Policy Research Journal
ISSN (E): 3006-7030 ISSN (P) : 3006-7022 Volume 3, Issue 2, 2025

DECODING ACADEMIC CHOICES: EXPLORING FACTORS INFLUENCING STUDENTS' PURSUIT OF STATISTICS AS A MAJOR IN THE EVOLVING EDUCATIONAL LANDSCAPE

Muhammad Atif[1], Gohar Ayub[2], Aqsa Zahid[3], Muhammad Farooq*[4], Syed Habib Shah[5], Muhammad Ilyas[6], Muhammad Shafiq[7]

[1,3,4]Department of Statistics, University of Peshawar,
[2]Department of Mathematics and Statistics, University of Swat,
[6]Department of Statistics, University of Malakand,
[5,7]Institute of Numerical Sciences, Kohat University of Science and Technology,

[1]m.atif@uop.edu.pk, [2]ayubgoher@gmail.com, [3]aqsaxahid@gmail.com, [4]m.farooq@uop.edu.pk, [5]habibshah@kust.edu.pk, [6]m.ilyasstatistics2015@gmail.com, [7]shafiq@kust.edu.pk

DOI: https://doi.org/10.5281/zenodo.14928828

Keywords
Statistics, Anxiety, Academic Choice, Students, Career.

Article History
Received on 17 January 2025
Accepted on 17 February 2025
Published on 26 February 2025

Corresponding Author: *
Muhammad Farooq

Abstract

In recent era of data-centric world the importance of data-driven fields, such as statistics, has become paramount. This article explores the intricate landscape of students' decision-making processes in choosing their major academic pursuit. A two-stage, two-phase sampling technique was employed to gather data, first targeting students studying and not studying statistics, followed by a second-phase sampling from professional statisticians. We investigate key factors such as lack of awareness, early perceptions, and external considerations like eligibility of graduates from other subjects for statistical jobs and syllabus of competitive exams using Structural Equation Modeling. The study reveals a complex interplay of these factors, indicating a shift beyond conventional perceptions of statistical challenges. The findings under-score the need to go beyond conventional narratives of statistical difficulty and intimidation, recognizing the influence of broader career dynamics. The inclusivity of statistical jobs for graduates from varied disciplines emerges as a significant factor shaping academic choices.

INTRODUCTION

Statistics plays a crucial role in various fields, ranging from social sciences to natural sciences, business, and healthcare. It provides researchers and professionals with the necessary tools to analyze data, make informed decisions, and draw meaningful conclusions. Despite its significance, statistics is often perceived as a challenging and daunting subject by many students, leading to the development of statistics anxiety and a negative attitude towards the discipline (Paechter, 2017). Statistics anxiety refers to the fear or apprehension experienced by individuals when encountering statistics-related tasks, such as understanding statistical concepts, analyzing data, or interpreting statistical results. This anxiety can hinder students' academic performance, reduce their motivation to engage with statistics, and ultimately affect their overall learning experience. Negative attitudes towards statistics may emerge as a result of this anxiety, leading students to develop a dislike or avoidance of statistics courses, limiting their ability to acquire crucial statistical skills (Hunt et al, 2023).

The perception of statistics anxiety and negative attitudes towards statistics has been extensively studied among students, particularly at the graduate

level. Research in this area has shed light on the factors contributing to statistics anxiety and negative attitudes and their impact on academic achievement and career prospects. Several studies have identified potential predictors of statistics anxiety, including mathematical background, prior statistics experience, and perceived difficulty of statistics courses. Similarly, factors such as teaching methods, curriculum design, and classroom environment have been investigated to understand their influence on students' attitudes towards statistics (Yang et al, 2022).

One key aim of exploring statistics anxiety and negative attitudes is to develop effective strategies to alleviate these issues and enhance students' learning experiences. Understanding the underlying causes and potential interventions can help educators design supportive learning environments that foster positive attitudes towards statistics and alleviate anxiety. By addressing these concerns, educational institutions can empower students to develop the necessary statistical skills and competencies, preparing them for success in their respective fields.

This article aims to review the existing literature on the perception of statistics anxiety and negative attitudes of students towards statistics at the graduate level. By examining the key findings and insights from previous studies, we will gain a comprehensive understanding of the factors contributing to statistics anxiety, its impact on students' attitudes, and potential interventions to mitigate these challenges. The knowledge generated from this review will assist educators, policymakers, and researchers in developing evidence-based strategies to promote positive attitudes and alleviate statistics anxiety among graduate-level students.

1. Related Work

The perception of statistics anxiety and negative attitudes towards statistics among graduate-level students has garnered significant attention in the literature. Previous research has explored various factors influencing statistics anxiety, its impact on academic performance, and strategies for reducing anxiety and improving attitudes towards statistics. This section provides a comprehensive review of the related work, highlighting key findings and contributions in this area.

1.1. Statistics Anxiety and its Determinants

Several studies have investigated the factors contributing to statistics anxiety among graduate students. Henson and Roberts (2006) found that prior mathematics achievement, self-efficacy beliefs, and perceived usefulness of statistics significantly influence statistics anxiety. Additionally, Ashcraft and Kirk (2001) emphasized the role of math anxiety in predicting statistics anxiety, indicating that individuals with high levels of math anxiety are more likely to experience statistics anxiety. Furthermore, individual characteristics such as gender, age, and prior experience with statistics have beenfound to impact statistics anxiety (Balo ğlu M., 2002; Onwuegbuzie and Wilson, 2003).

