Test Anxiety, Emotional Regulation, and Cognitive Performance: Moderating Effects of Mindfulness Practices Among Senior Secondary School Students in Owerri Municipal

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Abstract
Academic examinations may provoke anxiety that interferes with students' emotional regulation and cognitive functioning. This study examined the relationship between test anxiety and cognitive performance, the mediating roles of cognitive reappraisal, expressive suppression, and the moderating effect of mindfulness among secondary school students in Owerri Municipality of Imo State. The study drew from Attentional Control Theory, and Process Model of Emotion Regulation Theory, using a cross-sectional correlational design. Population of the study comprised of 6,420 SS2 and SS3 students in 10 public secondary schools in Owerri Municipal-. Of which 400 students were selected for sampling through proportionate stratified random sampling technique, 388 valid responses representing 97.0% were analysed. Data were collected using instruments titled: Test Anxiety Inventory (TAI), the Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA), the Child and Adolescent Mindfulness Measure (CAMM), and a standardized Working Memory and Analytical Processing Battery. Descriptive statistics, Pearson correlation, and Hayes' PROCESS Macro Models 4 and 7 were used for the study at .05 significance level. Analysis showed that test anxiety was negatively correlated with cognitive performance ($r = -.49$, $p < .001$) and had a significant negative direct effect ($B = -0.362$, $p < .001$). Cognitive reappraisal showed an indirect effect of $B = -0.183$, 95% CI -0.247, -0.126 while expressive suppression was $B = -0.067$, 95% CI -0.115, -0.025 showing significantly mediated relationship, jointly accounting for 40.85% of the total effect. Mindfulness moderated the paths from test anxiety to reappraisal (interaction $B = 0.011$, $p < .001$) and suppression ($B = -0.008$, $p = .001$); the index of moderated mediation was significant. The findings suggest that mindfulness buffers adverse emotional-regulatory effects of test anxiety on cognitive performance. The study therefore recommends that schools should integrate mindfulness and cognitive reappraisal activities into guidance and counselling programmes.

Keywords: *Test anxiety, emotional regulation, cognitive performance, mindfulness practices, adolescents*

Introduction

Evaluation is the primary mechanism for educational certification, career placement, and social mobility globally, yet testing frequently triggers intense psychological distress among adolescents. In psychological context, test anxiety is a multidimensional constellation of phenomenological, physiological, and behavioral responses accompanying concerns about possible negative consequences or failure on an evaluative task. As educational psychological concept, test anxiety has become a potent barrier to optimal academic functioning (von der Embse et al., 2018; Putwain et al., 2021). Across secondary school systems worldwide, evaluative stress peaks during upper secondary education when examination outcomes dictate university admission and future vocational trajectories (Dundas & Nygård, 2024). While moderate arousal can facilitate task vigilance, elevated test anxiety induces intrusive worry, somatic tension, and cognitive interference that systematically degrade intellectual output even among well-prepared learners. In secondary schools, examination-related psychological pressure is always acute. Students in Nigeria often times navigate through assessment-driven educational landscapes dominated by either internal terminal examinations or external credentialing tests administered by either the West African Examinations Council (WAEC), the National Examinations Council (NECO), or the Joint Admissions and Matriculation Board (JAMB). The educational authorities and public policy makers in Nigeria do not help matters. Public secondary schools in urban centres like Owerri Municipal are frequently characterized by large class sizes, constrained instructional resources, heightened peer competition, and intense familial and societal expectations linking examination grades to personal worth and economic survival. Consequently, students experience chronic evaluative apprehension that often manifests as cognitive blocking, somatic distress, academic procrastination, and maladaptive coping behaviours. According to Ekeamadi (2024), the cognitive consequences of test anxiety are especially important because examinations require students to coordinate several mental operations within limited periods. Learners must understand instructions, retrieve previously acquired information, select relevant strategies, monitor their progress, and inhibit distracting responses. These activities depend substantially on working memory and executive attention. When a student repeatedly thinks about the possibility of failure, parental disappointment, or public embarrassment, part of the limited capacity available for the examination task is occupied by self-focused worry. The student may therefore know the material but still struggles to organize and retrieve the information efficiently. This distinction between knowledge acquisition and performance under pressure helps explain why examination outcomes do not always represent the full extent of a learner's competence. This is why Eysenck et al. (2017) argued that anxiety can reduce processing efficiency by diverting attention from task-relevant goals, even when the individual eventually produces a correct response. von der Embse et al., (2018) have indicated that the negative correlation between test anxiety and academic performance of students is neither uniform nor strictly direct. Rather, the cognitive toll of test anxiety depends heavily on the regulatory mechanism’s students deploy to manage affective arousal during evaluative encounters. Emotional regulation comprising the cognitive and behavioural processes through which individuals monitor, evaluate, and modify the intensity and trajectory of emotional experiences, serves as a pivotal psychological bridge between anxiety and cognitive execution. Adaptive strategies such as cognitive reappraisal allow students to reframe evaluative threats as manageable challenges, preserving working memory capacity, whereas maladaptive strategies such as expressive suppression, and rumination exacerbate cognitive interference (Debra et al., 2024).

