Proceedings of the 5th International Conference on Statistics: Theory and Applications (ICSTA'23)
Brunel University, London, United Kingdom – August 03-05, 2023
Paper No. 10.11159/icsta23.104
DOI: 10.11159/icsta23.104

Statistics Anxiety: What are the antecedents?

Milica Maricic[1], Teodora Rajkovic[1], Danica Lecic-Cvetkovic[1], Marina Ignjatovic[1]
[1]University of Belgrade, Faculty of Organizational Sciences
Jove Ilica 154, Belgrade, Serbia
milica.maricic@fon.bg.ac.rs; teodora.rajkovic@fon.bg.ac.rs; danica.lecic-cvetkovic@fon.bg.ac.rs,
marina.ignjatovic@fon.bg.ac.rs

Abstract **-** Study curriculums of higher education institutions on all levels of study (bachelor, master, and PhD) incorporate statistics courses. Such courses are more or less mandatory in higher education and specialisation. Research has shown that students report high levels of stress while attending statistics courses, high levels of anxiety while preparing and taking the exam and developing negative opinions of the statistics as a scientific field. In order to revert the negative connotation that is easily developed among students, it is of outer importance to explore the factors which impact their opinions on statistics. To do so, a survey was conducted among students who were attending a statistical course at the bachelor's level. The survey encompassed four parts: background information, previous experience with mathematical subjects, elements of the statistical course they feel anxiety about, and their opinion on the final outcome of the exam and the overall course. The conducted analysis was two-fold: first, to explore are there gender differences and study programme differences in opinions and attitudes and second, to construct a conceptual model to explore the impact of previous experience with mathematical subjects on anxiety and opinion. Statistical analyses used to answer the defined task is structural equation modelling (SEM). It is believed that the obtained results could shed light on the antecedents of statistical anxiety among students who are attending a statistical course at the university level for the first time. Professors and teaching assistants could be provided with valuable insights which can help them adjust their curriculum and in-class dynamics so as to reduce the possibility for students to develop statistics anxiety. Besides improving the grades and percentage of students who pass the statistics exam, they could improve the students' perception of the scientific field, thus encouraging them to pursue a career in statistics and data analysis, leading to the popularisation of the scientific field.

Keywords**:** Statistics anxiety, Attitude towards statistics, higher education, conceptual model

1. Introduction

Anxiety disorder became an everyday term that presents the most common mental problem in the world today. Besides six major types of anxiety disorders as phobia, panic disorder, social anxiety disorder, obsessive–compulsive disorder generalized anxiety disorder, and posttraumatic stress disorder, new forms of anxiety disorders have been defined in recent years. Some of them include test and performance anxiety, mathematic anxiety, stage fright and statistics anxiety [1].

Today, in higher education we encounter the term "statistics anxiety". Authors [2] define statistics anxiety as "an anxiety which occurs as a result of encountering statistics in any form and at any level to involve a complex array of emotional reactions which have the propensity to debilitate learning". This specific anxiety presents a fear that appears when an individual has to solve some statistics problems or instructional situations [3]. Authors [4] consider statistics anxiety as anxiety that appears with meeting with statistics at any level and in any form regarding collecting, processing and data interpretation. According to authors [5], statistics anxiety is affected by the perceived worth of statistics, the anxiety of class and tests, interpretation anxiety, conceptual self-concept, fear of teachers that teach statistics and as well fear of asking for help.

Authors [6] consider that learning statistics and statistics-related courses is quite important for the professional and academic development of higher education students. Also, they consider that statistics anxiety is related to a lack of statistical knowledge and that students who do not have strong background knowledge in statistics are frightened of statistics-related courses. But statistics anxiety can be situation-specific, i.e., symptoms can appear only in a specific situation, for example, while learning statistics or applying statistics [7].

Having the above-said in mind, the subject of this paper is to identify the antecedents of the interpretation anxiety and perceived usefulness of statistics among faculty students. The starting premise of this study is that the fear, anxiety, and negative emotions towards statistics are not formed at the statistical course per se, whereas previous experience with quantitative subjects, such as mathematics plays a role. To explore our assumption, we created and tested a new conceptual model for exploring the impact of previous quantitative experience of students on statistical anxiety. To evaluate the proposed model, an online survey was conducted at the Faculty of Organizational Sciences, which is a part of University of Belgrade, Serbia, while the answers were analysed using structural equation modelling (SEM).

