



A descriptive study of individual and cross-cultural differences in statistics anxiety

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ABSTRACT

The present study investigated individual and cross-cultural differences in statistics anxiety among 223 Turkish and 237 American college students. A 2×2 between-subjects factorial multivariate analysis of covariance (MANCOVA) was performed on the six dependent variables which are the six subscales of the Statistical Anxiety Rating Scale. Independent variables were country and gender. Grade Point Average (GPA) and age were entered as covariates. Results showed that GPA and age had significant covariate effects on the combined dependent variables. There was no significant interaction effect of country by gender; however, after adjusting for the covariates, significant main effects for country and gender were found. The main effect of country was significant on worth of statistics, interpretation anxiety, fear of asking for help, and fear of statistics teachers on which American students scored higher than Turkish students. The main effect of gender was significant on interpretation anxiety and test/class anxiety where women scored higher than men.

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1. Introduction

Statistics is a common course in many college programs; however, several emotional difficulties such as negative attitudes toward and anxiety in statistics are identified in the literature (Onwuegbuzie & Wilson, 2003). Onwuegbuzie (1999) estimated that approximately 75% of students experience moderate to high levels of statistics anxiety. Therefore, it may be an obstacle to undergraduate and graduate students (Onwuegbuzie & Wilson, 2003). A review of the literature indicates that most difficulties in statistics are reflections of attitudinal factors such as misconceptions, negative attitudes, or anxiety (Pan & Tang, 2005). Thus, statistics anxiety was defined as the “feelings of anxiety encountered when taking a statistics course or doing statistical analyses; that is, gathering, [data] processing, and interpret[ing]” (Cruise, Cash, & Bolton, 1985, p. 92).

A particular focus of the present study is gender and cultural differences in statistics anxiety. Onwuegbuzie (1995) and Zeidner (1991) reported that women experience higher levels of statistics anxiety than men. Rodarte-Luna and Sherry (2008) found that women scored significantly higher than men on interpretation anxiety, test/class anxiety, lack of computational self-concept, and fear of asking for help as measured by the subscales of the Statistical Anxiety Rating Scale (STARS); but, the effect sizes on the differences were low, which

lead the researchers to conclude that “differences are likely minimal” (p. 338). Baloğlu (2003) and Cruise and Wilkins (1980) failed to find significant differences between men and women regarding statistics anxiety. Moreover, numerical gender differences, if any, diminish especially after controlling for students' previous mathematics experiences (Baloğlu, 2003).

Another commonly investigated variable in relation to statistics anxiety is age (e.g., Baloğlu, 2003; Bell, 2003). Bell (2003) and Onwuegbuzie (1999) found that older students experienced more statistics anxiety than their younger counterparts. Baloğlu (2003) found that age had a significant multivariate effect on the components of statistics anxiety in that older students showed higher levels of statistics anxiety. Considering the controversy on the topic, Rodarte-Luna and Sherry (2008) suggest that more research is needed on the influence of age in relation to statistics anxiety.

Recent literature suggests that culture plays a significant role in anxiety (Abbasi & Stacks, 2007; Draguns & Tanaka-Matsumi, 2003) and, accordingly, cross-cultural aspects of anxiety have been of an increasing interest in educational and psychological research (Varela, Sanchez-Sosa, Biggs, & Luis, 2008). However, most cross-cultural studies on anxiety have focused on state and trait anxiety (see Abbasi & Stacks, 2007 for a review), test anxiety (see Bodas & Ollendick, 2005 for a review), or mathematics anxiety (see Ho et al., 2000 for a review).

Statistics is purported to be different from mathematics and, more specifically, statistics anxiety is found to be distinct from both test anxiety and mathematics anxiety (Baloğlu, 2004; Onwuegbuzie, DaRoss, & Ryan, 1997). A review of the literature revealed that there is lack of research that compare students from various cultures on

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statistics anxiety. Bell (1998) compared American and international students who were studying in the United States and found that international students scored significantly higher on the interpretation anxiety, computational self-concept, fear of asking for help, and fear of statistics teacher subscales of the STARS. Onwuegbuzie (1999) found that African-American graduate students differed significantly from Caucasians on worth of statistics, interpretation anxiety, and test/class anxiety, suggesting possible differences across ethnic groups.

A review of the relevant literature on statistics anxiety shows that only a few studies looked into cultural effects in relation to statistics anxiety. Therefore, the purpose of the present study was to investigate multivariate cross-cultural differences among college students' statistics anxiety levels, after accounting for differences in grade point average (GPA) and age.

2. Method

2.1. Sample

2.1.1. Turkish sample

The study was conducted at a large Turkish state university in the central part of the country. Researchers announced the study by fliers and handouts. Volunteering participants responded the research package in their classes. Of the total 223 Turkish college students who participated in the study, there were 148 (66.4%) women and 75 (33.6%) men. Participants' ages ranged from 18 to 32 years with a mean of 21.24 years ($SD = 1.47$). In terms of college status, 55 (24.7%) were sophomores, 99 (44.4%) were juniors, 45 (20.2%) were seniors, and 24 (10.7%) were graduate students. Turkish students' GPA ranged from .70 to 3.68 ($M = 2.81$, $SD = .42$).