1.2. Impact on Academic Performance

Statistics anxiety has been shown to negatively affect academic performance among graduate students. In their study, Dowker et al (2016) found that statistics anxiety is associated with lower grades and higher dropout rates in statistics courses. Similarly, Onwuegbuzie and Wilson (2003) reported a negative correlation between statistics anxiety and academic achievement. These findings highlight the importance of addressing statistics anxiety to enhance students' learning outcomes and success at the graduate level.

1.3. Strategies for Reducing Statistics Anxiety

Several interventions and strategies have been proposed to alleviate statistics anxiety and promote positive attitudes towards statistics among graduate students. Chiou et al (2014) emphasized the significance of incorporating active learning methods, such as hands-on activities and group projects, to enhance engagement and reduce anxiety. Furthermore, technology-based tools and resources, such as interactive software and online tutorials, have been suggested as effective means for increasing students' confidence and reducing anxiety in statistical learning (Yang et al, 2018; Billingsley, 1999).

1.4. Attitudes Towards Statistics

Negative attitudes towards statistics can further compound the challenges faced by graduate students. Caroline et al (2012) explored the attitudes of

graduate students towards statistics and identified factors such as the perceived difficulty and relevance of statistics, teaching methods, and previous negative experiences as influential factors. Their findings emphasized the need for pedagogical approaches that address these concerns and foster positive attitudes towards statistics.

1.5. Cross-Disciplinary Perspectives

Considering the diverse academic backgrounds of graduate students, it is crucial to examine the differences in statistics anxiety and attitudes towards statistics between students studying statistics and those from non-statistical fields. McGrath et al (2015) compared statistics anxiety among graduate students from different disciplines and found that students studying statistics exhibited lower levels of anxiety compared to their peers from non-statistical disciplines. Understanding these differences can inform tailored interventions and support mechanisms for students in different academic contexts. In summary, previous research has shed light on the factors influencing statistics anxiety, its impact on academic performance, and strategies for reducing anxiety and improving attitudes towards statistics among graduate students. This study aims to build upon this existing literature by specifically focusing on the perception of statistics anxiety and negative attitudes towards statistics at the graduate level, incorporating a mixed-methods approach to provide a comprehensive understanding of this phenomenon and inform targeted interventions for this student population.

2. Methodology

2.1. Sampling Design

In this research study, a two-stage stratified sampling design with two phases was utilized to collect data on the perception of statistics anxiety and negative attitudes towards statistics. The design incorporates stratification based on student status (individuals who are studying statistics as major and those who are not studying statistics) and includes a second phase of sampling to target professional statisticians for comparison purposes.

2.1.1. Stage 1: Stratification

The first stage involves stratifying the target population into two distinct strata: students studying statistics and students not studying statistics. Stratification ensures that each subgroup is well-represented in the final sample and allows for more accurate estimations and comparisons between the two groups. Stratification can be based on enrollment data or other relevant information regarding students' field of study.

2.1.2. Stage 2: Sample Selection

Within each stratum, a sample will be selected for data collection. The sample was obtained using simple random sampling. The sample size from each stratum was determined based on statistical considerations, such as desired precision and power.

2.1.3. Phase 1: Data Collection from Selected Students

In the first phase, data was collected from the selected students within each stratum. This phase involves administering surveys, questionnaires, or structured interviews to capture information related to statistics anxiety and negative attitudes towards statistics. The data collection instrument was designed to assess relevant variables and ensure the validity and reliability of the collected data.

2.1.4. Phase 2: Sampling from Professional Statisticians

In the second phase, a sub-sample of professional statisticians was selected to provide a comparison group. This phase involves identifying and sampling professional statisticians from relevant organizations, such as statistical consulting firms or academic institutions. The selection of professional statisticians was done using methods such as purposive sampling, ensuring representation from different sectors and levels of experience.

By incorporating a second phase of sampling targeting professional statisticians, this design allows for a comparative analysis between students and professionals in terms of their perception of statistics anxiety and negative attitudes towards statistics. This comparison can provide valuable insights into the potential differences or similarities in these perceptions across the two groups.

2.2. Structural Equation Modeling

In the measurement model of our study, we employ a structural equation modeling (SEM) framework to delineate the relationships between latent constructs and their corresponding observable indicators. The six critical latent constructs under investigation includes "Awareness about statistics", "Job Eligibility", "Statistics in competitive exams", "Statistical intimidation", "Little incentives", and "Weird language". These constructs were not directly observable but were inferred from a set of carefully chosen observable items. These observable indicators serve as proxies for the latent variable of interest, allowing us to quantitatively assess the responses among the study participants regarding various aspects of statistics.

The measurement model involves specifying the relationships between these latent constructs and their observable indicators through factor loadings. Factor loadings indicate the strength and direction of the connection between the latent construct and each observed item. Higher factor loadings suggest a more substantial influence of the latent variable on the corresponding observable item. The utilization of SEM allows us not only to examine the measurement properties of our latent constructs but also to explore the relationships between them and other variables in the structural model. By modeling latent constructs with observable indicators, we aim to provide a comprehensive understanding of the participants' awareness of statistical concepts and their perceived job eligibility, contributing valuable insights to the broader objectives of our study. Figure 1 below represents the SEM model used in this study. Figure A represents the SEM model which predicts the odds of choosing statistics as an academic major based on various factors. Whereas, model B is designed to align with Academic and Career Achievements after studying statistics as a major.

