Academic Stress and Statistical Achievement: A Study of University Students in Khyber Pakhtunkhwa, Pakistan

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Abstract
This study investigated the level of academic stress and its relationship with statistical achievement among undergraduate students enrolled in statistics courses across higher education institutions in Khyber Pakhtunkhwa (KP), Pakistan. A sample of 600 students was drawn using stratified random sampling from public and private universities and colleges. Data were collected using a standardized academic stress scale and course performance scores. Descriptive statistics revealed that students experienced moderately elevated stress levels (M = 3.22, SD = 0.62) and an average performance score of 71.4 (SD = 9.8). A one-sample t test confirmed that stress was significantly higher than the neutral midpoint (t(599) = 8.70, p < .001). Independent-samples t tests and ANOVA results indicated that public-sector students reported higher stress and lower performance compared to private-sector students, with significant differences across institution types. Post hoc comparisons further showed that private universities and colleges consistently outperformed public institutions. Regression analysis demonstrated a significant negative relationship between academic stress and performance (β = −2.10, p < .001), with stress remaining a predictor even after controlling for sector, institution type, and gender. These findings highlight the importance of addressing academic stress as a determinant of student achievement, particularly in public institutions, and suggest the need for targeted interventions to improve learning environments and student support systems.
Keywords: Academic stress; Statistics achievement; Higher education; Public vs. private institutions; Khyber Pakhtunkhwa; Regression analysis; ANOVA; Undergraduate students

Introduction
Academic stress has emerged as one of the most critical challenges faced by students in higher education worldwide. Stress is often defined as the body's response to academic demands that

exceed an individual's coping resources (Lazarus & Folkman, 1984). In higher education, students encounter multiple stressors such as examinations, assignments, workload, and expectations from teachers and parents. These stressors can significantly influence students' learning outcomes and overall academic performance.

Statistics, as a subject, is particularly associated with high levels of anxiety and stress among students. Research indicates that statistics anxiety is a common phenomenon in higher education, often leading to reduced confidence, avoidance behaviors, and poor academic achievement (Onwuegbuzie & Wilson, 2003). For students in Khyber Pakhtunkhwa (KP), Pakistan, the challenge is compounded by contextual factors such as limited resources, large class sizes, and exam-oriented teaching practices. Understanding the relationship between academic stress and performance in statistics is therefore crucial for improving teaching strategies and student support systems in KP's higher education institutions.

Academic Stress in Higher Education

Academic stress is widely recognized as a critical factor influencing student learning and achievement. Lazarus and Folkman (1984) defined stress as the psychological and physiological response to demands that exceed an individual's coping resources. In higher education, students face multiple stressors such as examinations, assignments, workload, and expectations from teachers and parents. Misra and McKean (2000) found that academic stress is strongly associated with anxiety, poor time management, and reduced satisfaction with academic life.

In Pakistan, stress has become an integral part of students' academic life due to cultural expectations, financial constraints, and institutional pressures. A study by Akhter and Iqbal (2021) reported that undergraduate students in Pakistani universities experience stress from multiple sources, including academic workload, financial challenges, and performance expectations, all of which negatively affect their academic outcomes.

Stress and Student Performance

The relationship between stress and performance has been explained through the **Yerkes Dodson Law (1908),** which suggests that moderate stress can enhance performance, but excessive stress impairs it. Putwain (2007) highlighted that test anxiety and stress are negatively correlated with academic achievement, particularly in subjects perceived as difficult. Similarly, Onwuegbuzie and Wilson (2003) emphasized that statistics anxiety is a common phenomenon in higher education, often leading to avoidance behaviors and poor performance.

In the Pakistani context, studies confirm that academic stress significantly influences student performance. For example, Iqbal (2021) found that stress negatively impacted students' grades and overall satisfaction with their academic programs. These findings underscore the importance of managing stress to improve learning outcomes.

Statistics as a Stress-Inducing Subject

Statistics is often considered one of the most challenging courses in higher education. Research shows that students experience high levels of anxiety when dealing with quantitative reasoning, formulas, and data analysis (Onwuegbuzie & Wilson, 2003). Statistics anxiety has been linked to lower confidence, reduced motivation, and poor academic performance. In KP, where many students come from diverse educational backgrounds with limited exposure to advanced mathematics, statistics courses are particularly stressful.

