FEARS OF STATISTICS AMONG TEFL POST GRADUATE STUDENTS

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ABSTRACT

Although the field of statistics serves as a crucial and obligatory component of the curriculum across a myriad of academic disciplines, it has been observed that a significant proportion of students, particularly those enrolled in postgraduate programs focused on Teaching English as a Foreign Language (TEFL), frequently experience profound feelings of intimidation and find the subject matter exceedingly challenging to comprehend. Consequently, this pervasive difficulty often leads to a state of underachievement among these students, which can have adverse effects on their overall academic performance and self-confidence. In light of these circumstances, a particular type of anxiety, which is specifically identified as statistical anxiety, tends to manifest among learners and necessitates prompt and focused intervention to alleviate its detrimental effects. To date, an extensive and continually expanding body of scholarly research has concentrated on identifying and investigating various aspects and dimensions of statistics that elicit feelings of fear and tension among students. However, despite the wealth of literature available, the specific issue of statistical anxiety experienced by TEFL postgraduate students has not been adequately addressed or prioritized within academic discourse. In the context of the present study, efforts are made to systematically evaluate and articulate the specific areas of anxiety that individuals pursuing postgraduate studies in TEFL encounter during their engagement with a statistics course. To achieve this objective, the current research employed a descriptive research design, specifically utilizing survey research methodologies to gather data. Initially, a well-structured statistical anxiety questionnaire was disseminated to a sample of 72 TEFL postgraduate students, which was designed to capture three interrelated dimensions of statistical anxiety, namely Examination Anxiety, Asking for Help Anxiety, and Interpretation Anxiety. Following the questionnaire distribution, in-depth interview sessions were conducted with a subset of 10 participants to facilitate a more thorough exploration of their responses to the items presented in the questionnaire. The subsequent analysis of the collected data indicated that Examination Anxiety was the most frequently reported concern among the various anxiety subscales,

while the least frequent concern was associated with Asking for Help Anxiety. These descriptive findings, in conjunction with the conceptual insights derived from the participants' perspectives regarding their primary anxieties related to statistics, hold significant implications for educators who teach statistics, developers of academic courses, policymakers within the educational sector, and, of course, the TEFL postgraduate students themselves, as they seek to navigate the complexities of statistical concepts.

Introduction

The growing necessity for acquiring a comprehensive understanding of statistical methods and the ability to apply these techniques across an extensive range of academic disciplines has resulted in the establishment of statistics courses as mandatory components of the curriculum at virtually all higher education institutions worldwide (Onwuegbuzie & Wilson, 2003). To elaborate, the acquisition of knowledge in these statistical domains is not merely beneficial but is of paramount significance for both the academic advancement and the professional growth of university students, as it equips them with essential skills that are increasingly required in their respective fields. This implies that, in order to successfully engage in quantitative research studies and to competently interpret and analyze numerical data derived from research findings, it becomes critically important for students, regardless of their specific academic focus, to attain a level of proficiency in statistical methodologies. However, it is worth noting that a substantial proportion of students who enter these courses with a relatively weak foundation in statistical principles often perceive statistics-related academic content as intimidating and even overwhelmingly difficult to comprehend or manage. As a direct consequence of this situation, a distinct form of anxiety emerges, which is specifically associated with a lack of familiarity and confidence in statistical concepts, ultimately presenting a significant challenge for these individuals.

In alignment with the insights provided by Zeidner (1990), the phenomenon known as statistics anxiety can be succinctly defined as follows: "a performance characterized by extensive worry, intrusive thoughts, mental disorganization, tension, and physiological arousal...when exposed to statistics content, problems, instructional situations, or evaluative contexts, and is commonly claimed to debilitate performance in a wide variety of academic situations by interfering with the manipulation of statistics data and solution of statistics problems" (p. 319). In simpler terms, statistics anxiety encapsulates a particular form of apprehension that