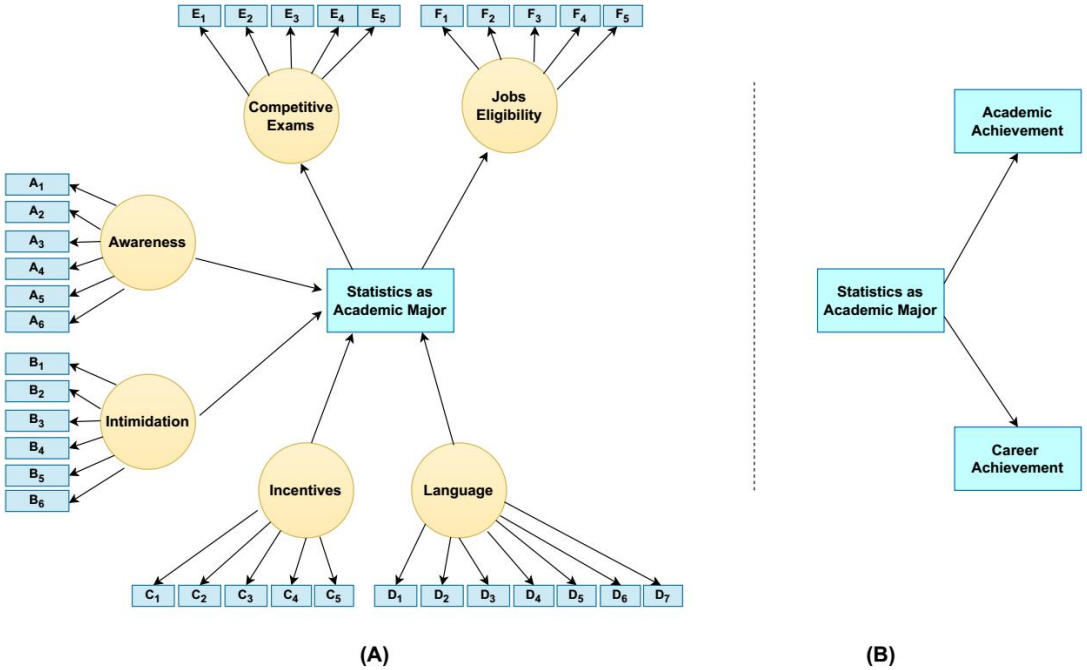

Figure 1: SEM Model

2.3. Data Validity

The Cronbach's alpha index serves as a metric indicating the reliability and consistency of a given scale or questionnaire. In many research scenarios, a commonly accepted threshold for Cronbach's alpha is .70, signifying good internal consistency \cite{r14}. In our study, the computed alpha value for the entire scale yielded a notable 0.89. This value suggests that the items within the construct demonstrated a notably high level of internal consistency, affirming their reliability as measures of the underlying construct. Similarly, the internal consistency for each

of the six factors is considered acceptable, as the Cronbach's alphas for all factors surpass the 0.7 threshold. This reinforces the reliability of the scale and the consistency of measurement within each distinct factor.

3. Results

This section opens a window into the intricate relationships and patterns identified during the study. Through statistical analyses and insightful interpretations, we illuminate the connections between variables, providing a delicate understanding of students' attitudes and barriers in Statistics education. Table 1 provides a clear breakdown of the gender distribution, indicating that the majority (61.5%) are males, while females account for the remaining 38.5% of the sample.

Table 1: Gender distribution of the respondents in the study

Gender	Frequency	Percentage
Males	246	61.5
Females	154	38.5

3.1. Fit Indices for Model Diagnostics

Table 2 presents a range of fit indices aimed at assess the model's overall goodness of fit. The chi-square statistic yields a statistically significant result with a p-value of 0.000, suggesting differences between observed and expected model. However, this significance may be attributed to the large sample size. The $\chi^2/_{df}$ f ratio, a measure of relative fit, is 1.601. The Comparative Fit Index (CFI) is 0.900, the Tucker-Lewis Index (TLI) is 0.871, the Incremental Fit Index (IFI) is 0.905, and the Normed Fit Index (NFI) is 0.781. These indices further contribute to the comprehensive assessment of the model's fit. The CFI, TLI, and IFI values, approaching 1, suggest favorable model fit, while the NFI, though slightly lower, still falls within an acceptable range. Collectively, these fit indices reinforce the notion that, despite statistically significant differences in observed and expected co-variances; the model maintains a reasonably good fit to the data. Additionally, the Root Mean Square Error of Approximation (RMSEA) value is close to zero. This further supports the overall model fit, as RMSEA values near zero indicate a good fit of the model to the observed data.

Table 2: Goodness of Fit Indices for SEM model

Fit Statistic	Value	Recommended value
χ^2	312.201	.000 (p-value)
d.f	195	-
$\chi^2/_{df}$	1.601	≤ 2.0
CFI	0.900	≥ 0.9
TLI	0.871	≥ 0.9
IFI	0.905	≥ 0.9
NFI	0.781	≥ 0.9
RMSEA	0.092	Close to 0

Note: Recommended values are based on Kline, 2005

3.2. Measurement Model

Table 3 provided below displays the factor loadings derived from the measurement model. All items for the first construct exhibit high factor loadings, generally around or above 0.7, signifying a robust relationship with the underlying construct. However, item A_6 stands out with a relatively low loading of 0.328. These items collectively represent the lack of awareness factor, capturing aspects related to students' comprehension, information, and perceived significance of statistics. Similarly, items of the second construct exhibit high factor loadings, ranging from 0.717 to 0.802, indicating a robust relationship with the latent factor "Statistical