Local studies in Pakistan have highlighted similar concerns. Students often report statistics as a subject that requires extensive effort and induces significant stress, which in turn affects their performance. This makes statistics an ideal subject for examining the relationship between academic stress and achievement.

Comparison of Public and Private Sector Institutions in Statistical Achievement

In Australia, Public and Private school and universities students were compared using international and national test results, one group of studies has used the results of Program for International Student Assessment to compare the results of students in public and private schools and universities. The 2012 national Program for International Student Assessment report shows that there was no significant difference between the results of public and private universities and schools, in statistics, mathematics and science subject reading (Thomson, De Bortoli, & Buckley, 2013).The national results from Program for International Student Assessment 2009 also showed no significant difference exist between public and private sector schools and universities (Thomson, De Bortoli, Nicholas, Hillman, & Buckley, 2010). The results for Australia, and many other countries, indicate that socio-economic differences have a much larger impact on student achievement. For example, 56 per cent of the total variation in mathematics and statistics achievement in Program for International Student Assessment 2012 was explained by socio-economic differences between schools and six per cent by socio-economic differences between students within schools (Thomson, De Bortoli, & Buckley, 2013). Research work on this particular aspect of investigation and **Analyzing Data, the Aspect of statistical** thinking ability and its relation with statistical achievement is rare. Therefore, to inquire about the problem of low achievement, the relationship between **Analyzing Data aspect of** statistical thinking and statistical achievement was focused on this study with further comparison of gender-wise and sector wise among university students in Khyber Pakhtunkhwa, Pakistan.

Research Gap

While international literature has extensively examined the impact of academic stress on student performance, limited research exists in Pakistan, particularly in KP, focusing on statistics courses. Most local studies address general academic stress but do not specifically analyze its effect on performance in quantitative subjects. This study aims to fill that gap by investigating the relationship between academic stress and student performance in statistics among higher education students in KP.

Problem Statement

Despite the growing recognition of academic stress as a determinant of student success, limited research has been conducted in Pakistan, particularly in KP, to explore its impact on performance in statistics courses. Statistics is a compulsory subject in many degree programs, yet students often perceive it as difficult and stressful. This study seeks to address this gap by examining whether academic stress significantly affects student performance in statistics at the higher education level in KP.

Objectives of the Study

1. To measure the level of academic stress among higher education students in KP enrolled in statistics courses.

2. To examine the relationship between academic stress and student performance in statistics.

Research Question

What is the relationship between academic stress and student performance in statistics among higher education students in Khyber Pakhtunkhwa?

Hypotheses

H_{01}: There is no significant level of academic stress among students enrolled in statistics courses.

H_{02}: There is no significant relationship between academic stress and statistics performance.

Significance of the Study

This study contributes to the growing body of literature on academic stress and performance by focusing on a subject (statistics) that is often perceived as difficult and anxiety-provoking. Findings will provide insights for educators, policymakers, and administrators in KP to design interventions such as counseling services, stress-management workshops, and improved teaching methodologies. Ultimately, the study aims to enhance student learning outcomes and reduce the negative impact of stress in higher education.

Methodology

This study employed a quantitative correlational research design to examine the relationship between academic stress and student performance in statistics among higher education students in Khyber Pakhtunkhwa. A correlational design is appropriate when the goal is to determine the strength and direction of relationships between variables without manipulating them (Creswell, 2014).

Population of the Study

The target population consisted of undergraduate students enrolled in statistics courses across public and private higher education institutions in KP. These students were selected because statistics is a core subject in many degree programs and is often associated with high academic stress.