students frequently encounter when they attempt to grapple with courses and subject matter related to statistical analysis. Furthermore, in certain specialized disciplines such as psychology, education, or sociology, where students may exhibit a diminished interest in numerical data and quantitative relationships, the importance of statistics is frequently underestimated and undervalued (Ruggeri, Dempster, Hanna, & Cleary, 2008). Consequently, when these students are confronted with statistical concepts and methodologies, they are more likely to experience heightened levels of stress and unease as they navigate through the course material (Onwuegbuzie, 2004; Onwuegbuzie & Wilson, 2003; Druggeri et al., 2008). Indeed, research has consistently indicated that statistics courses are often regarded as the most anxiety-inducing subjects for a significant number of students (Blalock, 1987; Caine et al., 1978; Gaydosh, 1990; Lundgren & Fawcett, 1980; Schacht & Stewart, 1990, 1991; Zeidner, 1991). This pervasive anxiety has contributed to the perception of quantitative and statistics classes as exceedingly negative and frustrating experiences (Onwuegbuzie, 1997). As a result of this discomfort, many students tend to delay or procrastinate the completion of statistics-related course requirements, often feeling a sense of nervousness and anxiety during the duration of quantitative methods courses (Onwuegbuzie, 1997; Robert & Bilderback, 1980).

The aforementioned tension associated with statistics anxiety is particularly pronounced within the realms of human and social sciences, where there exists a considerably limited opportunity for practical engagement with numerical data. Historically, applied linguistics, and specifically the subfield of second language acquisition, exhibited a relatively low emphasis on the practical application of statistical knowledge and techniques. Nevertheless, due to a significant and ongoing expansion in the application of interdisciplinary research within the domain of applied linguistics, the role and relevance of statistics have experienced a remarkable surge in prominence among researchers and practitioners alike. In other words, the interdisciplinary approach to research has fostered a diversification of research methodologies, each of which necessitates the utilization of specific statistical techniques tailored to their unique requirements. This evolving landscape has consequently engendered an increasing demand for individuals to engage with statistical concepts and to acquire a robust understanding of statistical principles (Comanaru, 2014; Pica, 2003). The existing literature pertaining to statistical literacy compellingly underscores the quintessential importance of possessing statistical knowledge in the context of applied linguistics research (Lazaraton, 1987; Loewen et al., 2014; Gonulal, Loewen, & Plonsky, 2017). Through the development of a solid foundation in statistical knowledge, researchers in the fields of English as a Foreign Language (EFL) and English as a Second Language (ESL) can effectively summarize

and analyze the data collected from their research samples, thereby facilitating the generalization of their findings to a broader population of interest (Scholfield, 1991), which constitutes the primary aim of quantitative research methodologies. However, the prevailing challenge lies in the fact that various factors, such as inadequate statistical background, lack of confidence, insufficient knowledge, and limited experience, have rendered the subject of statistics overly complex and perplexing for many students to grasp. This predicament is particularly evident among postgraduate students enrolled in Teaching English as a Foreign Language (TEFL) programs, as they represent a specific demographic of learners who are disproportionately affected by their struggles with conducting statistical analyses.

Fears of statistics among TEFL (Teaching English as **a** Foreign Language) postgraduate students are not uncommon and can stem from several factors:

1. Math Anxiety and Lack of Background Knowledge
Many TEFL students often come from humanities or linguistics backgrounds, where they may not have had extensive exposure to mathematics or statistics. This lack of familiarity can lead to anxiety when faced with statistical concepts, methods, or tools.

2. Perceived Complexity of Statistics
Statistics is often viewed as a complex and challenging subject due to its reliance on mathematical formulas, abstract concepts, and data interpretation. This perception can intimidate students who feel they lack the skills or mindset to understand and apply statistical methods.

3. Fear of Failing or Underperforming
Given that many TEFL postgraduate programs involve research components that require statistical analysis, students may fear that their lack of statistical knowledge will negatively impact their research work and, consequently, their grades or academic progress.

4. Inadequate Instruction or Support
Sometimes, fears stem from the way statistics is taught. If the instruction is too fast-paced, overly technical, or lacks practical applications, students may find it hard to grasp the concepts. Moreover, limited access to resources like tutorials, support from instructors, or peer study groups can exacerbate their fears.

5. Application to Research in Linguistics
Linguistics and TEFL research often involve qualitative data, but when it comes to quantitative research and data analysis, students may feel unprepared. The unfamiliarity with how statistics apply to their field can lead to fear and avoidance.

6. Negative Past Experiences

Previous negative experiences with math or statistics can lead to a fixed mindset, where students believe they are "not good at math" or that statistics is beyond their capabilities.

7. Lack of Confidence in Using Statistical Software

Many postgraduate students are required to use statistical software (e.g., SPSS, R, or Python) for data analysis. The technical aspects of learning new software, along with interpreting statistical outputs, can be daunting without adequate training and practice.

8. Fear of Interpretation and Misrepresentation

Even when students understand statistical concepts, they may still fear misinterpreting data or presenting inaccurate findings in their research, which could lead to flawed conclusions.