Intimidation." This factor appears to be primarily represented by items that capture emotional responses, perceived challenges, and cognitive difficulties associated with statistics. The items in the third context demonstrate high factor loadings, ranging from 0.752 to 0.813, signifying a robust relationship with the latent factor "Little Incentive." The "Little Incentive" factor encapsulates perceptions related to limited employment opportunities, a perceived lack of relevance to career goals, a sense of limited rewards, and the belief that the job market does not prioritize expertise in statistics. These items collectively contribute to the characterization of the "Little Incentive" factor, reflecting participants' attitudes and beliefs regarding the incentives associated with pursuing statistical expertise in their careers. The items of fourth construct exhibit a strong relationship with the latent factor "Weird Language". This factor reflects difficulties and confusion arising from the technical and jargon-laden language used in statistics. These items collectively capture respondents' experiences and perceptions regarding challenges associated with the specialized terminology and language used in the field of statistics. The items of fifth construct demonstrate moderate to high factor loadings, indicating a strong to moderate relationship with the latent factor "Competitive Exams". However, item E_5 stands out with a negative loading (-0.760), implying an inverse relationship with the "Competitive Exams" factor. This factor encompasses perceptions of low weightage and minimal contribution of statistics in competitive exams. Item E_3 emphasizing the perception that statistics requires a significant amount of time and is not preferred. The items of the sixth construct demonstrate a strong positive relationship with the latent factor "Eligibility for Job." This factor reflects the perception that graduates from various educational backgrounds, not necessarily in statistics, are considered eligible for statistical jobs. This implies an inclusive perspective on eligibility criteria for positions that require statistical expertise.

Table 3: Factor Loading and Reliability Coefficients

Factor	Items	Loading
Lack of Awareness	A1 : Students have no idea of what's going on in statistics	800
	A2 : Students did not have enough information about statistics	783
	A3 : Statistics is not a course option among school student	568
	A4 : Students do not need the subject for their future study	793
	A5 : Statistics is useful in research but not to other professions	701
	A6 : Statistics concerns are rarely presented in everyday life	328
Reliability	0.72	
Statistical Intimidation	B1 : Difficulty level of Statistics evoked strong emotions, leading me to tears	749
	B2 : The mere thought of statistics triggers intense nervousness within me	733
	B3 : Dealing with statistics-related matters leaves me feeling negatively impacted	717
	B4 : Students believe that achieving high marks in the subject will be challenging	450
	B5 : Statistics requires extensive computational work	802
	B6 : Students struggle with comprehending statistics due to their cognitive ability	718
Reliability	0.76	
Little Incentive	C1 : Graduates in statistics face limited opportunities to secure employment	798
	C2 : Learning statistics seems irrelevant to my future career goals	752
	C3 : I lack the drive to excel in statistics due to its perceived limited benefits	497
	C4 : I don't perceive any significant rewards for excelling in statistics	797
	C5 : The current job market doesn't seem to prioritize statistics expertise	813

Reliability	0.73	
Weird Language	D1 : The jargon used in statistics textbooks often confuses me	780
	D2 : Statistical terms sound like a foreign language to me	710
	D3 : I find it difficult to understand terminology used in statistics	680
	D4 : The way statistics are explained feels overly complex and difficult to grasp	750
	D5 : I often struggle to decipher meaning of statistical concepts due to language	720
	D6 : The technical language of statistics makes the subject harder to learn	770
	D7 : Statistical explanations often seem convoluted and hard to follow	690
Reliability	0.88	
Competitive Exams	E1 : Aspirants are not choosing statistics in competitive exam because of low weight-age	772
	E2 : I perceive that the contribution of statistics in competitive exams is minimal	768
	E3 : Statistics needed much time due to which it is not preferred	570
	E4 : Statistics aspirants tend to avoid difficult mathematical and probability concepts	487
	E5 : Scoring well in statistics doesn't significantly impact competitive exam results	-760
Reliability	0.85	
Eligibility for Job	F1 : Graduates from non-statistical backgrounds are considered eligible for statistical jobs	720
	F2 : Other subject graduates are perceived to have equal chances of securing statistical jobs	760
	F3 : Graduates from various fields are considered for roles that require statistical expertise	740
	F4 : opportunities for statistical skills is open to candidates with different backgrounds	730
	F5 : The eligibility criteria for statistical jobs are inclusive of diverse educational paths	770
Reliability	0.89	

The results presented in Table 4 from the SEM analysis provide insights into the influence of different latent factors on the binary observed variable "Ever studied statistics as a major academic choice". The P-values associated with each latent factor suggests that all the latent factors considered in the analysis are found to be significantly associated with the decision to study statistics as a major. The results suggest that the latent factors examined in the SEM analysis play a statistically significant role in influencing the decision of individuals to study statistics as a major academic choice. This information can be valuable for educators, policymakers, and researchers interested in understanding the factors that contribute to academic choices in the field of statistics.

- **Lack of Awareness:** The standardized path estimate of -0.58 reveals a moderately strong negative correlation between lack of awareness and the choice of statistics as a major academic pursuit. This implies that as the lack of awareness about statistics increases, there is a corresponding decrease in the likelihood of students choosing statistics as their major. This finding underscores the importance of early exposure and education in statistics. It implies that fostering awareness and understanding of statistics at an earlier stage in education could positively influence students' perceptions and choices, potentially encouraging more students to consider statistics as a major academic focus.

• **Statistical Intimidation:** The standardized path estimate of -0.87 suggests a strong negative correlation between choosing statistics as a major academic choice and experiencing statistical intimidation. This finding has implications for academic advising, curriculum design, and understanding the psychological dynamics associated with students' academic choices in the field of statistics.