Our research hypothesis is defined as: *Current conceptual models for exploring the students' attitudes towards statistics and statistical anxiety can be upgraded by incorporating new antecedents.*

The paper is structured in the following sections. The introductory part briefly describes this topic's importance, the study's subject and purpose, and the main hypothesis. The second section provides a literature review of the research conducted on statistical fear and anxiety and the identified antecedents, as well as similarities and differences of mathematics anxiety and statistics anxiety. In the next section, we present our conceptual model, its hypotheses, and the statistical method used for model validation (Structural Equation Modelling - SEM). Section four is related to the research methodology, the sample characteristics and the study results. The final section sees the summary of the findings and conclusions, future study directions and practical implications of this study, with an explanation of study limitations and challenges.

2. Literature review

Statistics anxiety can present a critical factor which influences the students' vocational and academic objectives [8]. Students that have developed a high level of statistics anxiety strive to miss classes, have higher level of study-related stress and achieve lower performance on statistics tests [9]. From the student's perspective, many students believe that statistic course presents a major threat to graduation [10] and it may prevent students from completing their degree programs [11], [12].

An interesting fact in research about statistics anxiety reported by [13] is that female students resulted with higher levels of statistics anxiety at the beginning and in the middle of the examination. Also, depending on the knowledge background, authors [14] consider that students with a social sciences background (i.e. Faculty of Education) may not have much experience with numbers and can convince themselves to be weak with numbers. But the most often in literature is written about the correlation between mathematics and statistics anxiety, as well as possible ways to overcome statistics anxiety. More about these topics is presented in the following subsections.

2.1. Mathematics anxiety vs. statistics anxiety

Many authors have dealt with the problem of statistics anxiety, while many of them connected mathematics anxiety with statistics anxiety. Those two anxieties have many similarities in terms of their effects, nature, treatments and antecedents [15], while there is a major difference between the cognitive processes of mathematics and statistics [16]. Author [17] states that statistics anxiety is related to mathematics and test anxiety, as well as a history of an individual's experience regarding success and failure in mathematics. "The findings of self-report scale regarding the factors contributing to statistics anxiety showed that students with a good numerical history tend to be less nervous" [6]. Authors [18] and [19] believe that there is a connection between statistics anxiety and previous experience with mathematics and statistics.

When it was first detected, statistics anxiety was observed as a type of mathematics anxiety [1]. Both, mathematics and statistics anxiety are correlated significantly and negatively with numerical ability, while statistics anxiety is correlated significantly with inductive reasoning ability [20]. Authors [21] have done the research with the main findings that statistics and mathematics anxiety are related to numeric ability and to high school mathematics grade: the lower numeric ability and high school mathematics grade, related anxieties are higher. Also, they have found that statistics anxiety and statistics course grades are related to inductive reasoning ability: with higher ability, the statistics anxiety is lower and the course grade is higher.

2.2. Possible ways to overcome statistical anxiety

The main reason for statistics anxiety is poor communication between teachers and students [22], while there are many ways to decrease or even overcome statistics anxiety. One of the solutions to reduce students' statistics anxiety

and improve their learning performance is the application of the one-minute paper strategy [23]. According to the same authors, this strategy implies anonymous student responses at the end of the class on questions related to the material covered covered on the class. After the class, the teacher reads all the responses and can conclude did students understood the class and what remains to be further clarified. Another solution could be to reduce the proportion of theoretical aspects and increase the proportion of practical examples during lectures.

Authors [24] propose the application of humorous cartoons in statistics to reduce statistics anxiety because the application of statistics in the cartoon content decreases statistics anxiety in students and improves their learning. Also, the application of attention-getting teaching techniques called "gimmicks" in statistics classes reduces the students' statistics anxiety [25]. Author [26] considers supporting materials and untimely tests' effect on the decrease of anxiety and increase in performance. Another author [27] considers two approaches for the decrease of statistics anxiety: application of current news for explaining the concepts and methodological issues in statistical research, as well as introduction with older articles with the interesting topic for students that will be used for reading, explanation and critic, with the application of methodological issues in statistical research. Author [28] has done research where results show that students with lower anxiety levels believe more in their better performance in class, as well as have more interest in statistics. Author [29] considers important that students share and discuss their experiences with statistics anxiety to overcome statistics anxiety.