Addressing These Fears

- To mitigate these fears, TEFL programs could consider:

- Providing foundational courses or workshops in statistics tailored to non-mathematical backgrounds.
- Incorporating practical and context-relevant examples to make statistics more accessible.
- Offering peer tutoring, mentorship, and access to statistical resources.
- Encouraging a growth mindset and a supportive learning environment where students feel comfortable asking questions and making mistakes.

In addition to the challenges faced by students, it is important to recognize that educators also encounter significant frustration when attempting to motivate and guide students in learning statistical concepts, particularly when those students may not possess an inherent aptitude for such material. To put it another way, the frustration experienced by learners not only compounds their own difficulties but also adds an additional layer of complexity to the teaching of statistics. Given this educational barrier, it is imperative to identify the primary sources of anxiety associated with statistics, as this understanding will enable educators to devote increased attention and resources to addressing these specific challenges, ultimately leading to the development of effective solutions for students struggling with quantitative methodologies. The present study aims to bridge this identified gap in the literature. The positive outcomes derived from this research endeavor are anticipated to empower and enable TEFL postgraduate students to recognize their weaknesses in conducting and interpreting quantitative analyses, rather than resorting to avoidance behaviors, while also providing educators with the opportunity to reassess and refine their instructional strategies and materials in order to foster a more supportive learning environment.

The exploration of the significance pertaining to the identified problem is a crucial endeavor that warrants careful consideration and analysis.

The outcomes derived from previous research studies compellingly demonstrate that, despite the prevalent and extensive implementation and utilization of quantitative research methodologies within the realms of English as a Foreign Language (EFL) and English as a Second Language (ESL) studies over the preceding years, there exists a palpable lack of confidence among researchers when it comes to employing more advanced and complex statistical analysis techniques. This predicament is particularly exacerbated for postgraduate students, who frequently find themselves lacking the requisite statistical knowledge and practical experience necessary to navigate these complexities effectively. As a direct consequence of this knowledge gap, a form of anxiety related to statistics arises, which adversely affects students' academic performances and their overall attitudes towards the discipline of statistics itself. Therefore, it has become increasingly evident that the apprehension surrounding statistics, especially for individuals who have not cultivated a strong foundational understanding of the subject, is now more pronounced than it has ever been in the past. This profound fear appears to be deeply rooted in a conspicuous lack of confidence regarding the application and interpretation of statistical analyses, as substantiated by the findings of various scholars (Loewen et al., 2014; Gonulal, Loewen, & Plonsky, 2017). Consequently, the primary aim of this particular investigation is to illuminate the characteristics and various forms of statistics-related anxiety that are prevalent among university students while simultaneously uncovering the fundamental origins of such fears as they pertain specifically to postgraduate students enrolled in Teaching English as a Foreign Language (TEFL) programs.

In the context of the relevant academic scholarship, the term "statistical anxiety" is often employed to describe a distinct situation in which a statistics course engenders feelings of tension, fear, and nervousness among students (e.g., Macher et al., 2015). This particular type of anxiety is so widespread that it has been reported that nearly 80 percent of students enrolled in social and behavioral sciences encounter it at some point during their academic journeys (Onwuegbuzie & Wilson, 2003). With this in mind, it is important to note that the existing body of literature addressing statistical anxiety is both extensive and focused specifically on this pressing issue. For instance, Cruise, Cash, and Bolton (1985) postulated that statistical anxiety should be conceptualized as a multidimensional construct, which is composed of six principal types of anxiety that students might experience: 1) Interpretation Anxiety,

which encompasses the stress and pressure associated with interpreting statistical data accurately; 2) Test and Class Anxiety, which pertains to the feelings of unease experienced during participation in statistics classes and examinations; 3) Fear of Asking for Help, which arises when students hesitate to seek assistance during a statistics lesson; 4) Worth of Statistics, which reflects students' perceptions regarding the significance and relevance of statistics in their academic and professional lives; 5) Computation Self-Concept, which denotes students' self-assurance in their ability to understand and engage with statistical concepts; and finally, 6) Fear of Statistics Teachers, which represents the anxiety stemming from interactions with instructors who teach statistics.

