

Examining gender differences in statistics anxiety among college students

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Abstract

The study described and compared the statistics anxiety of male and female college students. Responses were gathered from 180 students enrolled in basic statistics courses. The students completed the Statistical Anxiety Rating Scale (Cruise, Cash & Bolton, 1985) which measures statistics anxiety in six dimensions. The overall statistics anxiety scores showed that students experienced the highest level of anxiety when interpreting statistical data. On the other hand, students were least anxious towards their teacher. A one-way multivariate analysis of variance revealed a significant main effect for gender which was mainly attributable to fear of asking for help domain. Implications of the findings are discussed.

Key words: gender differences, statistics anxiety, college students

1. Introduction

Statistics is considered a very important academic course in the higher education. The quantitative skills that students learned in statistics courses are relevant to the completion of their research works. Statistics education also prepares students to take higher level of statistics courses and facilitate professional career development. There has been a growing demand of statistical methods in various disciplines such as education, economics, agriculture, and health sciences. However, statistics is often the least favorite subject of many students probably because of its mathematical nature. Educators would agree that most statistical concepts are complex and difficult hence many students find it hard to understand and apply statistical ideas.

While the intervention for inherent skills seems difficult, some studies focused on the affective domains such as students' feelings and attitudes towards statistics. Statistics anxiety has been found to be one of the most common attitudinal problems associated with statistics courses

(Baloglu, 2003). Cruise, Cash & Bolton (1985) defined statistics anxiety as “a feeling of anxiety when taking statistics course or doing statistical analyses”(p.92). This anxiety is characterized by extensive worry, tension, and stress when individuals are exposed to statistics content and problems (Zeidner, 1991). It can be observed that many students tend to feel high levels of anxiety and fear when confronted with statistical ideas, instructional and evaluative situations such as examinations. Research suggests that statistics anxiety is a multidimensional construct (Cruise, et al., 1985; Cherney and Cooney, 2005). Cruise, et al. (1985) identified six components of statistics anxiety which include the worth of statistics, computational self-concept, fear of teachers, interpretation anxiety, test and class anxiety, and fear of asking help subscales. While the statistics anxiety constructs identified by Cherney and Cooney (2005) comprise of mathematics perception, statistics perception and perception of relevance domains. Various measures of statistics anxiety also revealed inverse effects on students’ performance in both undergraduate and graduate levels (Macher, Paechter, Papousek & Ruggeri, 2012; Ali & Iqbal, 2012; Keely, Zayac, & Correia, 2008).

Onwuegbuzie and Wilson (2003) classified the antecedents of statistics anxiety around three major factors namely, environmental, situational and dispositional factors. Environmental or the person-related factors are often the area of interest of most studies where gender is widely explored. However, empirical investigations showed varying results for gender variable. DeCesare (2007) found that females experienced higher statistics anxiety than the male group. Likewise, males have somewhat more positive attitudes towards statistics than females (Coetzee and van der Merwe, 2010). Gender differences were also found to vary according to type of statistics anxiety (Eduljee & LeBourdais, 2015). On the contrary, other studies reported no significant differences between the two gender groups (Baloglu, 2003; Mji, 2009 and Hsiao & Chiang, 2011).

The present study has two main purposes: (1) to describe the level of statistics anxiety of the college students and (2) to examine gender differences in statistics anxiety. The literature offers

mixed results for gender hence this research aims to explore gender differences in statistics anxiety among select Filipino students. Examining different dimensions of statistics anxiety will help identify specific situations in the class where apprehensions of the female and male students may vary. Furthermore, this study recognized the role of the teachers to facilitate the learning and development of their students academically, emotionally and professionally. Schau (2003) argued that students who completed statistics course must believe that they can understand and use statistics and realize that the course is relevant to their academic and professional endeavors. Identifying and gaining better understanding of the students' anxieties would be a good basis for teachers to make instructional adjustments and adopt effective strategies for statistics class.

2. Methods

The descriptive survey was conducted before the end of the second semester of the academic year 2014. A total of 180 students who are currently enrolled in basic statistics courses in Bulacan State University, Philippines willingly participated in the survey. There were 76 (42.2%) males and 104 (57.8%) females in the study. The students represented academic disciplines such as language and communication (29.4%), social sciences (29.5%), and management courses (41.1%).

The participants completed the Statistical Anxiety Rating Scale (STARS) instrument developed by Cruise, et al. (1985). The 51 items of the STARS measures anxiety in two parts and can be administered in the beginning, during or after a statistics course. The first part corresponds to 28 items related to students' feelings towards statistics represented by the worth of statistics (16 items), computational self-concept (7 items) and fear of teacher (5 items) subscales. On the other hand, the second part of the instrument pertains to 23 anxiety-related statements and consists of the interpretation anxiety (11 items), test and class anxiety (8 items), and fear of asking for help (4 items) subscales. Responses for STARS are based on a 5-point Likert scale and scores were

summed where high scores indicate high levels of anxiety. The current Cronbach's alpha coefficient is .95 for the entire scale and .93, .83, .81, .84, .81 and .75 for the six subscales, respectively.