3. Conceptual model for determining the antecedents of statistical anxiety among students

According to Cruise et al. [4] there are six components of statistics anxiety: (a) computational self-concept, (b) test and class anxiety, (c) interpretation anxiety, (d) worth of statistics, (e) fear of statistics teachers, and (f) fear of asking for help. As the overall concept of statistical anxiety is quite complex, herein we focused on interpretation anxiety and usefulness (worth) of statistics. *Worth of statistics* deals with student's perception of the relevance of statistics, while the *Interpretation anxiety* is related with the anxiety experienced when a student is faced with making a decision from or interpreting statistical data [8]. The aim of this study is to provide insights whether or not previous experience in quantitative courses has an impact on how students perceive the usefulness of the statistics and on their level of interpretation anxiety. Our proposed conceptual model is given in Figure 1. We strive to explore how grades is there quantitative subjects (Mathematics 1, Mathematics 2, and Probability theory) impact the *Usefulness of statistics* and *Interpretation anxiety.*

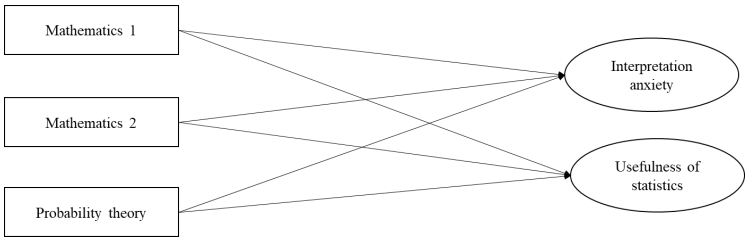

Fig. 1: The proposed conceptual model.

Six research hypotheses can be formed according to the proposed conceptual model:
H_1: The obtained grade on the course Mathematics 1 has an impact on statistical interpretation anxiety
H_2: The obtained grade on the course Mathematics 1 has an impact on the perceived usefulness of statistics
H_3: The obtained grade on the course Mathematics 2 has an impact on statistical interpretation anxiety
H_4: The obtained grade on the course Mathematics 2 has an impact on the perceived usefulness of statistics
H_5: The obtained grade on the course Probability Theory has an impact on statistical interpretation anxiety
H_6: The obtained grade on the course Probability Theory has an impact on the perceived usefulness of statistics

So far the antecedents of statistical anxiety have been studied. Onwuegbuzie [8] explored how self-perception impacts statistical anxiety, De Meo Cook and Catanzaro [30] analysed how socio-demographic background impacted statistical anxiety and statistics attitudes, McCaughey et al. [31] researched the impact of self-efficacy, anxiety sensitivity, and perfectionism on both statistics/math anxiety. These studies confirm that this is a prominent field of study and that there is still need for related research.

3.1. Research instrument

The questionnaire consisted of four sections. The first section aimed at capturing the students' background with questions related to gender, study program, and year of study. The following section had the goal of measuring the students' previous experience and results with quantitative subjects at the Faculty. The students were asked to state their grades on Mathematics 1, Mathematics 2, and Probability theory. The following five questions were adapted from [10] and aimed to quantify the level of the students' anxiety in specific situations related to using statistics and interpreting statistical results. The final scale examined the students' expectations and opinions on the course and the course outcomes and it was proposed by the authors.

3.2. Partial-least squares SEM analysis

To explore the proposed conceptual model's validity, we turned to structural equation modelling (SEM). SEM analysis is based on the principles of two statistical multivariate analyses: factor analysis and regression analysis [32], [33]. The idea is to use the principles of factor analysis to group the measured variables into latent factors, and to use multiple linear regression to explore the relationships between the measured and latent variables. There are two main SEM approaches: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM). The main difference between the two approaches is their goal: CB-SEM aims to reproduce the theoretical covariance matrix, while PLS-SEM aims at maximizing the explained variance of the dependent latent constructs [34].