This assertion aligns with Dundas & Nygård, (2024) emphasis that mindfulness weakens the extent to which test anxiety disrupts emotional regulation, thereby protecting cognitive performance under pressure. However, it is necessary to stress that the relationship between anxiety and performance is not necessarily linear or identical for every learner. This is because a manageable level of concern may encourage preparation, punctuality, and vigilance, whereas persistent and intense worry can become disruptive. The distinction is important in school settings because ordinary examination nervousness should not automatically be treated as a clinical problem (Pekrun, 2016). The intensity, duration, frequency, and functional consequences of anxious reactions are more informative than the mere presence of nervousness. Students who experience occasional apprehension but remain able to concentrate may require reassurance and effective study guidance; those whose worry repeatedly interferes with sleep, attendance, recall, or participation may need more structured support. When examinations are considered extremely important but personal control is perceived as low, anxiety may become particularly pronounced. To address this gap students, need to be aware that anxiety many affect performance. This study examines how emotional regulation mediates the link between test anxiety and cognitive performance, and whether mindfulness practices moderate this affective pathway among public senior secondary school students in Owerri Municipal.

Objectives of the Study

The broad objective of this study is to examine the relationships between test anxiety, emotional regulation, mindfulness practices, and cognitive performance among senior secondary school students in Owerri Municipal. Its specific objectives are to:

1. Determine the relationship between test anxiety and cognitive performance among senior secondary school students in Owerri Municipal.
2. Examine the mediating role of emotional regulation on test anxiety and cognitive performance among senior secondary school students in Owerri Municipal.
3. Evaluate the moderating effect of mindfulness practices on test anxiety, emotional regulation, and on cognitive performance among senior secondary school students in Owerri Municipal.

Research Questions

To guide the investigation, the following research questions were formulated:

1. What is the relationship between test anxiety and cognitive performance among senior secondary school students in Owerri Municipal?
2. To what extent does emotional regulation mediate on test anxiety and cognitive performance among senior secondary school students in Owerri Municipal?
3. How do mindfulness practices moderate test anxiety, emotional regulation, and cognitive performance among senior secondary school students in Owerri Municipal?

Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

$H0_1$: There is no significant relationship between test anxiety and cognitive performance among senior secondary school students in Owerri Municipal.

$H0_2$: Emotional regulation does not significantly mediate test anxiety and cognitive performance among senior secondary school students in Owerri Municipal.

$H0_3$: Mindfulness practices do not significantly moderate test anxiety, emotional regulation, and cognitive performance, among senior secondary school students in Owerri Municipal.