Means and standard deviations were computed to summarize and describe the statistics anxiety subscales scores. For the analysis of gender differences in statistics anxiety, a one-way multivariate analysis of variance (MANOVA) was performed with gender (male, female) as independent variable and six measures of anxiety (worth of statistics, computational self-concept, fear of teachers, interpretation anxiety, test and class anxiety and fear of asking help) as dependent variables. Analyses of variance (ANOVA) were then conducted as follow-up tests to the MANOVA.

3. Results

3.1 Overall statistics anxiety scores

The descriptive measures of the STARS subscales are shown in Table 1. Looking closely at the computed mean and maximum score for each subscale, the students registered the highest level of anxiety in the interpretation domain (64.58%), followed by test and class (61.58%), fear of asking for help (56.45%), computational self-concept (52.2%), worth of statistics (49.96%) and fear of teacher (46.96%).

Table 1. Descriptive measures of the STARS subscales

STARS subscales	Mean	SD
Worth of Statistics (max=80)	39.97	12.35
Computational Self-Concept (max=35)	18.27	5.73
Fear of Teacher (max=25)	11.74	4.26
Interpretation Anxiety (max= 55)	35.52	6.53
Test and Class Anxiety (max= 40)	24.73	5.65
Fear of Asking for Help (max =20)	11.29	3.23

3.2 Gender differences in statistics anxiety

The null hypothesis of equality of variance-covariance matrices is not rejected as required (Box's M test = 21.28, $p > .001$). A one-way MANOVA revealed a significant main effect for gender, Wilks' $\lambda = .882$, $F(6,173)= 3.865$, $p<0.05$, partial eta squared= .118. Given the significance of the overall test, the univariate main effects were examined. The result of univariate F -test showed that the effect of gender was attributable to fear of asking for help domain $F(1, 178)= 9.264$, $p=.003$, partial eta squared=.049 at Bonferroni adjusted alpha level of .008. Comparison of the mean scores suggests that males ($M=12.13$, $SD= 2.67$) were more anxious than females ($M=10.68$, $SD=3.47$) when asking for help.

Table 2. Means, standard deviations and univariate results for males and females

Dependent Variables	Males (n=76)	Females (n=104)	<i>F</i>
	Mean (SD)	Mean (SD)	
Worth of Statistics	42.38(11.35)	38.21(12.79)	5.124
Computational Self-Concept	18.51(5.30)	18.09(6.05)	.231
Fear of Teacher	12.11(4.00)	11.47(4.44)	.973
Interpretation Anxiety	33.89(5.79)	31.52(6.87)	5.968
Test and Class Anxiety	25.77(4.90)	23.96(6.05)	4.626
Fear of Asking for Help	12.13(2.67)	10.68(3.47)	9.264*

* $p<0.01$

4. Discussion and Implications

The study investigated the level of statistics anxiety of the college students and examined gender differences in the six measures of statistics anxiety. The descriptive results of the STARS indicate that students have high level of statistics anxiety since four out of the six subscales scored more than 50%. Results showed that students were most anxious when interpreting statistical data. The interpretation anxiety domain deals with situations where students are making decisions based on statistical data. Statistical literacy is very important since statistics is taken in preparation of research courses. The high anxiety levels of the students are indicative of how well the topics

learned were transformed to a more engaging activity where students can apply and reason with statistical ideas with confidence. Garfield (1995) stressed that one of the principles of learning statistics is that “students learn to do well only when they practice doing it”(p. 30). This explains that students cannot learn to analyze statistical information and make arguments unless they are encouraged to do related-activities. It might be helpful if students can have hands-on experience on actual data processing and analysis. On the other hand, the descriptive findings showed that students were least anxious towards their teacher. This result suggests that the respondents were comfortable with their instructors despite the difficulty of the course.

The present research also examined gender differences in the six factors of statistics anxiety. The study obtained significant gender differences contrary with the findings of Baloglu (2003), Mji (2009) and Hsiao & Chiang (2011). Inspection of the computed mean scores indicates that male students generally experienced higher statistics anxiety than female students. DeCesare (2007) likewise found significant gender differences but in the opposite direction. Analysis revealed that the significant gender effects were mainly attributable to the fear of asking for help domain where anxiety is higher for males. This result is quite expected. One possible reason is that asking for help might be an embarrassing feeling for most males. Men are often viewed by the society as strong and independent. High conformity to traditional masculine norms was found to be significantly related with avoidance of academic help-seeking (Wimer, 2009).

A significant link between help-seeking and the following variables were likewise reported: perceived faculty helpfulness and academic competence (Payakachat, Gubbins, Ragland, Norman, Flowers, Stowe & Hastings, 2013) and self-efficacy measures (Williams & Takaku, 2011). These possibilities for both gender groups could be further studied.