A bibliometric study done by Ciavolino and associates [35] indicates that the PLS use has gained momentum relative to factor-based SEM in recent years and that PLS-SEM analysis has been increasingly used to verify conceptual models [36]. In our study, we used PLS-SEM and the SmartPLS Software version 4 [37].

Among several algorithms available in SmartPLS 4, we turned to the bootstrapping algorithm. The bootstrapping algorithm creates a predefined number of subsamples, estimates the SEM model on each of the subsamples, and provides the original sample coefficients, mean coefficients, calculated standard deviation of the coefficients, the T statistics, which is used to assess the statistical significance of the path, and the p-value [38]. To assess the model, we used the standard metrics of model quality of PLS-SEM models – the chi-square statistics, standardised mean residual (SRMR), and NFI index.

4. Results

Alongside the results of our conceptual model, in this section, we present the case setting, so that the readers would be familiar with the specific course curriculum and course organization. We will also present the characteristics of the students who participated in the survey.

4.1. Case study setting

The case study presented in this paper observes the opinions and attitudes of students at the Faculty of Organizational Sciences (FOS), University of Belgrade (UB), Serbia, on statistics and statistics courses. In recent years the FOS has become one of the most popular faculties of UB according to the number of students who apply for the entry exam. FOS is classified as a faculty within the technical-technological cluster of the UB as the title the students receive upon graduation is in the field of engineering. FOS educates students on information systems and technologies (ICT) and business and management (B&M).

The first two years of studies are quite similar for both students of ICT and B&M. In the first two years, students have quantitative subjects such as Mathematics 1, Mathematics 2, Probability theory, and Statistics, as well as more qualitative subjects such as Management, Marketing, Principles of organisation, and Production systems. Herein we focused on the bachelor's studies and students who attended the lectures on the subject Statistics.

Statistics at FOS is a mandatory subject for all students, no matter the study program they attend. The course is held in the second year, in the fourth semester. It is important here to say that in the first year, students have mandatory courses in Mathematics 1 and Mathematics 2, while in the third semester, they have the mandatory course of Probability theory. Therefore, before attending the course Statistics, they are expected to have attended three quantitative courses. However, there are no official prerequisites for the student to listen and attend the course Statistics.

When the research was conducted, in the school year 2021/22, 1330 students were enrolled in the course Statistics.

The topics covered by the course are: Descriptive statistics, Sampling theory, Estimation theory, Hypothesis testing, Parametric tests, Nonparametric tests, Analysis of variance, and Linear regression. The course lasts 15 weeks, with 13 weeks of classes and two mid-term exam weeks. The mid-term exams take place after seven weeks of classes. During one week,

students have 1.5 hours of lectures and 1.5 hours of practical classes. The exam consisted of two segments: theoretical and practical segment. The theoretical part could be passed only during exam terms and consisted of a 30-minute test with open and closed questions related to formulas, practical usage of formulas, definitions, statistical concepts, and statistical tests. This part of the exam was assigned 70 points. The practical part was organised during the semester. Namely, every week, at a predefined time, students were given an online quiz to solve. The quiz consisted of a task related to the lecture covered the week before. In total 30 points could be collected this way.

4.2. Sample characteristics

The survey was conducted in March 2022. The questionnaire was disseminated to students during online lectures. The students were asked to fill out the questionnaire and forward it to other students who did not attend the class. In total, 218 answers were collected, representing 16.4% of all enrolled students in the course.

There were 141 female respondents (64.7%) and 77 male respondents (35.3%). There is a gender disproportion among the respondents. However, it could have been expected for two reasons: more females are enrolled at FOS [39] and females are more likely to participate in surveys. Most of the students were second-year students (84.9%). The rest of them were from the third or fourth year of studies. As the subject Statistics is perceived as a difficult quantitative subject, students often do not pass it in the second year, so they have to re-take it in the following year or years.

Regarding the study program the students attend, there is a slight disproportion: 58.7% are students of the ICT program, while the rest, 41.3% are from the B&M program. However, this slight disposition could have been expected as there are more students enrolled in the ICT program.