Literature Review

Conceptualizing Test Anxiety in Adolescence

Putwain et al., (2021) have conceptualized test anxiety as a situation-specific personality trait and transient emotional state characterized by heightened cognitive worry, emotionality, and physiological hyperarousal in evaluative settings. According to von der Embse et al., (2018) contemporary multidimensional frameworks distinguish between cognitive components and affective-physiological components, whereas cognitive components comprise task-irrelevant worry, self-deprecatory rumination, and perceived cognitive interference, affective-physiological components comprise autonomic tension, accelerated heart rate, and somatic discomfort. In child developmental psychology, the periods from middle-to-late adolescence, there is rapid neurodevelopmental maturation of prefrontal-limbic circuitry in adolescents, this coincides with heightened sensitivity to peer comparison and social evaluation among children that could render secondary school students, particularly the vulnerable ones, to evaluative threat (Dundas & Nygård, 2024). Also in their studies, von der Embse et al. (2018) established that test anxiety exhibits a consistent negative association with standardized test scores, grade point averages, and domain-specific academic performance across educational levels, with cognitive worry exerting the strongest deleterious effect. Similarly, Putwain et al. (2021) also demonstrate that while test anxiety is psychometrically distinct from generalized anxiety disorder and panic disorder, elevated test anxiety substantially compromises school-related psychological well-being and academic performance. This is in alliance with the views held in Ekeamadi (2024) that examination in Nigeria, especially external terminal ones, such as; WAEC, NECO, and JAMB are very high-stakes for secondary school students, so it comes with high level of anxiety and fear, leading to working memory overload, retrieval failure, and diminished academic self-efficacy. Test anxiety may also be understood through the distinction between worry and emotionality. Whereas worry refers to repetitive thoughts about failure, consequences, personal inadequacy, and the evaluation of one's performance. Emotionality refers to perceived physiological reactions such as muscular tension, sweating, rapid heartbeat, and stomach discomfort. These dimensions can interact: bodily arousal may be interpreted as evidence that a student is unprepared, while negative thoughts can intensify physical discomfort. The interaction may create a feedback cycle in which attention shifts from the examination task to monitoring signs of anxiety. In this way, the learner becomes occupied with managing the experience of being anxious rather than applying knowledge to the task. The distinction also suggests that interventions should not rely on a single technique. Cognitive strategies may be required to address catastrophic predictions, while breathing and relaxation exercises may help students respond to physiological arousal.

Emotional Regulation as a Mediating Mechanism

Emotional regulation encompasses the intrinsic and extrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, particularly their intensive and temporal features, to accomplish personal goals (Gross, 1998). Within educational contexts, students routinely encounter frustration, fear of failure, and evaluative tension that must be regulated to sustain cognitive engagement. Two primary regulatory strategies dominate adolescent psychological research: cognitive reappraisal, an antecedent-focused strategy involving the cognitive reframing of an emotion-eliciting situation to alter its emotional impact, and expressive suppression, which is a response-focused strategy involving the conscious inhibition of outward emotional expression once an emotional state is already underway (Gross,

1998). A recent study by Debra et al. (2024) underscores that emotional regulation operates as a critical intermediary linking evaluative anxiety to cognitive and academic outcomes. Debra et al. Through ecological momentary assessment they carried out in adolescents, they demonstrate that individual differences in cognitive control and affective inhibition shape the deployment of adaptive versus maladaptive regulation strategies in daily life, with maladaptive rumination amplifying negative effect. When test-anxious students lack cognitive reappraisal skills and default to expressive suppression or catastrophic rumination, regulatory effort itself depletes finite executive resources. Consequently, emotional dysregulation functions as a behavioural and cognitive conduit through which test anxiety impairs working memory updating, complex problem-solving, and examination performance. The process through which emotional regulation influences cognitive functioning can be explained by considering the timing and cognitive demands of different strategies. Cognitive reappraisal occurs before an emotional response is fully developed or while it is emerging. A student may reinterpret an examination as an opportunity to demonstrate learning, regard a difficult question as a problem to be approached systematically, or remind himself that one assessment does not determine his entire future. Such reframing does not deny the importance of examinations; it changes the meaning assigned to the situation and may reduce the intensity of the emotional response. Expressive suppression, in contrast, involves inhibiting the outward display of an emotion after it has arisen. A student who attempts to conceal visible fear may continue to experience internal arousal while also expending effort to control facial expression, speech, or bodily reactions. Gross (2015) emphasizes that regulatory strategies differ in their antecedents, consequences, and implications for well-being.