Furthermore, the antecedents of statistical anxiety have been systematically categorized into three distinct types: situational, dispositional, and environmental influences (Baloglu, 2004; Onwuegbuzie & Wilson, 2003). Situational antecedents pertain to the attitudes and experiences that individuals possess regarding statistics and mathematics more broadly (Baloğlu, 2004; Bell, 2005; DeVaney, 2017). Examples of significant situational antecedents that impact statistical anxiety include academic self-concept and students' interest in the subject matter (Benson, 1989; Jones et al., 2011; Krapp, 2005; Pintrich & DeGroot, 1990; Zeidner, 1991). Dispositional antecedents, on the other hand, are reflective of certain personality traits that individuals may possess, such as procrastination tendencies (Onwuegbuzie, 2004). Lastly, environmental antecedents encompass various background variables, such as age, gender, and prior mathematical experience, which have been the subject of extensive investigation in numerous studies that often yield divergent results.

When considering the dimension of age, previous research findings have produced inconclusive outcomes concerning its impact on statistical anxiety levels. For example, one study indicated that older learners tend to experience higher levels of statistical anxiety compared to their younger counterparts (Bell, 2003). Conversely, another research endeavor concluded that age does not significantly influence the levels of anxiety experienced by students (Bui & Alfaro, 2011).

Apart from the variable of age, it is imperative to note that the phenomenon of gender disparities in relation to statistics anxiety has been thoroughly examined across a multitude of scholarly investigations, which have consistently demonstrated that, regardless of the specific discipline or area of study in which individuals are engaged, females exhibit a higher propensity to experience heightened levels of statistical stress when compared to their male counterparts (Benson, 1989; Benson

& Bandalos, 1989). Moreover, it is of significant importance to highlight that while a subset of studies has indicated the absence of discernible gender differences in the realm of statistics anxiety (Baloğlu, 2003; Bui & Alfaro, 2011; Hsiao & Chiang, 2011), there exists another cohort of research findings that emphatically underscore the presence of such disparities (Baloğlu, Deniz, & Kesici, 2011; Rodarte-Luna & Sherry, 2008).

Furthermore, it has been established through empirical research that prior knowledge and proficiency in statistics and mathematics are substantially correlated with the degree of statistics anxiety that learners may encounter throughout their educational journey (Zeidner, 1991; Trimarco, 1997). In a general sense, the extent of exposure that students receive to statistical and mathematical concepts over an extended period is inversely related to the level of anxiety they report experiencing while studying, interpreting data, and undertaking examinations within this specific academic field. In a similar vein, various studies have illustrated that individuals who possess limited or no foundational knowledge in statistics tend to exhibit significantly higher levels of anxiety in comparison to those who have previously engaged in coursework related to numerical sciences (Benson, 1989; Hunsley, 1987; Morris, Kellaway, & Smith, 1978; Sutarso, 1992). Additionally, these investigations have indicated a notable inverse relationship wherein an increase in mathematical anxiety correlates with a marked decline in statistical performance and achievement. This particular issue has also been thoroughly examined in the scholarly contributions of Malik (2015). The results gathered from self-report scales that assess the factors contributing to statistics anxiety have shown a clear trend: students who possess a robust numerical background are generally less prone to feelings of nervousness. Conversely, it has been observed that individuals who struggle to grasp the language and terminology of statistics tend to experience a greater array of anxiety-related symptoms.

In addition, the intricate relationship between statistics anxiety and academic achievement, as well as overall performance, has been the subject of investigation in a variety of studies that have employed sophisticated multivariate analytical techniques (Fitzgerald, 1996; Onwuegbuzie, 2003; Onwuegbuzie & Seaman, 1995). The findings presented in the aforementioned studies unequivocally suggest that students who experience heightened levels of anxiety are statistically more likely to encounter failure in their academic pursuits (Fitzgerald, 1996). In a notable Structural Equation Modeling (SEM) based path analysis conducted by Onwuegbuzie (2003), a significant correlation between levels of anxiety and academic performance was reported, thereby further substantiating the connection between these two

variables. Likewise, the relationship between anxiety levels and test outcomes, as documented in a study conducted by Onwuegbuzie and Seaman (1995), was identified as both meaningful and statistically significant.

Another critical factor that may exert influence over the levels of statistics anxiety experienced by students is the construct of perfectionism (Onwuegbuzie & Daley, 1999). It has been reported that students who strive to uphold idealistic and often unattainable standards tend to experience greater feelings of anxiety and nervousness in comparison to their peers who exhibit a lower degree of perfectionistic tendencies in relation to areas such as interpretation, examination performance, and the willingness to seek assistance. In addition to the influence of perfectionism, it has been found that students' self-perception regarding their capabilities in comprehending statistical concepts, along with their overall self-esteem, contribute significantly to their levels of statistics anxiety (Zeidner, 1991).