• **Little incentive to learn Statistics:** There is a strong negative relationship (standardized path estimate of -0.78) between having little incentive to learn statistics and statistics as a major academic choice. This effect indicates that when individuals perceive limited incentive, it paradoxically decreases their likelihood of engaging with the subject.

• **Weird language:** The negative standardized path estimate of -0.82 indicates that perceiving statistics as being communicated in a weird language reduces the likelihood of studying it as major. This effect implies that the perceived language barrier indeed has an impact.

• **Role of statistics in competitive exams:** The negative path estimate of -0.11 suggests that perceiving a limited role of statistics in competitive exams slightly diminishes the likelihood of studying the subject. This effect indicates that competitive exam considerations could play a role in this decision.

• **Eligibility of other subject graduates in statistical jobs:** The negative path estimate of -0.50 suggests that perceiving graduates from other subjects as eligible for statistical jobs decreases the likelihood of studying statistics. This effect implies that the perceived competition from graduates of other disciplines might deter some individuals from studying statistics.

Table 4: Effects of Various Factors on Study Statistics

Hypothesis	Std. path estimate	P-values
Lack of awareness	-0.58	0.01
Statistical Intimidation	-0.87	0.00
Little incentive to learn	-0.78	0.00
Weird language	-0.82	0.00
Role of statistics in competitive exams	-0.11	0.03
Eligibility of other subject graduates in statistical jobs	-0.50	0.01

3.3. Phase 2: Professional Statisticians

In the second stage, a purposive sample of 1000 professional statisticians was chosen to delve into the academic and professional accomplishments of individuals who pursued statistics as their academic major. Figure 2 below showcase a few examples of the role of professional statisticians in various organizations. The role of statistical officers can be found in various other ministries and government departments where data-driven decision-making is crucial. The exact designation and responsibilities may vary, but the common thread is the utilization of statistical expertise for informed policy-making. A significant portion of professional statisticians is employed within educational and research institutions. The majority of these professionals have pursued advanced degrees, such as M.Phil. and Ph.D., showcasing a strong inclination toward higher education. This trend highlights the commitment of statisticians to continuous learning and expertise development. By obtaining advanced degrees, these professionals not only deepen their knowledge in the field but also contribute to the overall academic and research excellence within their respective institutions. The pursuit of higher education among statisticians underscores the dynamic and evolving nature of the field, emphasizing the importance of advanced qualifications for impactful contributions to research and education. Their specialized expertise stands as a cornerstone for advancing knowledge and fostering continuous improvement in educational practices. By applying rigorous statistical methodologies, statisticians enhance the reliability of research outcomes, ultimately supporting informed decision-making in educational settings and contributing to the overall progress of the academic and research domains. Similarly, The significant recruitment of statisticians by the Federal Bureau of

Statistics (FBS) reflects the critical need for skilled professionals to fulfill the bureau's diverse responsibilities. The hiring of a substantial number of statisticians underscores the importance placed on robust data collection, analysis, and interpretation across various domains, including demographics, economics, and social indicators. These statisticians contribute their expertise to ensure the accuracy and reliability of statistical information that forms the basis for informed decision-making at national levels. Their role in the FBS aligns with the bureau's commitment to upholding statistical standards, conducting vital surveys and censuses, and supporting evidence-based policies for the socio-economic development of Pakistan. Furthermore, the health department's recruitment of statisticians underscores their integral role in advancing various aspects of research, particularly in the realms of clinical trials and public health. Statisticians employed by the health department are instrumental in designing and conducting robust clinical trials. They contribute to the formulation of trial protocols, determine appropriate sample sizes, implement randomization procedures, and conduct sophisticated statistical analyses to evaluate the safety and efficacy of medical interventions. Also, statisticians contribute significantly to public health research initiatives. They analyze epidemiological data, identify trends in disease occurrence, assess the impact of public health interventions, and offer evidence-based recommendations for enhancing population health. The employment of a significant number of statisticians in quality control and manufacturing processes underscores the critical role these professionals play in ensuring product quality and process efficiency. Development and interpretation of control charts are common tasks for statisticians. These charts provide a visual representation of process stability and help in identifying trends or anomalies that may affect quality. Also, Statisticians are integral to the implementation of SPC methodologies. They use statistical tools to monitor and control manufacturing processes in real-time, ensuring that variations are within acceptable limits.

In addition to these institutions, a substantial number of statisticians have been appointed as statistical officers in various ministries of the Government of Pakistan. Statistical officers in Pakistan play a pivotal role in leveraging data-driven insights for informed decision-making and effective governance. Their responsibilities span a wide range of areas, contributing to the formulation of policies, program evaluation, economic analysis, demographic studies, and other crucial functions within the respective ministries. The subplot B provides information about the number of statistical officers employed in various government ministries. There are 96 statistical officers working in the ministry or department related to agriculture and livestock. These officers contribute to analyzing agricultural data, crop yields, and trends. They provide insights into the effectiveness of agricultural policies and programs aimed at rural development. There are 50 statistical officers in the Population Welfare ministry. These officers likely focus on demographic data, family planning statistics, and related indicators. They play a key role in analyzing population trends and providing data-driven insights for population welfare programs. In the Planning and Development ministry, there are 82 statistical officers. These officers are likely involved in economic planning, development projects, and policy analysis. They contribute to evidence-based decision-making by providing statistical insights into various aspects of planning and development. There are 39 statistical officers in the finance ministry. These officers are likely responsible for financial data analysis, budgeting, and economic forecasting. They play a crucial role in supporting financial decision-making through the interpretation of statistical information. The number 33 represents the count of statistical officers in the Telecommunication ministry or department. These officers may be involved in analyzing statistical data related to telecommunication trends, network performance, and technological aspects. Their work contributes to informed decision-making in the field of telecommunications. In addition to employing statistical officers, various ministries in Pakistan also hire statistical assistants to contribute to their data-related functions. The primary responsibility of these assistants is to support the officers in tasks such as data collection and data entry into databases. Their role is instrumental in ensuring the accuracy and efficiency of the data management processes within

the ministries. By assisting in these fundamental tasks, statistical assistants play a vital role in maintaining the integrity of statistical information, ultimately supporting evidence-based decision-making within the respective ministries.

