
State Anxiety	19.70	6.90	.86***			
Internal Motivation	41.15	6.54	.04	.08		
External Motivation	39.62	6.42	.17*	.17*	.28***	
Cognitive Performance	61.39	17.08	-.57***	-.51***	.10	-.15

Note. $p < .001$ ***; $p < .01$ ** , $p < .05$ * EM = External Motivation, IM = Internal Motivation, SA = State Anxiety, TA = Trait Anxiety

Main analyses

Table 3 shows the unstandardized coefficients, t -tests, probabilities, and 95% confidence intervals for cognitive performance in international students.

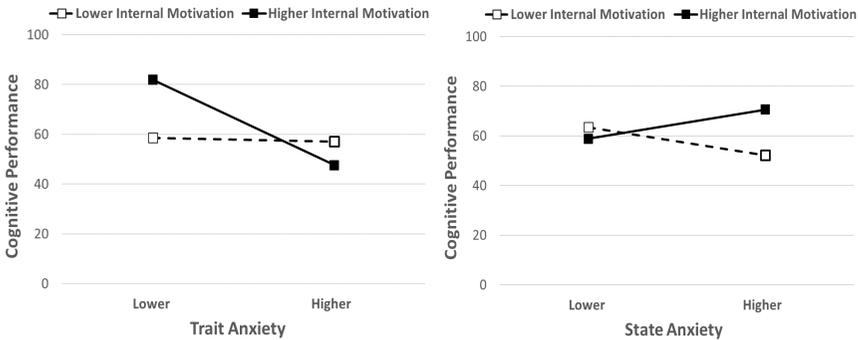
Table 3: Unstandardized Coefficients, *t*-tests, Probabilities and 95% Confidence Intervals for Cognitive Performance (*N* = 144)

	Unstandardized Coefficients				95% Confidence Intervals	
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	Lower Bound	Upper Bound
Internal Motivation						
Constant	61.29	1.52	40.39	.000	58.29	64.29
TA	-1.30	0.36	3.59	.000	-2.02	-0.58
SA	0.02	0.35	0.04	.965	-0.68	0.71
IM	0.53	0.20	2.64	.009	0.13	0.92
TA x SA	0.02	0.03	0.58	.563	-0.04	0.08
TA x IM	-0.18	0.04	4.24	.000	-0.27	-0.10
SA x IM	0.13	0.04	3.04	.003	0.04	0.21
TA x SA x IM	-0.01	0.00	1.49	.140	-0.02	0.00
External Motivation						
Constant	60.94	1.44	42.34	.000	58.09	63.78
TA	-1.13	0.36	3.15	.002	-1.85	-0.42
SA	-0.51	0.35	0.43	.670	-0.85	0.55
EM	0.18	0.23	0.78	.435	-0.27	0.63
TA x SA	0.00	0.02	0.14	.886	-0.04	0.05
TA x EM	-0.02	0.06	0.29	.769	-0.13	0.10
SA x EM	0.07	0.05	1.32	.188	-0.03	0.17
TA x SA x EM	-0.01	0.00	2.48	.014	-0.02	-0.00

Note. EM = External Motivation, IM = Internal Motivation, SA = State Anxiety, TA = Trait Anxiety

Internal motivation

The model for internal motivation accounted for 43% of the variance in cognitive performance, $R = .66$, $R^2\Delta = .02$, $F\Delta (1, 136) = 2.21$, $p = .140$, though the full model was not significant $F(7, 135) = 12.18$, $MSE = 175.87$, $p < .001$. There was a significant main effect of trait anxiety, $b = -1.30$, $t(135) = 3.59$, $p < .001$ and internal motivation, $b = 0.53$, $t(135) = 2.64$, $p = .009$, such that higher trait anxiety and lower internal motivation were associated with lower cognitive performance. These main effects were subsumed by significant 2-way interactions involving trait anxiety x internal motivation, $b = -0.18$, $t(135) = 4.24$, $p < .001$, and state anxiety x internal motivation $b = 0.13$, $t(135) = 3.04$, $p = .003$. The 3-way interaction was not significant, $t(135) = 1.49$, $p = .140$. The pattern of the 2-way interactions is shown in Figure 1.