As a potential remedy for the pervasive issue of statistics anxiety among students, Bridges et al. (1998) embarked on an innovative quasi-experimental study that sought to investigate whether the pacing of statistics courses across the entire degree program, as opposed to presenting it as a singular, intensive one-shot course, might serve to mitigate the anxiety typically associated with statistical learning. The significant findings derived from their comprehensive study indicated that the intervention was indeed effective not only in enhancing students' comprehension of quantitative reasoning but also in significantly lowering their levels of anxiety regarding statistical concepts. In a related discussion, Onwuegbuzie et al. (2010) argued that the exclusive presentation of quantitative methods could, in fact, exacerbate the levels of anxiety experienced by learners, thereby suggesting that alternative pedagogical strategies are necessary to alleviate statistics-related anxiety among students. This notion is further corroborated by various other empirical studies that have echoed similar sentiments regarding the need for different approaches in statistics education (Gorard, 2015; Payne & Williams, 2011). Conversely, Williams et al. (2015) arrived at a distinct conclusion concerning the manner in which quantitative methods are presented within a substantive unit, suggesting that such an approach could potentially lead to adverse outcomes for learners in terms of their engagement and understanding.

Shifting the focus to the critical necessity of employing statistical methodologies within quantitative research designs in the domain of applied linguistics, a multitude of scholars have diligently explored the degree to which emphasis has been placed on these research designs in the literature (Lazaraton, 2000; Lazaraton, 2005;

Loewen & Gass, 2009; Plonsky & Gass, 2011; Cunnings, 2012; Plonsky, 2013). For example, an extensive review of published investigations over a span of seven years, specifically from 1991 to 1997, revealed that a striking 90 percent of the articles published in four prominent academic journals were quantitative in nature (Lazaraton, 2000). Subsequent years saw a reaffirmation of a robust trend towards the incorporation of statistical analysis within research designs, a phenomenon that was again confirmed in later studies (Lazaraton, 2005; Loewen & Gass, 2009). Nevertheless, it is noteworthy that there has been a degree of inconsistency observed with respect to the application of more sophisticated statistical methodologies, such as structural equation modeling, as documented in the literature (Loewen & Gass, 2009; Cunnings, 2012; Plonsky & Gass, 2011; Plonsky, 2013). A recent investigation conducted by Khany and Tazik (2019) illuminated the fact that, among various statistical techniques, descriptive statistics and ANOVA were notably favored by researchers within the field. In a similar vein, the prevalence and popularity of ANOVA-related techniques had already been discussed in earlier literature by Lazaraton (2005). It is imperative to acknowledge that numerous instances of inadequate quantitative research design have been extensively highlighted in the existing literature, particularly in relation to the challenges posed by insufficient statistical knowledge among researchers (Plonsky, 2013).

In a thorough investigation aimed at assessing the statistical knowledge possessed by researchers in the fields of applied linguistics and second language acquisition, Loewen et al. (2019) discovered that, notwithstanding their proficiency in fundamental statistical concepts, researchers within these disciplines exhibited a considerably lower level of understanding concerning more advanced statistical topics. Furthermore, the study revealed that prior experience with statistics courses, in addition to the utilization of various statistics textbooks, served as significant predictors of a more profound comprehension of statistical knowledge in general. Likewise, the lack of enthusiasm exhibited by researchers towards the application of advanced statistical techniques, including factor analysis and regression analysis, was brought to light by Lindstromberg (2016), who conducted an examination of several experimental studies published in the Language Teaching Research journal. The findings of this particular study indicated a pronounced inclination towards traditional statistical methods, thereby underscoring a potential area for further development and educational enhancement within the field.

Conclusion:
The primary objective that underpins the present investigation was to meticulously evaluate and thoroughly articulate the various manifestations of anxiety that