The distinction between regulation and suppression should not be interpreted as suggesting that every instance of emotional restraint is harmful. In a classroom or examination hall, students may reasonably regulate outward expressions to avoid disrupting others. The concern arises when concealment becomes the dominant response and prevents the learner from acknowledging, understanding, or appropriately addressing emotional distress. Likewise, cognitive reappraisal is not automatically effective in every circumstance. Reframing requires a degree of flexibility and may be difficult when a student faces severe preparation gaps, inadequate resources, or repeated experiences of failure. Effective regulation therefore involves selecting strategies that fit the situation rather than applying one technique indiscriminately. For this study, cognitive reappraisal and expressive suppression provide two measurable dimensions through which the regulatory pathway between test anxiety and cognitive performance can be examined.

Mindfulness Practices as a Protective Moderator

Dundas & Nygård, (2024) conceptualize Mindfulness as a metacognitive state and trainable disposition characterized by intentional, sustained attention to present-moment experiences, this include thoughts, bodily sensations, and affective states approached with openness, curiosity, and non-judgmental acceptance. Rather than attempting to forcibly suppress anxious thoughts that frequently triggers paradoxical rebound effects, mindfulness cultivates decentering or cognitive defusion, enabling students to observe test-related worries as transient mental events rather than objective truths requiring immediate defensive reaction. Studies in adolescent psychology highlight the protective role of mindfulness against evaluative distress. Dundas and Nygård (2024) state that mindfulness practices attenuate negative self-evaluation, self-judgment, and pre-examination anxiety by interrupting automatic emotional reactivity at the attentional deployment stage. On the other hand, dispositional mindfulness enhances cognitive reappraisal capacity and

reduces reliance on energy-draining expressive suppression. Mindfulness operate through several connected processes that are relevant to examination settings. First, attentional awareness enables students to notice when their thoughts have moved from the examination question to imagined failure or anticipated criticism. Second, non-judgmental acceptance reduces the tendency to interpret anxious feelings as proof of incompetence. Third, decentering allows students to recognize that thoughts are mental events rather than facts that must dictate behaviour. These processes create a brief psychological space in which a student can choose a more constructive response, such as returning to the question, slowing their breathing, or applying a learned problem-solving strategy. Mindfulness, however should not be taken to be equivalent to positive thinking, distraction, or the elimination of all uncomfortable emotions. Rather, it concerns a changed relationship with present experience and may help learners respond to anxiety without becoming completely absorbed by it. Dunning et al. (2019) present that in school practice, mindfulness exercises should be brief, age-appropriate, culturally responsive, and presented as optional skills for attention and emotional awareness rather than as a replacement for educational counseling, or teaching support.

Theoretical Framework

This study draws from two complementary psychological theories: Attentional Control Theory as developed by Eysenck et al., in (2007), and the Process Model of Emotion Regulation Theory as developed by Gross, in (1998).

- **Attentional Control Theory**

The attentional control theory was developed to explains how anxiety impairs cognitive performance by disrupting the balance between the goal-directed otherwise called "top-down" attentional system and the stimulus-driven referred to as "bottom-up" attentional system. Anxiety increases the influence of the stimulus-driven system while weakening the goal-directed system, rendering anxious individuals highly susceptible to attentional capture by internal threat cues such as worry thoughts and external distractors. The theory explains why test anxiety primarily impairs processing efficiency (cognitive effort) before performance effectiveness (accuracy) by disrupting working memory updating, inhibition, and shifting. Relevance of this theory to the present study lies in its explanation of the mechanism through which anxiety competes with task-focused cognition. The theory identifies three executive functions that are especially important: inhibition, shifting, and updating. Inhibition concerns the capacity to resist dominant but irrelevant responses; shifting involves moving attention flexibly between tasks or mental sets; and updating concerns the monitoring and replacement of information held in working memory. During an examination, an anxious student may find it difficult to inhibit intrusive thoughts about failure, shift attention away from perceived threat, or update working memory with information needed to solve a problem. These difficulties may increase the effort required to complete a task and reduce the efficiency with which cognitive resources are used. In this study, this theory, Attentional Control Theory underpins Hypothesis 1 and the direct pathway of the study.