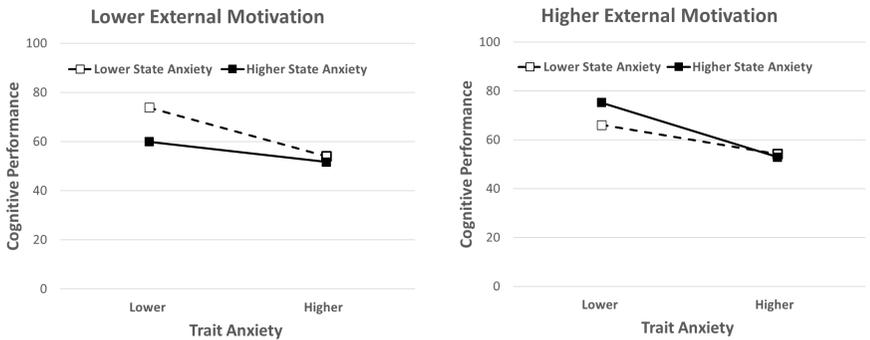
Note. Simple slopes are calculated at ± 1 SD from the mean score on each of high and low values on the predictor variables.

Figure 1: Relationship between Trait and State Anxiety, Internal Motivation, and Cognitive Performance

As shown in the left hand panel, the trait anxiety x internal motivation interaction reflected the fact that there was no relationship between trait anxiety and cognitive performance at lower internal motivation, $b = -0.11$, 95% CI [-0.77, 0.56], $t(135) < 1$, whereas at higher internal motivation, higher trait anxiety predicted lower cognitive performance $b = -2.50$, 95% CI [-3.60, -1.40], $t(135) = 4.48$, $p < .001$. The right-hand panel shows the state anxiety x internal motivation interaction. Tests of simple slopes revealed that at higher internal motivation, there was no relationship between state anxiety and cognitive performance, $b = -0.85$, 95% CI [-0.21, 1.90], $t(135) = 1.59$ $p = .115$, whereas at lower internal motivation, higher state anxiety was associated with lower cognitive performance, $b = -0.82$, 95% CI [-1.47, -0.17], $t(135) = 2.48$, $p = .014$.

External motivation

The model for external motivation accounted for 37% of the variance in cognitive performance, $R = .61$, $R^2\Delta = .04$, $F\Delta (1, 136) = 6.15$, $p = .014$ and the full model was significant $F(7, 234) = 19.36$, $MSE = 181.13$, $p < .001$. There was a significant main effect of trait anxiety, $b = -1.13$, $t(136) = 3.15$, $p = .002$, such that higher trait anxiety was associated with lower cognitive performance. This main effect was further qualified by a 3-way interaction, $b = -0.01$, $t(136) = 2.48$, $p = .014$. The pattern of the 3-way interaction is shown in Figure 2.



Note. Simple slopes are calculated at ± 1 SD from the mean score on each of high and low values on the predictor variables.

Figure 2: Relationship between Trait and State Anxiety, External Motivation, and Cognitive Performance

As can be seen in the left panel, at lower external motivation, higher trait anxiety was associated with lower cognitive performance at lower state anxiety, $b = -1.45$, 95% CI [-2.36, -0.54], $t(136) = 3.14$, $p = .002$ but not higher state anxiety, $b = -0.60$, 95% CI [-1.51, 0.31], $t(136) = 1.30$, $p = .196$. The right panel shows, at higher external motivation, higher trait anxiety was a significant predictor of lower cognitive performance at higher state anxiety, $b = -1.62$, 95% CI [-2.75, -0.49], $t(136) = 2.84$, $p = .005$, but not at lower state anxiety, $b = -0.86$, 95% CI [-2.28, 0.55], $t(136) = 1.21$, $p = .230$.

DISCUSSION

We predicted that international students reporting higher trait and state anxiety would reveal poorer cognitive performance and that this relationship would be moderated by motivation. We found partial support for our hypothesis. For those who reported higher internal motivation, our data revealed that higher trait anxiety predicted lower cognitive performance, yet for those lower in internal motivation, higher state anxiety was associated with lower cognitive performance. For external motivation, our predictions were fully supported. We noted a moderating effect of external motivation, such that for those lower in external motivation, higher trait anxiety was associated with lower cognitive performance, but not higher state anxiety. Nevertheless, at higher external motivation, higher trait anxiety was linked to lower cognitive performance, but not at lower state anxiety.