individuals enrolled in postgraduate programs focused on Teaching English as a Foreign Language (TEFL) may encounter during the course of their studies in statistics. The findings derived from this study have indicated that, in a broad sense, anxiety is indeed a prevalent phenomenon among students pursuing TEFL, highlighting the emotional challenges they face in their academic endeavors. More specifically, this research has illuminated the fact that students tend to experience heightened levels of anxiety particularly when they are subjected to assessments in statistics, suggesting a direct correlation between testing and emotional distress. An in-depth analysis of the perspectives expressed by participants during interview sessions has revealed that the anxiety related to examinations is not solely attributable to the inherent difficulties associated with the academic subject of statistics; rather, it encompasses a more profound and pervasive fear of the examination process itself. This is significantly influenced by the examination culture prevalent in the educational landscape of Iran, where students consistently find themselves grappling with anxiety during examination periods, irrespective of the specific content being assessed. As a result, it becomes exceedingly challenging to distinctly identify the various sources contributing to this anxiety, thereby indicating a complex interplay of factors that warrants further exploration. This area presents a valuable opportunity for future research endeavors, as the current study lacks empirical data to substantiate these observations. Additionally, the evidence gathered from this investigation suggests that students frequently express dissatisfaction regarding the extensive volume of statistical material that they are required to assimilate within a constrained timeframe, as the pressure to prepare for examinations significantly exacerbates their levels of statistical anxiety. This finding is congruent with the outcomes of other scholarly investigations, which advocate for the extension of quantitative courses to alleviate such pressures (Bridges et al., 1998; Onwuegbuzie et al., 2010). An important implication arising from this insight is that faculty members and curriculum designers should consider implementing a more judicious approach to the amount of content covered within a single course, or at the very least, allocate a limited portion of the curriculum specifically for examination preparation. Nonetheless, it would be beneficial for subsequent research to explore effective strategies that could potentially mitigate examination-related anxiety among students.

Another noteworthy finding that emerged from this study, which aligns with previous research, is the observation that a deficiency in statistical background contributes to elevated levels of anxiety when it comes to interpreting and analyzing statistical materials. This critical information could be leveraged to devise targeted interventions aimed at enhancing and fortifying students' statistical foundations

prior to their enrollment in postgraduate programs. Furthermore, it has been established that possessing purely theoretical knowledge alone does not equip students with the necessary tools to effectively navigate their statistical challenges. In other words, the absence of adequate guided and supervised statistical practice constitutes one of the principal sources of anxiety that students encounter. A pragmatic approach to address this concern could involve striking an appropriate balance between students' declarative knowledge of statistical concepts and their proficiency in applying procedural knowledge within real-world contexts.

REFERENCES:

1. Ary, D., Jacobs, L. C., Irvine, C.K.S., & Walker, D. A. (2013). Introduction to research in education. Wadsworth: Cengage Learning.
2. Baloğlu, M. (2003). Individual differences in statistics anxiety among college students.
3. Personality and Individual Differences, 34(5), 855–865.
4. Baloğlu, M. (2004). Statistics anxiety and mathematics anxiety: Some interesting differences.
5. Educational Research Quarterly, 27(3), 38–48.
6. Baloğlu, M., Deniz, M. E., & Kesici, Ş. (2011). A descriptive study of individual and cross- cultural differences in statistics anxiety. Learning and Individual Differences, 21(4), 387– 391. https://doi.org/10.1016/j.lindif.2011.03.003
7. Bell, J. A. (2003). Statistics anxiety: The nontraditional student. Education, 124(1), 157-163.
8. Bell, J.A. (2005). Length of term and levels of statistics anxiety: A comparison of types of offerings. Academy of Information and Management Sciences Journal, 8(1), 103–108.
9. Benson, J. (1989). Structural components of statistical test anxiety in adults: An exploratory model. Journal of Experimental Education, 57, 247-261.
10. Benson, J., & Bandalos, D. (1989). Structural model of statistical test anxiety. In R. Schwarzer, H.M. van der Ploeg, & C.D. Spielberger (Eds.), Advances in test anxiety research (vol. 5) (pp. 207-211). Lisse: Swets and Zeitlinger: Hillsdale, N.J. Erlbaum.
11. Blalock, H.M. (1987). Some general goals in teaching statistics. Teaching Sociology, 15, 164- 172.
12. Bridges, G.S., Gillmore, G. M., Pershing, J. L., & Bates, K. A. (1998). Teaching quantitative research methods: A quasi-experimental analysis. Teaching Sociology, 26(1), 14–28.
13. Bui, N. H., & Alfaro, M. A. (2011). Statistics anxiety and science attitudes: Age, gender, and ethnicity factors. College Student Journal, 45(3), 573–585.

14. Caine, R.D., Centa, D., Doroff, C., Horowitz, J.H., & Wisenbaker, V. (1978). Statistics from who? Teaching Sociology, 6, 37-46.