- **Process Model of Emotion Regulation Theory**

This theory posits that emotions unfold dynamically over time through a generative sequence involving situation, attention, appraisal, and response. Regulatory strategies are categorized into antecedent-focused strategies such as cognitive reappraisal, and response-focused strategies such as expressive suppression. Cognitive reappraisal intervenes early and efficiently without heavy

cognitive load, whereas expressive suppression intervenes late, requiring continuous inhibitory effort that consumes working memory resources and elevates physiological arousal.

Relevance of Process Model of Emotion Regulation Theory in this study is that it complements cognitive explanation by specifying how students may influence the emotional response that accompanies an evaluative situation. The model proposes that regulation can occur through situation selection, situation modification, attentional deployment, cognitive change, and response modulation. Cognitive reappraisal is located at the cognitive-change stage, whereas expressive suppression is an example of response modulation. In a school examination context, a student may prepare a realistic revision timetable, seek clarification from a teacher, direct attention to the question, reinterpret nervousness as manageable, or attempt to hide visible anxiety. These responses occur at different points in the emotional process and may have different cognitive costs. The model thus provides a framework for explaining why the strategies used to regulate anxiety may partly account for the relationship between anxiety and cognitive performance. This framework directly underpins the mediating mechanism (Hypothesis 2) and moderating interaction (Hypothesis 3). Together, the two theories produce a coherent foundation for this study.

Methodology

This study adopted a cross-sectional correlational. The design enabled simultaneous measurement of naturally occurring psychological traits, regulatory dispositions, and cognitive performance indicators across a large adolescent sample.

Area of the Study

The study was conducted in Owerri Municipal Council of Imo State. As the urban administrative and educational hub of Imo State, Owerri Municipal Council Area contains a concentrated network of public secondary schools with uniform administrative structures.

Population and Sample

Population of this study comprised all 6,420 (SS2) and (SS3) students across the 10 public secondary schools in Owerri Municipal. A sample size of 400 participants was used. This was determined using Taro Yamane's formula and proportionate stratified random sampling technique was adopted in selecting the sample. (See table 1 below for the population and sample of the study).

Table 1: Population Distribution and Sample Allocation Across the Public Secondary Schools in Owerri Municipal.

S/N	Name of Schools	Type of School	SS2 & SS3 Pop.	Proportion (%)	Sample Quota
1	Government Secondary School, Owerri	Boys	980	15.26	61
2	Holy Ghost College, Owerri	Boys	860	13.40	54
3	Emmanuel College, Owerri	Co-ed	790	12.31	49
4	Owerri Girls Secondary School, Owerri	Girls	820	12.77	51
5	Ikenegbu Girls Secondary School, Owerri	Girls	740	11.53	46
6	Urban Development Secondary School, Owerri	Co-ed	560	8.72	35

7	City School, Owerri	Co-ed	490	7.63	31
8	Boys Secondary School, New Owerri	Boys	430	6.70	27
9	Comprehensive Development Secondary School	Co-ed	410	6.39	25
10	Young Scientists College, Owerri	Co-ed	340	5.30	21
	Total	—	6,420	100.00	400

Instrumentation:
Data were gathered using a structured questionnaire capturing demographics, the Test Anxiety Inventory (TAI), the Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA), the Child and Adolescent Mindfulness Measure (CAMM), and a standardized Working Memory and Analytical Processing Battery. Pilot testing established strong internal consistency using Cronbach's alpha coefficients at .78 to .87.

Ethical Considerations & Data Analysis:
Approval was obtained from Imo State Secondary School Education Management Board (SEMB), and school principals of each of the schools. 388 valid respondents out of the 400 representing 97.0% were retrieved and analyzed using descriptive statistics, Pearson product-moment correlations, and Hayes' PROCESS Macro (Models 4 and 7) for parallel mediation and moderated mediation analyses at alpha = .05.