The following three questions were related to the students' results on three quantitative subjects: Mathematics 1, Mathematics 2, and Probability theory. The results are given in Table 1.

The results indicate a relatively high percentage of students enrolled in the course Statistics who have not passed Probability theory, which is in a way an introduction to statistics. Also, numerous students have not passed the two mathematical subjects. Of the 218 surveyed students, 130 have passed all three previous quantitative subjects. The highest mean grade is for Mathematics 1 (7.43), which can be explained by the fact that for that exam, students had multiple chances to take the exam and pass it. Regarding the two mathematical subjects, the modes and the medians are the same and equal to 7. This the measured standard deviations are somewhat low. The passing rate for the subject Probability theory is lower, 67.0% of the surveyed students have passed it. The mean grade was 6.98 with the mode 5, indicating that most commonly, the respondents did not pass the exam.

Table 1: Descriptive statistics of the students' success in passing the three quantitative subjects

Subject	Did not pass (Grade 5)	Passed (Grades 6 to 10)	Mean	Mode	Median	Std
Mathematics 1	12.4%	87.6%	7.43	7.00	7.00	1.483
Mathematics 2	19.7%	80.3%	7.11	7.00	7.00	1.539
Probability theory	33.0%	67.0%	6.98	5.00	7.00	1.690

This table indicates that a good percentage of the surveyed students have adequate mathematical knowledge for understanding the basic principles of statistics. However, regarding the course Statistics it would have been better for both students and lecturers if more students had passed the Probability theory exam.

4.3. Verification of the conceptual model

The next step in the analysis was the inspection of the two constructs' internal consistency and validity. Three metrics were used Cronbach's alpha [40], reliability of the partial least squares (Rho_A) [41] and Composite reliability (Rho_C). All these metrics take values from 0 to 1. The closer the measured values are to 1, the greater the internal consistency is. The threshold for all of them is 0.7 [41], [42]. As can be seen from Table 2, the two proposed scales have satisfactory values of the three metrics. This indicates that the scales are reliable and consistent and that the SEM analysis can be performed. Also, to additionally explore the construct structures, we calculated the Variance Inflation Factor (VIF) to assess whether there is a problem with multicollinearity. As all obtained VIFs were below the threshold of 5, we can conclude that there is no multicollinearity in the proposed constructs.

Table 2: Inspection of construct validity and internal consistency

Scale	Cronbach's alpha	Rho_A	Rho_C	VIF
Interpretation anxiety	0.832	0.851	0.881	All VIFs are below 2
Usefulness of statistics	0.647	0.716	0.724	All VIFs are below 2.5

The following step in the analysis was related to the application of SEM analysis. Herein, we opted for the PLS-SEM and its bootstrapping algorithm with 5000 replications. The obtained value of the chi-square statistics of the overall model on the whole sample is 322.464, the SRMR is 0.096, while the NFI equals 0.78. Therefore, according to the values of the evaluation metrics, we can conclude that the model is of satisfactory quality, taking into account the sample size and the model complexity.

The results of the PLS-SEM bootstrap analysis are provided in Table 3. Out of three predictors of *Interpretation anxiety*, only the grade in Mathematics 1 proved to be statistically significant. The obtained path coefficient is negative, indicating that the higher the grade is in Mathematics 1, the less anxious the students would be regarding using statistics. The calculated paths between Statistical anxiety and the other two predictors are as well negative but not statistically significant. Indicating that success and grades in mathematics 2 and Probability theory have no impact on the anxiousness related to statistics. The received grade in Mathematics 1 explains 11.3% of the overall statistical anxiety. Again, out of the three predictors of the *Usefulness of statistics*, only one is statistically significant – Grade from Probability theory. The higher the grade in Probability theory, students will find statistics more practical and used in everyday life. The received grade in Probability theory explains 13.5% of the overall statistical usefulness.