15. Comanaru, R.S. (2014). Essential statistics for applied linguistics. International Journal of Bilingual Education and Bilingualism, 17(4), 498-500. DOI: 10.1080/13670050.2013.809910

16. Cruise, R.J., Cash, R.W., & Botlon, D.L. (1985). Development and validation of an instrument to measure statistical anxiety. In Proceedings of the American Statistical Association. Paper presented at the annual meeting of the Statistical Education Section. Chicago, IL, pp. 92–97.

17. Cunnings, I. (2012). An overview of mixed-effects statistical models for second language researchers. Second Language Research, 28, 369–382. doi:10.1177/0267658312443651

18. DeVaney, T. A. (2017). Anxiety and attitude of graduate students in on-campus vs. online statistics courses. Journal of Statistics Education, 18(1). doi.org/10.1080/10691898.2010.11889472

19. Dörnyei, Z. (2007). Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies. Oxford: Oxford University Press.

20. Druggeri, K., Dempster, M., Hanna, D., & Cleary, C. (2008). Experiences and expectations: The real reason nobody likes stats. Psychology Teaching Review, 14(2), 75–83.

21. Fitzgerald, S.M., Jurs, S. & Hudson, L.M., (1996). A model predicting statistics achievement among graduate students. College Student Journal, 30, 361–366.

22. Gaydosh, L.R. (1990). Syllabi and instructional materials for social statistics. Washington, DC: American Sociological Association.

23. Gonulal, T., Loewen, S., & Plonsky, L. (2017). The development of statistical literacy in applied linguistics graduate students. ITL – International Journal of Applied Linguistics, 168(1), 4–32. https://doi.org/10.1075/itl.168.1.01gon

24. Gorard, S. (2015). Rethinking "quantitative" methods and the development of new

25. researchers. Review of Education, 3(1), 72-96. https://doi.org/10.1002/rev3.3041

26. Hsiao, T., & Chiang, S. (2011). Gender differences in statistics anxiety among graduate students learning English as a foreign language. Social Behavior and Personality, 39(1), 41–42.

27. Huns ley, J.D. (1987). Cognitive processes in mathematics anxiety and test anxiety: The role of appraisals, internal dialogue, and attributions. Journal of Educational Psychology, 79, 388- 392.

28. Jones, B. D., Wilkins, J. L. M., Long, M. H., & Wang, F. (2011). Testing a motivational model of achievement: How students' mathematical beliefs and interests are related to their achievement. European Journal of Psychology of Education, 27(1), 1-20. https://doi.org/10.1007/s10212-011-0062-9

29. Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. Learning and Instruction, 15, 381–395.

30. Khany, R., & Tazik, K. (2019). Levels of statistical use in applied linguistics research articles: From 1986 to 2015. Journal of Quantitative Linguistics, 26(1), 48–65. https://doi.org/10.1080/09296174.2017.1421498

31. Lazaraton, A. (2000). Current trends in research methodology and statistics in applied linguistics. TESOL Quarterly, 34(1), 175–181. https://doi.org/10.2307/3588103

32. Lazaraton, A. (2005). Quantitative research methods. In E. Hinkel (Ed.), Handbook of research in second language learning (pp. 209–224). Mahwah, NJ: Lawrence Erlbaum.

33. Lazaraton, A., Riggenbach, H., & Ediger, A. (1987). Forming a discipline: Applied linguists' literacy in research methodology and statistics. TESOL Quarterly, 21(2), 263–277. https://doi.org/10.2307/3586735

34. Lindstromberg, S. (2016). Inferential statistics in language teaching research: A review and ways forward. Language Teaching Research, 20(6), 741–768. https://doi.org/10.1177%2F1362168816649979

35. Loewen, S., & Gass, S. (2009). The use of statistics in L2 acquisition research. Language Teaching, 42(2), 181–196. doi:10.1017/S0261444808005624

36. Loewen, S., Lavolette, E., Spino, L. A., Papi, M., Schmidtke, J., Sterling, S., & Wolff, D. (2014). Statistical literacy among applied linguists and second language acquisition researchers. TESOL Quarterly, 48(2), 360–388. https://doi.org/10.1002/tesq.128

37. Loewen, S., Gönülal, T., Isbell, D. R., Ballard, L., Crowther, D., Lim, J., Maloney, J., & Tigchelaar, M. (2019). How knowledgeable are applied linguistics and SLA researchers about basic statistics?: data from north America and Europe. Studies in Second Language Acquisition, 42(4) 871-890. doi:10.1017/S0272263119000548

38. Lundgren, T.D., & Fawcett, R. (1980). Statistics from statisticians. Teaching Sociology, 7, 191- 201.

39. Malik, S., (2015). Undergraduates' statistics anxiety: A phenomenological study. The Qualitative Report, 20(2), 120–133.