Given these findings, it becomes important to identify strategies that will help male students overcome their tendencies of having negative attitudes in a statistics class. Teachers could

use classroom approaches to positively promote academic help-seeking and communicate with students in a nonthreatening way. The study also provided basis for designing multidimensional teaching approaches to reduce students' learning anxieties in statistics. It might be helpful to create activities where students can practice analytical thinking skills, develop confidence, experience the benefit of collaborative learning and believe that they can use statistics. The study also yielded good reliability measures for the STARS suggesting its suitability for further classroom research.

The present research is also delimited to students who are enrolled in non-quantitative courses and this may limit the generalizability of the current findings. Thus, future investigation can be conducted to a wider range of academic disciplines to provide further evidence.

References

- Ali, A. Z., & Iqbal, F. (2012). Statistics anxiety among psychology graduates: An analysis. *International Proceedings of Economics Development and Research*, 53(25), 113-117. Retrieved from <http://www.ipedr.com/vol53/025-BCPS2012-C10026.pdf>
- Baloğlu, M. (2003). Individual differences in statistics anxiety among college students. *Personality and Individual Differences*, 34(5), 855-865.
- Cherney, I. D., & Cooney, R. R. (2005). Predicting student performance in a statistics course using the mathematics and statistics perception scale (MPSP). Retrieved from <http://digitalcommons.unl.edu/tnas/41>
- Coetzee, S., & Merwe, P. V. D. (2010). Industrial psychology students' attitudes towards statistics. *SA Journal of Industrial Psychology*, 36(1), 1-8.
- Cruise, R. J., Cash, R. W., & Bolton, D. L. (1985, August). Development and validation of an instrument to measure statistical anxiety. Paper presented at the annual meeting of the American Statistical Association Statistics Education Section. Las Vegas, Nevada.

- DeCesare, M. (2007). "Statistics Anxiety" Among Sociology Majors: A First Diagnosis and Some Treatment Options. *Teaching Sociology*, 35(4), 360-367.
- Eduljee, N.B. & LeBourdais, P. (2015). Gender Differences in Statistics Anxiety with Undergraduate College Students. *The International Journal of Indian Psychology*, 2(3), 69-82. Retrieved from <http://oaji.net/articles/2015/1170-1428319493.pdf>
- Garfield, J. (1995). How students learn statistics. *International Statistical Review/Revue Internationale de Statistique*, 25-34. Retrieved from <http://iase-web.org/documents/intstatreview/95.Garfield.pdf>.
- Hsiao, T. Y., & Chiang, S. (2011). Gender differences in statistics anxiety among graduate students learning English as a foreign language. *Social Behavior and Personality: An International Journal*, 39(1), 41-43.
- Keeley, J., Zayac, R., & Correia, C. (2008). Curvilinear relationships between statistics anxiety and performance among undergraduate students: Evidence for optimal anxiety. *Statistics Education Research Journal*, 7(1), 4-15. Retrieved from [http://iase-web.org/documents/SERJ/SERJ7\(1\)_Keeley.pdf](http://iase-web.org/documents/SERJ/SERJ7(1)_Keeley.pdf)
- Macher, D., Paechter, M., Papousek, I., & Ruggeri, K. (2012). Statistics anxiety, trait anxiety, learning behavior, and academic performance. *European journal of psychology of education*, 27(4), 483-498.
- Mji, A. (2009). DIFFERENCES IN UNIVERSITY STUDENTS' ATTITUDES AND ANXIETY ABOUT STATISTICS 1. *Psychological reports*, 104(3), 737-744.
- 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.

- Payakachat, N., Gubbins, P. O., Ragland, D., Norman, S. E., Flowers, S. K., Stowe, C. D., ... & Hastings, J. K. (2013). Academic help-seeking behavior among student pharmacists. *American journal of pharmaceutical education*, 77(1).
- Schau, C. (2003, August). Students' attitudes: The "other" important outcome in statistics education. In *Proceedings of the joint statistical meetings* (pp. 3673-3681).
- Williams, J. D., & Takaku, S. (2011). Help seeking, self-efficacy, and writing performance among college students. *Journal of writing research*, 3(1), 1-18. Retrieved from http://www.jowr.org/articles/vol3_1/JoWR_2011_vol3_nr1_Williams_Takaku.pdf
- Wimer, D. J. (2009). *The relation of masculinity, teacher sex, and help seeking style with academic help seeking avoidance of college men in psychology courses* (Doctoral dissertation, University of Akron). Retrieved from https://etd.ohiolink.edu/rws_etd/document/get/akron1225835976/inline
- Zeidner, M. (1991). Statistics and mathematics anxiety in social science students: Some interesting parallels. *British Journal of Educational Psychology*, 61(3), 319-328.