Table 3: Results of the PLS-SEM bootstrap analysis

Construct	Predictor	Original sample	Sample Mean	Std	T stat	P value	R^2
Interpretation anxiety	Mathematics 1	-0.236	-0.237	0.091	-2.594	**0.010**	0.113
	Mathematics 2	-0.076	-0.080	0.086	-0.884	0.377	
	Probability theory	-0.066	-0.067	0.096	-0.691	0.490	
Usefulness of statistics	Mathematics 1	0.062	0.063	0.109	0.564	0.573	0.135
	Mathematics 2	0.071	0.068	0.096	0.614	0.540	
	Probability theory	0.292	0.301	0.102	2.880	**0.004**	

Some lecturing implications can be drawn from the above-presented results. The only statistically significant predictor of *Interpretation anxiety* is Mathematics 1. This indicates that the first quantitative subject thought by the FOS is quite important. Not only for the curricula, whereas as it might initiate fear, anxiety, and stress towards other quantitative subjects and the interpretation of quantitative results. Therefore, since the first contact with the quantitative subjects a more user-friendly should be taken, especially as the students from the FOS are more business-oriented than oriented toward theoretical aspects. Also, the students who better understood Mathematics 1, better understood statistical concepts, and had lower interpretation anxiety. This might indicate that the students with higher marks in Mathematics 1 were more self-confident regarding their interpretation skills. On the other hand, Probability theory has an impact on the students' opinion of the usefulness of statistics. The higher the grade in Probability theory, the more the student will perceive Statistics as a useful course. Therefore, students should be encouraged and more engaged during Probability theory classes.

5. Conclusion

Out of six research hypotheses derived from the proposed model, only two have been confirmed. Accepted hypothesis 1 indicated that the grade on the course Mathematics 1 has an impact on the interpretation anxiety related to statistics, while accepted hypothesis 6 indicated that the grade on the course Probability theory has a positive impact on the perceived usefulness of statistics. Interestingly, grade on the course Mathematics 2 proved not to be a statistically significant predictor in the model. This was not expected, especially having in mind that the course curriculum of the subject Mathematics 2 is more closely related to both Probability theory and Statistics. The research results indicate that the list of antecedents should be extended, as well as the list of students' opinions on different aspects of statistical anxiety and fear.

Some limitations of the conducted research arise. First, the results should not be generalized on the level of University of Belgrade or Serbia, as the study was done on just one faculty with 16.4% of all enrolled students in the course participating. Therefore, a valuable future direction of the research could be towards conducting a similar or extended survey at other faculties of the University of Belgrade on which statistics courses are taught and do a comparative analysis so unravel the similar and different behaviour patterns among students in relation to statistics anxiety. Another potential study limitation is the model complexity. Namely, due to small sample size, the complexity of the model was reduced. If a larger study was to be conducted, other antecedents such as type of previous education (humanities or science high school), opinions of quantitative subjects, opinions on the statistical course, learning techniques used, burnout could be implemented in the model to get a more detailed picture of the students' behaviour.

The value of this study is in the fact that the analysis on the teaching of statistics and students' opinion, perception, and anxiety related to statistics in Serbia is limited. The authors hope that this study could assist lecturers and teaching assistants of statistics and statistics-related courses on how to better understand their students, their fears and anxieties. Also, we believe that our findings could serve as a foundation for related academic research.

Acknowledgements

We thank the Faculty of Organizational Sciences, University of Belgrade for the financial support for conducting the research and attending the 5th International Conference on Statistics: Theory and Applications (ICSTA'23).

References

[1] I. Papousek *et al.*, "Psychometric Evaluation and Experimental Validation of the Statistics Anxiety Rating Scale," *J. Pers. Assess.*, vol. 94, no. 1, pp. 82–91, Jan. 2012.

[2] A. J. Onwuegbuzie and C. E. Daley, "Perfectionism and statistics anxiety," *Pers. Individ. Dif.*, vol. 26, no. 6, pp. 1089–1102, Jun. 1999.

[3] D. Macher, I. Papousek, K. Ruggeri, and M. Paechter, "Statistics anxiety and performance: blessings in disguise," *Front. Psychol.*, vol. 6, Aug. 2015.

[4] R. J. Cruise, R. W. Cash, and D. L. Bolton, "Development and validation of an instrument to measure statistical anxiety," *Am. Stat. Assoc. Proc. Sect. Stat. Educ.*, vol. 4, no. 3, pp. 92–97, 1985.