Results
Participants in this study include both boys and girls. Demographically, out of the 388 valid respondents, 184, making 47.4% of the figure were buys and 204, making 52.6% of the figure were girls. Ages are from 14-19 years, Mean is = 16.38, Standard Deviation (SD) is = 1.14). Regarding class distribution, 206, making 53.1% of the figure were in SS2 and 182, making 46.9% were in SS3. (See table below for descriptive statistics and zero-order Pearson correlations among the study variables).

Table 2: Descriptive Statistics and Zero-Order Pearson Correlation Matrix Among Study Variables

Variables	M	SD	1	2	3	4	5
1. Test Anxiety	54.62	11.45	—				
2. Cognitive Reappraisal	19.84	4.72	-.41	—			
3. Expressive Suppression	13.56	3.68	.37	-.26	—		
4. Mindfulness Practices	23.40	6.85	-.44	.48	-.35	—	
5. Cognitive Performance	58.15	14.30	-.49	.52	-.34	.46	—

Note. N = 388. p < .001 (two-tailed).

Hypothesis Testing:
$H0_1$ (Direct Relationship): Test anxiety exhibited a significant negative correlation and direct effect on cognitive performance (r = -.49, direct effect B = -0.362, p < .001), leading to the rejection of $H0_1$.
$H0_2$ (Mediation Analysis): Parallel mediation analysis indicated that cognitive reappraisal (indirect effect B = -0.183, 95% CI [-0.247, -0.126]) and expressive suppression (indirect effect B = -0.067, 95% CI [-0.115, -0.025]) significantly mediated the relationship between test anxiety

and cognitive performance, accounting for 40.85% of the total effect. $H0_2$ was rejected.
$H0_3$ (Moderated Mediation): Hayes PROCESS Model 7 revealed that mindfulness practices significantly moderated the first-stage paths (Interaction B = 0.011, p < .001 for reappraisal; B = -0.008, p = .001 for suppression). The index of moderated mediation was significant. Among students with high mindfulness, the negative effect of test anxiety was neutralized, whereas among those with low mindfulness, test anxiety severely impaired emotional regulation and cognitive performance. $H0_3$ was rejected.

Discussion of Findings

The findings of this study show the cognitive-affective pathways linking evaluative anxiety to intellectual functioning among students in Owerri Municipal. First, the inverse relationship between test anxiety and cognitive performance (r = -.49) corroborates the meta-analytic synthesis by von der Embse et al. (2018) and aligns with Putwain et al. (2021). Interpreted through Eysenck et al.'s (2017) Attentional Control Theory. This showed that high-stake examinations of secondary school students such as WAEC, NECO, and UTME trigger bottom-up threat capture, depleting working memory and processing efficiency.
Second, emotional regulation partially mediated this relationship (40.85% of total effect), supporting Gross's (1998) Process Model. Students relying on expressive suppression rather than cognitive reappraisal suffer dual cognitive depletion.
Third, mindfulness practices served as a robust moderator, buffering against emotional dysregulation and preserving cognitive performance among highly mindful students, mirroring findings by Dundas and Nygård (2024).

Conclusion

Test anxiety compromises cognitive performance among senior secondary school students in Owerri Municipal by eroding cognitive reappraisal and triggering expressive suppression. Dispositional mindfulness practices buffer this debilitating affective pathway, preserving executive cognitive functioning under evaluative stress. Thus, this study integrates Attentional Control Theory and the Process Model of Emotion Regulation. Practically, school guidance counselors should screen students for test anxiety and provide mindfulness and emotion-regulation training.

Recommendations:

Based on the findings of this study, the following recommendations are offered:
1) The State Secondary Education Management Board (SEMB) should integrate structured mindfulness exercises into weekly guidance periods across the 10 public secondary schools in Owerri Municipal prior to exams.
2) Guidance counselors should conduct cognitive reappraisal workshops for SS2 and SS3 students on rgular basis.
3) Teachers should adopt anxiety-reducing formative assessment practices to minimize evaluative threat on students

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