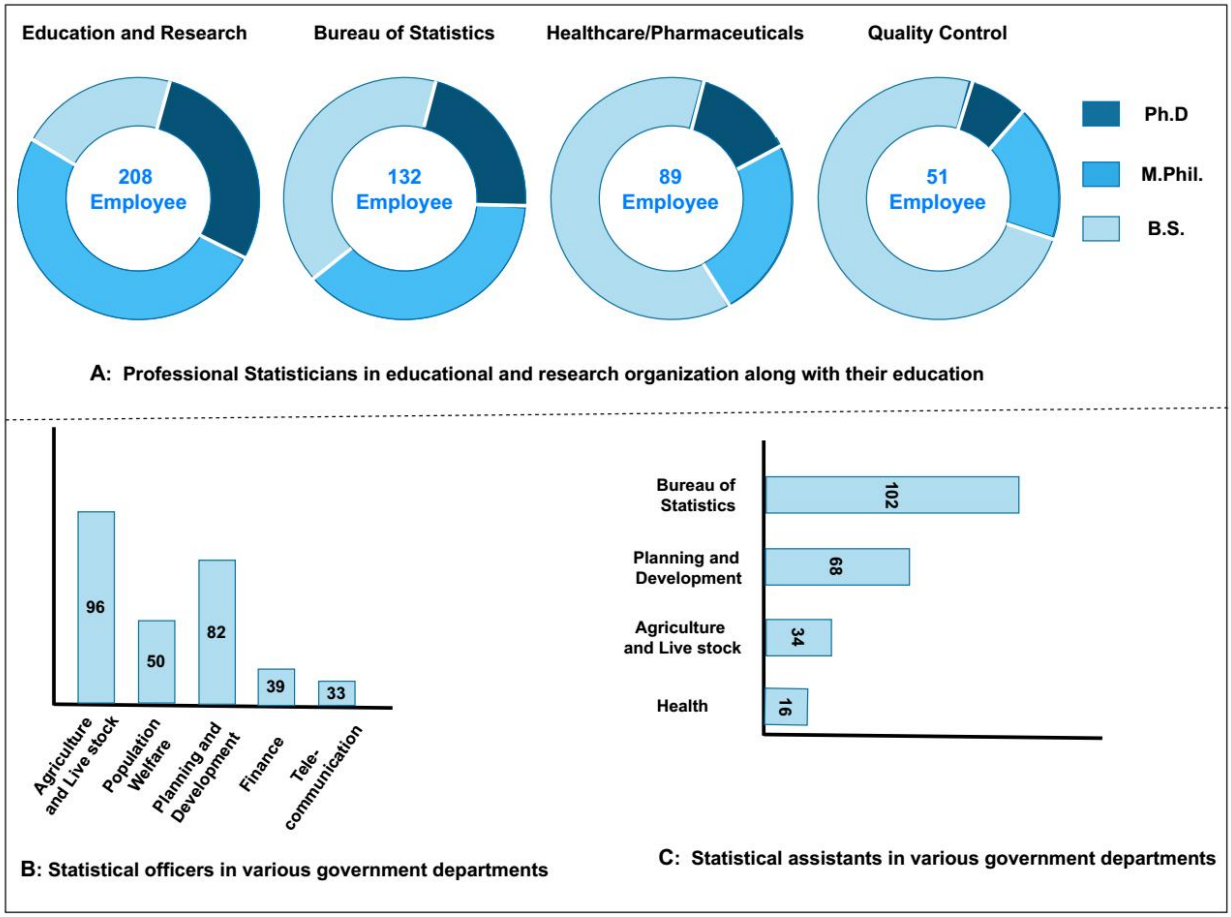

Figure 2: Academic and Professional Achievements of Statisticians

4. Discussion

The study's findings underscore the pivotal role that a lack of awareness about statistics plays in influencing academic choices. This highlights the importance of understanding students' perceptions and knowledge gaps regarding statistics, which can significantly impact their decisions when selecting academic majors or fields of study. Students are more likely to choose a subject as their academic focus if they are familiar with its concepts, applications, and relevance. Lack of information may lead to uninformed decisions, where students might not fully understand the potential benefits, career opportunities, and real-world applications of a particular subject. Secondly, Students may avoid subjects they perceive as challenging or incomprehensible due to a lack of exposure and understanding. This perception of difficulty can deter students from exploring subjects that might otherwise align with their interests and abilities. This is caused by the lack of exposure to statistics at the school level, which not only impacts students' academic choices but also influences their ability to contribute to data-driven fields. Sometimes lack of information cause a statistical intimidation in the individuals. Statistical intimidation represents a psychological barrier that some individuals may experience when confronted with statistical concepts. This could include anxiety, fear, or a sense of difficulty associated with the subject. The educational environment, including teaching methods, curriculum design, and support systems, plays a crucial role. An environment that addresses and mitigates statistical intimidation can foster a positive attitude toward statistics as a major academic choice. If students are introduced to statistics in a