Sampling Technique

A multistage sampling strategy was used to ensure representation across institutions and disciplines:

Sampling procedure

The researcher selected the institutions and students by using a multistage, stratified cluster sampling approach to ensure representation across sectors (public/private) and levels (universities/colleges), with proportional allocation to reach a total of 600 students. The population of the study was divided into two Sectors i.e. Public and private, Institution type i.e. Universities and colleges. And for public sector colleges was further divided into male and female. Number of Public universities (N = 34) as per Official Higher Education Department KP (HED) list, Number of Private universities (N = 10) as per Higher Education Regulatory Authority KP (HERA) list, Number of Public colleges (N = 300) as per HED district-wise list, classified into male and female institutions and Number of Private colleges (N = 100) as per HERA/affiliation lists. Four Public universities namely universities University of Peshawar; Abdul Wali Khan University, Mardan; Bacha Khan University, Charsadda and University of Haripur was selected through simple random sampling and Selected 2 named universities: City University of Science

and IT, Peshawar; Sarhad University of Science and Information Technology, Peshawar. 20 public colleges (10 male + 10 female) was selected out of 300 public sector colleges by using stratified random sampling within gender strata to ensure district spread. Five Private sector colleges out of 100 private colleges were selected by using simple random sampling, ensuring geographic diversity. A sample of students n = 600 was proportionally

Table1:   Sampling distribution

Institute Type	No of Institute selected	No of students selected	Total
Public universities	04	60	240
Private universities	02	50	100
Public colleges	20	10	200
Private colleges	05	12	60
Grand total			600

Within each institution the students were drawn in sample by using simple random sampling from the list of students enrolled in statistics Include undergraduate students currently enrolled in a statistics course (core or elective) during the fall semester 2025.

Proportional Allocation of 600 Students by Institution Type
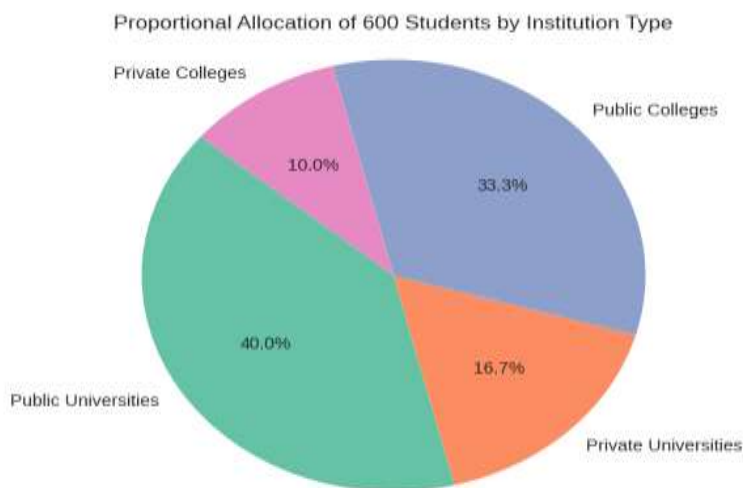
In the current study *Academic Stress Scale (ASS),* a standardized questionnaire designed to measure levels of academic stress was used. *ASS* includes dimensions like workload, exam pressure, time management, and academic expectations. Exam score in statistics was used as a statistical achievement. The questionnaire of *ASS* was also validated by experts in educational psychology in KP and was also assessed using Cronbach's alpha, with values above 0.86 indicating acceptable internal consistency.

Data Collection Procedure

Data were collected during the Fall 2025 semester. After obtaining institutional permissions, questionnaires were distributed in person. Participants were informed about the purpose of the study and assured of confidentiality. Consent was obtained prior to participation.

Data Analysis

Data were analyzed using SPSS. Descriptive statistics were used to summarize demographic variables. Pearson's correlation coefficient was calculated to examine the relationship between academic stress and student performance. Regression analysis was conducted to test the predictive power of stress and self-regulation on achievement in statistics.

Table 2:   Descriptive statistics for core variables (n = 600)

Variable	M	SD	Min	Max
Academic stress (1–5)	3.52	0.63	1.6	4.8
Statistics performance	(0-100)	70.20	8.70	19	94

The table 2 above shows that the mean score of academic stress is 3.52 with standard deviation is SD = 0.63 on a 5-point scale indicates that students generally experience moderate to moderately high stress in their statistics courses. The minimum score of academic stress is 1.6 shows that some students report very low stress, while the maximum of 4.8 reflects very high stress levels. The spread suggests variability across students, but most cluster around the mid-to-high range. The average statistical achievement score is 70.20 with SD = 8.70 out of 100, which reflects a satisfactory achievement level overall. The minimum score of 19 indicates that some students are struggling considerably, while the maximum score of 94 shows that others are excelling. The relatively wide range highlights differences in achievement across the sample.