40. Macher, D., Papousek, I., Ruggeri, K., & Paechter, M. (2015). Statistics anxiety and performance: blessings in disguise. Frontiers in psychology, 6,1116.

41. https://doi.org/10.3389/fpsyg.2015.01116

42. Morris, L.W., Kellaway, D.S., & Smith, D.H. (1978). Mathematics anxiety rating scale: Predicting anxiety experiences and academic performance in two groups of students. Journal of Educational Psychology, 70, 589-594.

43. Onwuegbuzie, A. J. (1997). Writing a research proposal: The role of library anxiety, statistics anxiety, and composition anxiety. Library & Information Science Research 19, 5-33.

44. Onwuegbuzie, A. J. (2004). Academic procrastination and statistics anxiety. Assessment & Evaluation in Higher Education, 29, 3–19.

45. Onwuegbuzie, A.J., & Seaman, M.A., (1995). The effect of time constraints and statistics test anxiety on test performance in a statistics course. The Journal of Experimental Education, 63(2), 115–124.

46. Onwuegbuzie, A.J., & Daley, C.E. (1999). Perfectionism and statistics anxiety. Personality and Individual Differences, 26, 1089-1102.

47. 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.

48. Onwuegbuzie, A.J. Leech, N. L., Murtonen, M., & Tähtinen, J. (2010). Utilizing mixed methods in teaching environments to reduce statistics anxiety. International Journal of Multiple Research Approaches, 4(1), 28–39.

49. Payne, G., & Williams, M. (2011). Teaching quantitative methods: Getting the basics right. Los Angeles, Calif: SAGE Publications Ltd.

50. Pica, S. (2003). Second language acquisition research and applied linguistics. Working Papers in Educational Linguistics, 18(2), 1–26.

51. Pintrich, P., & DeGroot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. Journal of Educational Psychology, 82, 33–40.

52. Plonsky, L. (2013). Study quality in SLA: An assessment of designs, analyses, and reporting practices in quantitative L2 research. Studies in Second Language Acquisition, 35(4), 655– 687.

53. Plonsky, L., & Gass, S. (2011). Quantitative research methods, study quality, and outcomes: The case of interaction research. Language Learning, 61, 325– 366. doi:10.1111/j.1467- 9922.2011.00640.x

54. Roberts, D.M., & Bilderback, E.W. (1980). Reliability and validity of a statistics attitude survey. Educational and Psychological Measurement, 40, 235-238.

55. Rodarte-Luna, B., & Sherry, A. (2008). Sex differences in the relation between statistics anxiety and cognitive/learning strategies. Contemporary Educational Psychology, 33(2), 327–344. https://doi.org/10.1016/j.cedpsych.2007.03.002

56. Schacht, S., & Stewart, B.J. (1991). What's funny about statistics? Interactive/user-friendly gimmicks for teaching statistics. Teaching Sociology, 20, 329-332.

57. Scholfield, P. (1991). Statistics in linguistics. Annual Review of Anthropology, 20(1), 377–393.

58. Sutarso, T. (1992). Some variables in relation to students' anxiety in learning statistics. Paper presented at the annual meeting of the Mid-South Educational Research Association, Knoxville, TN.

59. Trimarco, K.A. (1997, October). The effects of a graduate learning experience on anxiety, achievement, and expectations in research and statistics. Paper presented at the annual meeting of the Northeastern Educational Research Association, Memphis, TN.

60. Vigil-Colet, A., Lorenzo-Seva, U., & Condon, L. (2008). Development and validation of the statistical anxiety scale. Psicothema, 20(1), 174- 180.

61. Williams, M., Sloan, L., Cheung, S. Y., Sutton, C., Stevens, S. & Runham, L. (2015). Can't Count or Won't Count? Embedding Quantitative Methods in Substantive Sociology Curricula: A Quasi-Experiment. Sociology, 50(3), 435-452.

62. https://doi.org/10.1177%2F0038038515587652

63. Zeidner, M. (1990). Does test anxiety bias scholastic aptitude test performance by gender and sociocultural group? Journal of Genetical Psychology, 150, 175-185.

64. Zeidner, M. (1991). Statistics and mathematics anxiety in social science students -some interesting parallels. British Journal of Educational Psychology, 61, 319-328.