Given numerous methodological differences, reconciling our findings with other work was difficult. We found partial alignment with Hayat et al., (2018) who reported that higher motivation was related to greater academic performance. Although, this was only the case in our sample for those who reported lower trait anxiety. Our results had some similarities with Conti (2000) who found no relationship between motivation and academic performance. That is, our zero-order correlations between motivation and cognitive performance were non-significant. However, with the introduction of anxiety in our regression model, a moderating relationship became evident. Our results highlighted the importance of examining combined relationships rather than relying solely on bivariate associations.

Despite differences in measurements of the constructs, we found a similar pattern of results to Putwait and Symes (2018) who found that lower motivation and higher anxiety were associated with poorer cognitive performance. Our results also broadly concurred with Hancock (2001) who found higher (trait and state) anxiety and lower motivation were associated with poorer performance. Regardless of differences in setting (laboratory vs. real-world), our results agreed with Hoshino and Tanno (2017) who noted that at lower motivation, highly trait-anxious individuals exhibited poorer performance. Nonetheless, our data aligned with Putwin and Symes (2018), Hancock (2001) and Hoshino and Tanno (2017) only for those who reported higher state anxiety in the case of lower internal motivation, and higher trait and state anxiety in the case of lower external motivation.

Our findings partly concurred with studies that delineated internal and external motivation. Our results were in accord with Wu et al., (2022) even though they examined anxiety as a single construct. However, our findings did not completely align with Majali (2020). Our results were conceptually alike, such that higher trait and state anxiety was associated with greater cognitive performance, however we did not agree that trait and state anxiety was related to higher internal motivation. It is likely that the findings from our moderation models hold the key to explaining these differences. Specifically, it is not as simple as examining separate relationships because it seems there is a complex interplay between affective and motivational factors which shape cognitive and academic performance.

Importantly, we found a differential pattern of results for internal versus external motivation. That is, at higher internal motivation, higher trait anxiety predicted poorer cognitive performance, whereas at lower internal motivation, higher state anxiety predicted poorer cognitive performance. In contrast, our results for external motivation were in line with our hypotheses and attentional control theory (Eysenck et al., 2007). For those who reported lower external motivation, we found no relationship between high trait and state anxiety and cognitive performance. However, in the presence of higher external motivation, students who reported elevated trait and state anxiety also reported poorer cognitive performance. Furthermore, our data supports the idea that motivation could be one of the *additional cognitive resources* that anxious individuals recruit to avoid performance shortfalls, as specified by attentional control theory

(Eysenck et al., 2007). Furthermore, it is plausible that studying abroad, albeit during COVID-19, may represent the stressful state or situation to trigger high trait-anxious international students to experience the curvilinear relationship described by Yerkes Dodson (1908). That is, at mid-levels of arousal and/or stress, performance peaks, but when stress levels are too high, performance decreases sharply much like a ‘crash and burn’. Given the limitations with the cross-sectional design used here, such a casual explanation warrants further investigation.

The present work has its shortcomings, such as a small sample and well-known limitations with a cross-sectional design. However, we hope our preliminary findings will become the catalyst for further research. Future research should employ longitudinal or experimental designs to better establish causal relationships between anxiety, motivation, and cognitive performance. For example, studies with larger and more diverse samples, including students from different cultural backgrounds, academic disciplines, and institutional contexts would enhance generalizability and clarify the stability of these effects across populations. Research could also explore how support strategies tailored to students’ motivational profiles may influence both emotional well-being and academic outcomes.

In conclusion, our findings demonstrate that internal and external motivation in international students buffers the relationship between anxiety and performance on daily cognitive tasks in different ways. For internal motivation, state anxiety (i.e., situational experience of anxiety) but not trait anxiety (i.e., general predisposition to experience anxiety) was related to cognitive performance, such that lower internal motivation was linked to poorer performance, for those who reported higher state anxiety. For external motivation, state and trait anxiety combined to predict cognitive performance, specifically, higher external motivation was related to poorer cognitive performance for those who reported elevated state and trait anxiety. The present results have practical implications for university support services, who should be mindful that international students driven by external motivation such as grades and praise may be particularly vulnerable to anxiety-related cognitive difficulties. Strategies targeting anxiety alongside motivation may help improve students' academic performance and daily cognitive functioning.

Ethical considerations

The study was approved by the University of Queensland Human Research Ethics Committee (2020/HE001918). All procedures were in accordance with the ethical standards of the 1964 Helsinki Declaration. Written informed consent was obtained from all human participants.

Declaration of conflicting interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding statement

The authors have no funding to disclose.

Acknowledgment

No Artificial Intelligence (AI) tools were used in the preparation of this manuscript.

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