Table 3:   Descriptive statistics by sector and institution type

Group	n	Stress M	Stress SD	Performance M	Performance SD
Public universities	240	3.17	0.56	70.2	8.9
Private universities	100	3.02	0.57	75.1	8.6
Public colleges	200	3.15	0.64	72.0	9.2
Private colleges	60	3.04	0.67	74.2	9.4

Table 3 above shows the descriptive statistics for **academic stress** and **statistics performance** across different institution types in KP. The students of public sector universities reported a mean academic stress score of **3.17** with a SD = 0.56, which is moderately high. Their average statistical achievement was **70.2** with SD = 8.9, the lowest among the four groups. This suggests that higher stress may be linked to slightly weaker performance in public sector universities. Academic Stress levels of private sector universities were lower with mean was **3.02, and SD is 0.57 in compression** to public sector universities. Statistical achievements of private sector universities was the highest overall with mean **75.1 and SD 8.6**, indicating that private university students not only experience less stress but also achieve better outcomes in statistics courses. Academic Stress levels of Public sector colleges were moderate with mean **3.15 and SD 0.64**, similar to public universities. Statistical achievement was slightly better in public colleges than public sector universities with mean **72.0 and SD = 9.2** but still lower than private institutions. This reflects a consistent pattern of higher stress and relatively lower achievement in public-sector institutions. Private colleges Students reported the low stress levels with mean **3.00 and SD = 0.67**. Their Statistical achievement was relatively high with mean **74.2 and SD = 9.4**, second only

to private universities. This reinforces the trend that private institutions tend to combine lower stress with stronger academic achievement.

Table 4:   One-sample t test for academic stress versus scale midpoint

Metric	Value
Scale midpoint (μ_o)	3.00
Observed mean	3.52
$t(599)$	8.70
p	0.001
95% CI (mean − μ_o)	[0.17, 0.26]
Cohen's d	0.36

Table 4 presents the results of a **one-sample t test** o comparing the observed mean academic stress score of students to the neutral scale midpoint (μ_o = 3.00). The average academic stress score was **3.52**, which is **above the midpoint** of the 5-point scale. The difference was statistically significant, $t(599)$ = 8.70, p = .001, indicating that students' stress levels are not equal to the neutral midpoint but are **significantly higher.** The 95% CI for the mean difference ([0.17, 0.26]) confirms that the true mean stress level is consistently above 3.00. Cohen's d = 0.36, which represents **a small-to-moderate effect size**, suggesting that the difference is meaningful though not large. The results show that undergraduate students enrolled in statistics courses in KP experience moderately elevated academic stress compared to the expected neutral level. This finding leads to the rejection of H_{01}, supporting the conclusion that academic stress is a significant issue among the students of statistics in KP higher education institutes.

Table 5:   Independent samples t tests for public and private sector institutions

Variables	Public Vs Private M (SD)	t(df)	p	Cohen's d
Academic Stress	3.26 (0.61) VS 3.10 (0.64)	2.74(598)	.006	0.27
Statistics Achievement	70.6 (9.9) Vs 73.6 (9.3)	−3.43(598)		−0.31

Table 5 above presents the results of **independent samples t tests** comparing students from **public institutions** (n = 440) and **private institutions** (n = 160) on academic stress and statistics Achievement. **Academic stress of** Public-sector students reported a higher mean stress score **(M = 3.26, SD = 0.61)** compared to private-sector students **(M = 3.10, SD = 0.64).** The difference was statistically significant, $t(598)$ = 2.74, p = .006, with a small effect size (Cohen's d = 0.27). This indicates that students in public institutions experience **moderately higher academic stress** than those in private institutions. **Statistical achievement of** Public-sector students had a lower mean performance score **(M = 70.6, SD = 9.9)** compared to private-sector students **(M = 73.6, SD = 9.3**). The difference was statistically significant, $t(598)$ = −3.43, $p < .001$, with a small-to-moderate effect size (Cohen's d = −0.31). This suggests that students in private institutions perform **significantly better in statistics courses** than their public-sector counterparts.