way that alleviates fear and builds understanding, they may be more inclined to choose it as a major later on. Furthermore, the perceptions of little incentive for statisticians is vital for promoting statistics as a major academic choice. Little incentive for statisticians could include perceptions of limited employment opportunities, perceived irrelevance to future career goals, or a lack of perceived rewards. Individuals often choose academic majors that align with their career aspirations. If students perceive statistics as offering significant incentives and opportunities in their desired career paths, they are more likely to choose it as a major. Academic advisors play a crucial role in guiding students in their major selection. They can provide insights into the incentives and potential career paths associated with studying statistics, helping students make informed decisions. Similarly, perceiving the language of statistics as weird and the choice to study statistics as a major academic pursuit is a crucial aspect that involves the accessibility and comprehensibility of statistical concepts. The perception that language of statistics as weird is associated with a belief that statistical concepts are overly complex, convoluted, or difficult to understand. Statistics involves a unique set of terms and jargon that might be intimidating for some students. Perceiving the language as weird might also be related to a disconnect between the language used in statistics courses and its real-world applications. If students see the practical, everyday relevance of statistical concepts, they may find the language more approachable and be more likely to choose it as a major. Interactive and hands-on learning experiences that involve practical examples, real-world data, and applications can help demystify the language of statistics. Engaging students in activities that demonstrate the utility of statistical concepts can make the subject more accessible. Apart from these factors inclusion of statistics in competitive exams like Central Superior Services (CSS) and its perceived importance, relevance, and impact appears to have influence on the choice to study statistics as a major academic pursuit. Competitive exams play a significant role in shaping academic choices and career trajectories. If statistics is included as a subject in competitive exams, it can influence students' perceptions of its importance and relevance, potentially impacting their decision to choose it as a major. Students often choose majors based on their perceived alignment with the content of competitive exams. If statistics is seen as a subject that requires a significant amount of preparation and doesn't align well with the exam content or career goals, students may be less inclined to choose it. If the syllabi of competitive exams explicitly include statistics as a subject, students preparing for these exams may view studying statistics as a major academic choice as a strategic decision. If they perceive that statistical knowledge is in demand in various professions and that it opens doors to diverse career paths, they may be more inclined to it. Additionally, students perceive a broader eligibility criterion for statistical jobs, allowing graduates from various disciplines to enter the field. This perception could influence students to consider alternative majors instead of specializing in statistics. The eligibility of graduates from other subjects in statistical jobs implies that employers value a diverse skill set. Students might interpret this as an indication that they can enter the statistical field even without a specialized statistics major, potentially leading to a preference for more versatile majors. If graduates from diverse majors are considered eligible, academic advisors and career guidance counselors may play a crucial role in steering students toward majors that align with both their interests and career aspirations.

5. Conclusion

This study delves into the intricate landscape of students' perceptions and their attitude towards statistics education, offering valuable insights into the factors that influence their attitudes toward the subject. Through a comprehensive exploration that encompasses demographics and employs SEM, we've brought to light critical aspects that mold students' decisions regarding statistics as a major and their overall perceptions of the field. Moving beyond traditional classroom challenges, our findings uncovered a web of influences contributing to students' reluctance to choose statistics as a major. Factors such as a perceived lack of incentive, early perceptions, statistics' role in competitive exams, and language barriers all played integral roles in shaping students' decisions, emphasizing the need for holistic educational approaches. A key revelation emerged in

the significant link between household statistics exposure and both academic success and career achievements. This underscores the crucial role of early familiarity with statistical concepts in shaping educational and professional trajectories, paving the way for interventions that extend beyond individual students to encompass their broader socio-environmental contexts. This research sheds light on the challenges within the educational landscape, particularly in underdeveloped countries where limited budgets and reliance on conventional teaching methods contribute to negative perceptions of statistics among students. Urgent educational reforms are warranted, emphasizing resource-rich, practical learning environments to foster positive attitudes toward statistical education.

The implications of our findings resonate with academic institutions and the professional sphere alike. Academic institutions can leverage these insights to tailor their approaches, making statistics more accessible and appealing. Simultaneously, our research underscores the pivotal role of statistics proficiency in professional success, emphasizing the need for cultivating these skills among students to meet the demands of a data-driven world.

In summary, this study not only offers a foundational understanding of the factors influencing students' perceptions and their negative attitude towards statistics education but also contributes to shaping a positive and conducive environment for the study of statistics. Addressing identified challenges and leveraging strengths collectively ensures the integral role of statistics in shaping the skills and perspectives of future generations of professionals in an increasingly data-centric world. These findings provide valuable insights for educators, policymakers, and career counselors, emphasizing the importance of promoting awareness, addressing perceived challenges, and highlighting the interdisciplinary nature of statistical professions.

5.1. Limitations

There were certain limitations that were important to consider. These limitation also present opportunities for future research to address the gaps and refine our understanding of the factors influencing students' decisions to choose statistics as major academic choice.

- The findings of this study may be limited in their generalizability due to the specific demographic or cultural context of the sample. The study might not represent the diverse perspectives and decision-making processes of students in different regions or educational systems.

- The study's cross-sectional design limits its ability to establish causation. Longitudinal studies would be more effective in tracking changes in students' perceptions and decisions over time.

- Participants might provide responses that align with societal expectations or what they perceive as desirable, potentially influencing the accuracy of reported perceptions and decisions.

5.2. Recommendations

By implementing these recommendations, educational institutions and policymakers can contribute to creating an environment where students are well-informed, motivated, and empowered to choose statistics as a major academic pursuit.