2.1.2. American sample

The sample of American students was obtained using a similar recruiting method from a large state university in the southeastern part of the United States. Of 237 American students, there were 178 (75.1%) women and 59 (24.9%) were men. Participants' ages ranged from 18 to 55 years with a mean of 27.16 years ($SD = 8.74$). American students' GPA ranged from 2.00 to 4.00 ($M = 3.27$, $SD = .50$).

2.2. Instrument

The STARS and demographic questions were used to collect the data. The STARS, a 51-item, 5-point, Likert-type instrument, was developed to measure statistics anxiety in two parts (Cruise et al., 1985). The first part of the scale includes 23 statements that are related to statistics anxiety and the second part includes 28 items that are related to dealing with statistics. These two parts make up the instrument's six subscales: worth of statistics (16 items), interpretation anxiety (11 items), test/class anxiety (8 items), computational self-concept (7 items), fear of asking for help (4 items), and fear of statistics teachers (5 items). In general, higher scores from the subscales indicate higher interpretation anxiety, test/class anxiety, computational anxiety, fear of asking for help, and fear of statistics teachers, respectively. However, higher scores of the worth of statistics subscale indicate more negative perceptions of the usefulness of statistics.

The STARS is the most widely used measure of the construct of statistics anxiety (Hanna, Shevlin, & Dempster, 2008; Onwuegbuzie & Wilson, 2003). Initial psychometric properties of the STARS were reported by Cruise et al. (1985). Construct validity of the instrument was investigated through a principal component analysis with a varimax rotation. Analysis from 1150 students resulted in six factors, whose loadings varied between .48 and .86 (Cruise et al., 1985). By using the data from 537 students, the STARS' concurrent validity was found by correlating it with the Mathematics Anxiety Scale (Fennema

& Sherman, 1976; $r = .76$, $p < .01$). As Spielberger, Gorsuch, Lushene, Vagg, and Jacobs (1983) noted, due to the transitory nature of anxiety states, test-retest reliability techniques are not suitable for situation-specific anxiety measures. Therefore, test-re-test reliability studies for the STARS have not been conducted. Instead, Cruise et al. (1985) studied the internal consistency coefficients of the six subscales and found them ranging from .68 to .94, with a median of .88 (.94 for worth of statistics, .87 for interpretation anxiety, .68 for test/class anxiety, .88 for computational self-concept, .89 for fear of asking for help, and .80 for fear of statistics teachers).

Onwuegbuzie (1993) reported similar reliability coefficients (.92 for worth of statistics, .82 for interpretation anxiety, .90 for test/class anxiety, .93 for computational self-concept, .83 for fear of asking for help, and .85 for fear of statistics teachers). Baloğlu (2002) found adequate support for concurrent validity and marginal support for construct validity for the STARS. In the same study, the reliability of the six subscales ranged from .62 to .94, with a median of .87. In the present study, internal consistency reliability coefficients of the six subscales ranged between .70 to .89 for the Turkish sample and .70 to .94 for the American sample (Table 2). The STARS was translated and adapted to Turkish by Baloğlu (2009) and the psychometric properties of the Turkish STARS are reported by Baloğlu (2009).

2.3. Procedure

Statistics instructors were informed by the authors about the purpose of the study and given a sample survey packet. Prospective participants were contacted in their classes and informed about the study. Students signed an informed consent form and gave permission to use their responses for research purposes. The authors distributed the research packets during the class hours and collected them after 20 min. After the completion of the packets, participants were debriefed. The Statistical Procedures for Social Sciences (SPSS) 17.0 (SPSS Inc, 2008) was used to code and analyze the data.

Data were screened for the assumptions of parametric statistics. Normality, homogeneity of variances, and linearity assumptions were tested at the multivariate level. Multivariate outliers were investigated according to Mahalanobis distance at $p < .001$. Analysis did not reveal any multivariate outlier. The homogeneity of variances assumption was tested using Box's M statistics and was found to be 96.44 ($F = 1.01$, $p > .001$). Finally, bivariate investigation of correlation coefficients did not indicate any multicollinearity or singularity problems.

3. Results

Means and standard deviations of the STARS subscale scores for Turkish and American men and women are presented in Table 1. When each subscale mean was divided by the number of items on

Table 1
Means and standard deviations of the STARS subscale scores on a 5-point scale.

| Dependent variables | Turkish sample ($n = 223$) | | American sample ($n = 237$) | |
|-----------------------------|---------------------------------|---------------------|----------------------------------|---------------------|
| | Gender | | | |
| | Women ($n = 148$) | Men ($n = 75$) | Women ($n = 178$) | Men ($n = 59$) |
| Worth of statistics | 2.21 (.70) | 2.43 (.70) | 2.42 (.90) | 2.36 (.76) |
| Interpretation anxiety | 2.38 (.68) | 2.22 (.66) | 2.58 (.78) | 2.48 (.70) |
| Test/class anxiety | 3.09 (.83) | 2.85 (.84) | 3.21 (.98) | 2.93 (.78) |
| Computational self-concept | 1.97 (.67) | 2.21 (.66) | 2.30 (.95) | 2.24 (.78) |
| Fear of asking for help | 2.20 (.82) | 2.22 (.84) | 2.71 (.86) | 2.59 (.83) |
| Fear of statistics teachers | 2.17 (.78) | 2.36 (.71) | 2.27 (.89) | 2.27 (.75) |

Note. Values enclosed in parentheses represent standard deviations.

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