[5] R. J. Cruise and E. M. Wilkins, "STARS: Statistical anxiety rating scale," 1980.

[6] S. M. R. Amirian and S. Abbasi-sosfadi, "Fear of Statistics among TEFL Postgraduate Students," *Eurasian J. Appl. Linguist.*, vol. 7, no. 1, pp. 202–221, Apr. 2021.

[7] A. J. Onwuegbuzie, "Statistics Anxiety among African American Graduate Students: An Affective Filter?," *J. Black Psychol.*, vol. 25, no. 2, pp. 189–209, May 1999.

[8] A. J. Onwuegbuzie, "Statistics Anxiety and the Role of Self-Perceptions," *J. Educ. Res.*, vol. 93, no. 5, pp. 323–330, May 2000.

[9] P. K. H. Chew and D. B. Dillon, "Statistics Anxiety Update: Refining the Construct and Recommendations for a New Research Agenda," *Perspect. Psychol. Sci.*, vol. 9, no. 2, pp. 196–208, Mar. 2014.

[10] A. Vigil-Colet, U. Lorenzo-Seva, and L. Condon, "Development and validation of the statistical anxiety scale," vol. 20, no. 1, pp. 174–180, 2008.

[11] F. Chiesi, C. Primi, and J. Carmona, "Measuring Statistics Anxiety," *J. Psychoeduc. Assess.*, vol. 29, no. 6, pp. 559–569, Dec. 2011.

[12] A. J. Onwuegbuzie and V. A. Wilson, "Statistics Anxiety: Nature, etiology, antecedents, effects, and treatments--a comprehensive review of the literature," *Teach. High. Educ.*, vol. 8, no. 2, pp. 195–209, Apr. 2003.

[13] D. Macher, M. Paechter, I. Papousek, K. Ruggeri, H. H. Freudenthaler, and M. Arendasy, "Statistics anxiety, state anxiety during an examination, and academic achievement," *Br. J. Educ. Psychol.*, vol. 83, no. 4, pp. 535–549, Dec. 2013.

[14] D. Koh and M. K. Zawi, "Statistics Anxiety among Postgraduate Students," *Int. Educ. Stud.*, vol. 7, no. 13, pp. 166–174, 2014.

[15] M. Baloglu, "A Comparison of Mathematics Anxiety and Statistics Anxiety in Relation to General Anxiety," Texas A&M University-Commerce Department of Psychology, 1999.

[16] M. Baloglu, "Statistics Anxiety and Mathematics Anxiety: Some Interesting Differences I," *Educ. Res. Q.*, vol. 27,