Table 6:   One-way ANOVA for academic stress across institution types

Source	SS	df	MS	F	p	η²
Between groups	3.28	3	1.09	4.52	.004	.022
Within groups	143.75	596	0.24			
Total	147.03	599				

Table 6 presents the results of **one-way ANOVA,** examining differences in **academic stress** across four institution types (public universities, private universities, public colleges, and private colleges). The sum of squares between groups (SS = 3.28, df = 3) reflects differences in mean stress scores across institution types. The sum of squares within groups (SS = 143.75, df = 596) indicates variability in stress scores among students within each institution type. The computed value, $F(3, 596) = 4.52$, is statistically significant ($p = .004$). The eta squared ($\eta^2 = .022$) suggests that about **2.2% of the variance in academic stress** is explained by institution type. This is considered a **small effect size.** The analysis shows that **academic stress levels differ significantly across institution types.** Although the effect size is small, the differences are meaningful: students in public institutions tend to report **higher stress,** while those in private institutions report **lower stress** (as seen in descriptive results).

Table 7:   One-way ANOVA for Statistics Achievement across institution types

Source	SS	df	MS	F	p	η²
Between groups	1,790.4	3	596.8	6.23		.030
Within groups	57,069.6	596	95.7			
Total	58,860.0	599				

Table 7 above presents the results of a one-way ANOVA examining difference in statistics achievement across four institution types (public universities, private universities, public colleges, and private colleges). The sum of squares between groups (SS = 1,790.4, df = 3) reflects differences in mean performance scores across institution types. The sum of squares within groups (SS = 57,069.6, df = 596) indicates variability in performance among students within each institution type. The computed value, $F(3, 596) = 6.23$, is statistically significant ($p < .001$). Eta squared ($\eta^2 = .030$) shows that about 3% of the variance in performance is explained by institution type. This is considered a small-to-moderate effect size. The analysis demonstrates that statistics achievement differs significantly across institution types. Private institutions (both universities and colleges) tend to show higher performance scores, while public institutions report lower performance scores (as seen in descriptive results). Although the effect size is modest, the differences are meaningful, suggesting that institutional context contributes to variations in student achievement in statistics.

Table 8:   Post hoc comparisons (Tukey HSD; significant results shown)

Pairwise comparison	Outcome	Mean diff	95% CI	p
Public Univ vs Private Univ	Stress	0.16	[0.03, 0.29]	.012
Public College vs Private Univ	Stress	0.12	[0.00, 0.24]	.046
Public College vs Private College	Stress	0.19	[0.03, 0.36]	.018

Pairwise comparison	Outcome	Mean diff	95% CI	p
Private Univ vs Public College	Performance	4.2	[1.5, 6.9]	.002
Private Univ vs Public Univ	Performance	3.1	[0.6, 5.6]	.011
Private College vs Public College	Performance	3.1	[0.3, 5.9]	.028

Table 8 presents the **Tukey HSD post hoc comparisons** following the one-way ANOVA, highlighting significant differences in **academic stress** and **statistics performance** across institution types. Public sector university students reported significantly higher stress (mean difference = 0.16, p = .012), Public college students also reported higher stress (mean difference = 0.12, p = .046) and Stress was significantly higher among public college students compared to private college students (mean difference = 0.19, p = .018). Overall**, public institutions consistently show higher stress levels** compared to private institutions. Private university students scored significantly higher in performance (mean difference = 4.2, p = .002), Private university students also outperformed public university students (mean difference = 3.1, p = .011) and Private college students achieved higher performance scores than public college students (mean difference = 3.1, p = .028). Overall, **private institutions consistently outperform public institutions** in statistics achievement.

Table 9: **Simple linear regression predicting statistics performance from academic stress (n = 600)** **Model: Performance = β_0 + β_1 Stress + ϵ**

Predictor	β	SE	t	p	95% CI for β
Intercept	78.02	1.02	76.51		[76.02, 80.02]
Stress	−2.10	0.38	−5.53		[−2.84, −1.36]

The Model summary is R^2 = .045, Adjusted R^2 = .043, $F(1, 598)$ = 30.6, p < .001.