- The findings suggest that interventions aimed at enhancing the perceived incentives for statisticians could positively impact students' choices. Highlighting the importance of statistical expertise in today's data-driven world, showcasing successful career trajectories of statisticians, and providing information about the varied opportunities in the field can contribute to changing perceptions.

- The findings suggest that pedagogical approaches in teaching statistics play a vital role. Educators employing methods that simplify and demystify the language of statistics may contribute to making the subject more appealing to students.

- Educational institutions should consider diversifying their statistics curriculum to emphasize interdisciplinary skills. Additionally, career guidance programs should highlight the versatility of statistical expertise and the diverse paths it opens, including eligibility for graduates from other subjects.

• Provide robust educational support systems, including tutoring, workshops, and mentorship programs, to address students' concerns about the perceived difficulty of statistics. Demonstrating the availability of resources for overcoming challenges can encourage more students to pursue statistics majors.

• Emphasize the career flexibility offered by a statistics major. Showcase success stories of individuals who, despite having diverse educational backgrounds, have excelled in statistical professions. This can positively influence students' perceptions of career possibilities.

• Advocate for the inclusion of statistical components in competitive exams, such as standardized tests and entrance examinations. This can underscore the importance of statistical knowledge in a competitive academic landscape and motivate students to view statistics as a valuable skill set for success.

• Work towards integrating data-driven fields, including basic statistical concepts, into school-level curricula. Starting early exposure to statistical thinking can demystify the subject, foster a positive attitude, and prepare students for the data-centric demands of future academic and professional pursuits.

Ethical Approval

Ethical approval for this study has been obtained from the Graduate Study Committee of University of Peshawar.

Informed Consent

When human subjects were involved in the research, informed consent was obtained from all participants. Their rights, privacy, and confidentiality were respected throughout the study.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

Competing Interest

The authors have no conflict of interest to declare

Data Availability Statement

The data that support the findings of this study are openly available in OSF at https://osf.io/6duyc/?view_only=5a177cd2ad5041e48c77300d8912d6c8

REFERENCES

Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. Journal of Experimental Psychology: General. 130(2) 224–237.

Balo ̆Glu, M. (2002). Psychometric properties of the statistics anxiety rating scale. Psychological reports. 90(1), 315–325. https://doi.org/10.2466/pr0.2002.90.1.315.

Billingsley, P. (1999). Convergence of Probability Measures, 2nd ed. Wiley, New York.

Bourbaki, N. (1966). General Topology 1. Addison–Wesley, Reading, MA.

Chiou, C. C., Wang, Y. M., & Lee, L. T. (2014). Reducing statistics anxiety and enhancing statistics learning achievement: effectiveness of a one-minute strategy. Psychological reports. 15(1) 297–310. https://doi.org/10.2466/11.04.PR0.115c12z3

Caroline, R., Candace, S., & Esma, E. (2012). The Importance Of Attitudes In Statistics Education. Statistics Education Research Journal 11(2) 57–71.

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics Anxiety: What Have We Learned in 60 Years? Frontiers in psychology. 8, 508. https://doi.org/10.3389/fpsyg.2016.00508

Ethier, S. N. And Kurtz, T. G. (1985). Markov Processes: Characterization and Convergence. Wiley, New York.

George, D., & Mallery, P. (2016). IBM SPSS Statistics 23 Step by Step: A Simple Guide and Reference (14th ed.). Routledge, 1-17. https://doi.org/10.4324/9781315545899 6(1)

Giovanni, W.S., Dale, E.B., Amanda, T.S., & Justin C.M. (2011). Effectiveness of Computer-Assisted Instruction in Statistics: A Meta-Analysis. Review of Educational Research 81(1), 97–128.

Hunt, B. W., Mari, T., Knibb, G., Christiansen, P., & Jones, A. (2023). Statistics anxiety and predictions of exam performance in UK psychology students. PloS one. 18(8), e0290467. https://doi.org/10.1371/journal.pone.0290467

Henson, R. K., & Roberts, J. K. (2006). Use of Exploratory Factor Analysis in Published Research: Common Errors and Some Comment on Improved Practice. Educational and Psychological Measurement. 66(3) 393-416, https://doi.org/10.1177/0013164405282485

Kline, R.B. (2005). Principles and practice of structural equation modeling (2nd ed.) New York: Guilford Press. pp. 137-141.

Mcgrath, A.L., Ferns, A., Greiner, L., Wanamaker, K., & Brown, S. (2015). Reducing Anxiety and Increasing Self-efficacy within an Advanced Graduate Psychology Statistics Course. The Canadian Journal for the Scholarship of Teaching and Learning 6(1) 1–17.

Onwuegbuzie, A. J., & Wilson, V. A. (2003). Statistics anxiety: Nature, etiology, antecedents, effects, and treatments: A comprehensive review of the literature. Teaching in Higher Education. 8(2) 195–209.

Paechter, M., Macher, D., Martskvishvili, K., Wimmer, S., & Papousek, I. (2017). Mathematics
Anxiety and Statistics Anxiety. Shared but Also Unshared Components and Antagonistic Contributions to Performance in Statistics. Frontiers in Psychology. 8.10.3389/fpsyg.2017.01196

Yang, M., Viladrich, C., & Cruz, J. (2023). Examining the relationship between academic stress and motivation toward physical education within a semester: A two-wave study with Chinese secondary school students. Frontiers in Psychology. 13, https://www.frontiersin.org/articles/10.3389/fpsyg.2022.965690

Yang, C., Potts, R. & Shanks, D.R. (2018). Enhancing learning and retrieval of new information: a review of the forward testing effect. npj science of learning. 3,8. https://doi.org/10.1038/s41539-018-0024-y.