no. 3, pp. 38–48, 2004.
[17] J. Benson, “Structural Components of Statistical Test Anxiety in Adults,” *J. Exp. Educ.*, vol. 57, no. 3, pp. 247–261, Apr. 1989.
[18] K. Trimarco, “The Effects of a Graduate Learning Experience on Anxiety, Achievement, and Expectations in Research and Statistics,” 1997.
[19] M. Zeidner, “STATISTICS AND MATHEMATICS ANXIETY IN SOCIAL SCIENCE STUDENTS: SOME INTERESTING PARALLELS,” *Br. J. Educ. Psychol.*, vol. 61, no. 3, pp. 319–328, Nov. 1991.
[20] M. Paechter, D. Macher, K. Martskvishvili, S. Wimmer, and I. Papousek, “Mathematics Anxiety and Statistics Anxiety. Shared but Also Unshared Components and Antagonistic Contributions to Performance in Statistics,” *Front. Psychol.*, vol. 8, Jul. 2017.
[21] M. Birenbaum and S. Eylath, “Who is afraid of statistics? Correlates of statistics anxiety among students of educational sciences,” *Educ. Res.*, vol. 36, no. 1, pp. 93–98, Mar. 1994.
[22] K. Druggeri, M. Dempster, D. Hanna, and C. Cleary, “Experiences and Expectations: The Real Reason Nobody Likes Stats,” *Psychol. Teach. Rev.*, vol. 14, no. 2, pp. 75–83, 2008.
[23] C.-C. Chiou, Y.-M. Wang, and L.-T. Lee, “Reducing Statistics Anxiety and Enhancing Statistics Learning Achievement: Effectiveness of a One-Minute Strategy,” *Psychol. Rep.*, vol. 115, no. 1, pp. 297–310, Aug. 2014.
[24] S. Schacht and B. J. Stewart, “What’s Funny about Statistics? A Technique for Reducing Student Anxiety,” *Teach. Sociol.*, vol. 18, no. 1, p. 52, Jan. 1990.
[25] S. P. Schacht and B. J. Stewart, “Interactive/User-Friendly Gimmicks for Teaching Statistics,” *Teach. Sociol.*, vol. 20, no. 4, p. 329, Oct. 1992.
[26] A. J. Onwuegbuzie, “Attitudes toward Statistics Assessments,” *Assess. Eval. High. Educ.*, vol. 25, no. 4, pp. 321–339, Dec. 2000.
[27] J. Dilevko, “A New Approach to Teaching Research Methods Courses in LIS Programs,” *J. Educ. Libr. Inf. Sci.*, vol. 41, no. 4, p. 307, 2000.
[28] C. A. McKim, “The Value of Mixed Methods Research,” *J. Mix. Methods Res.*, vol. 11, no. 2, pp. 202–222, Apr. 2017.
[29] S. Malik, “Undergraduates’ Statistics Anxiety: A Phenomenological Study,” *Qual. Rep.*, vol. 20, no. 2, pp. 120–133.
[30] K. D. Cook and B. A. Catanzaro, “‘Constantly Working on My Attitude Towards Statistics!’ Education Doctoral Students’ Experiences with and Motivations for Learning Statistics,” *Innov. High. Educ.*, no. OnlineFirst, Aug. 2022.
[31] N. J. McCaughey, T. G. Hill, and S. P. Mackinnon, “The association of self-efficacy, anxiety sensitivity, and perfectionism with statistics and math anxiety,” *Personal. Sci.*, vol. 3, pp. 1–23, Dec. 2022.
[32] R. B. Kline, *Principles and practice of structural equation modeling*. 2005.
[33] P. Jovanović, T. Ivanović, M. Maričić, and S. Ivančević, “Public Procurement Employees’ Perception on Legal Changes, Perceived Red Tape and Job Stress: Evidence from Serbia,” *Eng. Econ.*, vol. 33, no. 5, pp. 507–520, Dec. 2022.
[34] J. Hair, G. T. M. Hult, C. M. Ringle, M. Sarstedt, N. P. Danks, and S. Ray, “An Introduction to Structural Equation Modeling,” 2021, pp. 1–29.
[35] E. Ciavolino, M. Aria, J.-H. Cheah, and J. L. Roldán, “A tale of PLS Structural Equation Modelling: Episode I— A Bibliometrix Citation Analysis,” *Soc. Indic. Res.*, vol. 164, no. 3, pp. 1323–1348, Dec. 2022.
[36] J. Hair, C. M. Ringle, and M. Sarstedt, “PLS-SEM: Indeed a Silver Bullet,” *J. Mark. Theory Pract.*, vol. 19, no. 2, pp. 139–152, Apr. 2011.
[37] S. GmbH, “SmartPLS,” 2023. [Online]. Available: https://www.smartpls.com/. [Accessed: 20-Jan-2023].
[38] G. W. Cheung and R. S. Lau, “Testing Mediation and Suppression Effects of Latent Variables,” *Organ. Res. Methods*, vol. 11, no. 2, pp. 296–325, Apr. 2008.
[39] U. of Belgarde, “Извештај универзитетске комисије заупис студената у прву годину студијских програма,” Belgrade, 2020.
[40] L. J. Cronbach, “Coefficient alpha and the internal structure of tests,” *Psychometrika*, vol. 16, no. 3, pp. 297–334, Sep. 1951.
[41] T. K. Dijkstra and J. Henseler, “Consistent partial least squares path modeling,” *MIS Q.*, vol. 39, no. 2, 2015.
[42] M. Tavakol and R. Dennick, “Making sense of Cronbach’s alpha,” *Int. J. Med. Educ.*, vol. 2, pp. 53–55, Jun. 2011.