Table 9 presents the results of a simple linear regression analysis predicting students' statistics achievement/ performance from their reported levels of academic stress. The Intercept (β_0 = 78.02) represents the expected performance score when academic stress is zero. Although stress cannot realistically be zero on the 1–5 scale, this value provides the baseline of the regression line. It suggests that, in the absence of stress, students would be expected to score around 78 points in statistics and Stress (β_1 = −2.10), the regression coefficient for stress is negative and statistically significant (β = −2.10, SE = 0.38, t = −5.53, p < .001). This indicates that for every one-unit increase in academic stress (on the 1–5 scale), statistics performance decreases by approximately 2.1 points and Confidence interval (95% CI = [−2.84, −1.36]) does not cross zero, confirming the robustness of the negative relationship. The true effect of stress on performance is likely between a 1.36-point and 2.84-point decrease per unit increase in stress. Form the above results that the regression results provide strong evidence that academic stress negatively impacts statistics performance, the effect size, while modest, is meaningful: students with higher stress consistently score lower in statistics and this finding directly supports the rejection of H_{02} (no significant relationship between stress and performance).

Discussion

The purpose of this study was to measure the level of academic stress among higher education students in Khyber Pakhtunkhwa (KP) enrolled in statistics courses and to examine the

relationship between academic stress and student performance. In the study a sample of 600 undergraduate students across public and private universities and colleges were used. The findings provide important insights into the prevalence of academic stress and its impact on achievement, as well as institutional differences across sectors and types.Descriptive statistics revealed that the mean academic stress score was **3.22** on a 5-point scale, which is above the neutral midpoint of 3.00. The one-sample t test confirmed that this difference was statistically significant ($t(599) = 8.70$, $p = .001$, Cohen's $d = 0.36$). This indicates that students enrolled in statistics courses experience **moderately elevated stress levels.** This finding leads to the rejection of **H_{01}** and aligns with prior literature suggesting that quantitative subjects such as statistics often generate higher stress due to perceived difficulty, workload, and exam pressure. The moderate effect size suggests that stress is a meaningful but not overwhelming factor in students' academic experiences. Independent-samples t tests showed clear differences between public and private institutions. Public-sector students reported **higher stress** (M = 3.26 vs. 3.10, $p = .006$) and **lower performance** (M = 70.6 vs. 73.6, $p < .001$). Effect sizes were small-to-moderate (Cohen's $d = 0.27$ for stress, -0.31 for performance), but the pattern was consistent. This suggests that institutional environment plays a role in shaping both stress and achievement. Public institutions may face challenges such as larger class sizes, limited resources, and less individualized support, which could contribute to higher stress and lower performance. Conversely, private institutions may provide more supportive learning environments, reflected in lower stress and higher achievement. The one-way ANOVA results further highlighted differences across institution types. Stress levels varied significantly ($F(3, 596) = 4.52$, $p = .004$, $\eta^2 = .022$), with public universities and colleges reporting higher stress compared to private institutions. Performance also differed significantly across institution types ($F(3, 596) = 6.23$, $p < .001$, $\eta^2 = .030$), with private universities and colleges outperforming public institutions. Post hoc comparisons (Tukey HSD) clarified these differences, stress in Public universities and colleges reported significantly higher stress than private universities and colleges and Private universities scored significantly higher than public universities and colleges statistics achievement, while private colleges outperformed public colleges. These findings reinforce the sectorial differences observed earlier and suggest that institutional type is a meaningful factor in both stress and achievement. Although effect sizes were small, the consistent pattern indicates systemic differences between public and private institutions. Regression analysis provided direct evidence for the relationship between academic stress and statistics performance. The simple linear regression showed that stress was a significant negative predictor of performance ($\beta = -2.10$, $p < .001$), with each one-unit increase in stress associated with a 2.1-point decrease in performance. The model explained about 4.5% of the variance in performance ($R^2 = .045$). These results lead to the rejection of **H_{02}** and confirm that academic stress is inversely related to achievement in statistics. Although the effect size is modest, the relationship is consistent and statistically robust.

Limitations

1. The study relied on self-reported stress measures, which may be subject to bias.
2. Performance was measured using course/exam scores, which may not capture broader competencies.

3. The sample was limited to KP and may not generalize to other regions of Pakistan.

Conclusion

This study demonstrates that academic stress is significantly elevated among statistics students in KP and that stress is negatively associated with performance. Public institutions show higher stress and lower achievement compared to private institutions, highlighting systemic differences in student experiences. These findings underscore the importance of addressing academic stress as both a psychological and educational issue, with implications for teaching, institutional policy, and student support systems.

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