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Examination of the score reliability and validity of the statistics anxiety rating scale in a Chinese population: Comparisons of statistics anxiety between Chinese college students and their Western counterparts

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Abstract:
R. J. Cruise and E. M. Wilkins' (1980) Statistical Anxiety Rating Scale (STARS) was administered to 201 college students in China to measure their levels of statistics anxiety. The acceptable score reliability and validity indicates that the STARS can be used with this population. In addition to examining the reliability and validity of the STARS scores in a sample of Chinese college students, a comparison of the means on the six original subscales were also undertaken between different studies conducted in the USA, the UK, and China. The Chinese population reported the lowest anxiety on the dimension of *Test and class anxiety*, and a low anxiety on *Fear of asking for help* and *Interpretation anxiety.* Possible explanations are discussed.

Key Words: college students; education in China; statistics anxiety; reliability; validity

Introduction

Statistics anxiety is defined as 'the feelings of anxiety encountered when taking a statistics course or doing statistics analyses; that is, gathering, processing, and interpreting' (Cruise, Cash & Bolton, 1985, p. 92). Knowledge of students' levels of statistics anxiety can help instructors, advisors, and the like identify who to target for counseling interventions (Onwuegbuzie & Daley, 1996). Moreover, knowledge of the particular aspect(s) or dimension(s) of statistics anxiety that prevail can help instructors, advisors, and others implement the most effective counseling interventions.

Statistics anxiety is prevalent among college students. According to Onwuegbuzie and Wilson (2003), 80% of graduate students have been found to experience uncomfortable levels of statistics anxiety. Many researchers (e.g. Fitzgerald, 1997; Webb, 1971) have reported that statistics anxiety negatively influences students' achievement in statistics courses. Moreover, some researchers (e.g. Onwuegbuzie, 1997; Roberts & Bilderback, 1980) have found that statistics anxiety often leads students to delay enrolling in statistics courses, thereby affecting the attainment of their degrees.

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Research has showed that statistics anxiety is a multidimensional construct. For example, a study conducted by Cruise et al. (1985) led to the identification of the following six components of statistics anxiety: worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of statistics teachers. According to these authors, *Worth of statistics* refers to a student's perception of the relevance of statistics. *Interpretation anxiety* refers to the anxiety experienced when a student is faced with making a decision based on statistical data. *Test and class anxiety* refers to the anxiety involved when taking a statistics class or test. *Computational self-concept* refers to the anxiety experienced when attempting to solve mathematical problems, as well as the student's perception of her/his ability to do mathematics. *Fear of asking for help* is defined as the anxiety experienced when asking a fellow student or professor for help in understanding the material covered in class, or with any type of statistical data, such as that contained in an article or a printout. Finally, *Fear of statistics teachers* is concerned with the student's perception of the statistics instructor.

The factors contributing to statistics anxiety are broad. Pan and Tang (2005) revealed four factors: fear of math, lack of connection to daily life, pace of instruction, and instructor's attitude. Onwuegbuzie and Wilson (2003) classified the antecedents of statistics anxiety into three categories: situational factors, dispositional factors, and environmental factors. Situational factors refer to factors that surround the stimulus, such as prior knowledge of statistics and the status of the course (i.e. required or elective). Dispositional factors refer to factors that an individual brings to the setting, such as math self-concept and self-esteem. Environmental antecedents refer to inherent characteristics, such as gender and racial differences, or pre-conceptions based on events that occurred in the past.

A comprehensive review of the literature revealed no study on statistics anxiety that has been conducted in the People's Republic of China (hereafter called China). Yet, one cannot assume that the findings pertaining to statistics anxiety that pertain to students from other countries will generalize to Chinese students. Thus, studies need to be conducted examining students' levels of statistics anxiety among this population. Because Cruise et al.'s STARS is by far the most utilized measure of statistics anxiety (Onwuegbuzie & Wilson, 2003) and satisfactory psychometric properties of this instrument have been reported in the United States (e.g. Baloglu, 2002; Cruise et al., 1985), the STARS likely is the most appropriate one to be used in China.

Reliability and validity are properties of scores rather than tests per se (Onwuegbuzie & Daniel, 2002, 2004; Thompson & Vacha-Haase, 2000; Vacha-Haase, Kogan & Thompson, 2000; Witta & Daniel, 1998). Because psychometric properties of the Chinese version of the STARS have not been established for Chinese college students, the aim of the present study was to examine the reliability and validity of the STARS scores in a sample of Chinese college students. Moreover, because the STARS has not been used in China before, it was hoped that the results from this study would provide future directions for studies of statistics anxiety in China.

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The fact that no study on statistics anxiety has been conducted in China does not mean that statistics anxiety is not a problem for Chinese college students. Rather, recent studies (Li & Wu, 2004; Jiang & Mei, 2003; Zhang, 2010; Bi, Duan & Liu, 2005) showed that there is a demand for how to help college students overcome their fears to learn advanced mathematics (including statistics). One reason for this demand is that more and more universities in China offer advanced mathematics courses (including statistics) for students majoring in social sciences (Li & Wu, 2004). Another reason is that college enrollment has tremendously increased during the last ten years. As a result, some students who were not well prepared for college have been accepted into social sciences majors. As Li (2009) explicated: 'First, students do not have very good math backgrounds when entering into college. Second, students do not have a good learning attitude due to their major in social sciences. Third, social science students have no interest in mathematics [or statistics]—normally this is a main reason for them to select social science as their major [in China]' (p. 253). A few more recent studies (e.g. Guo, Si & Zhao, 2009) have introduced statistics anxiety research into China. As more and more researchers and statistics instructors pay attention to statistics anxiety in China, a reliable and valid instrument to measure Chinese students' statistics anxiety would prove very important for both research and practice in China.

Method

Participants

The sample comprised 201 college freshmen selected from two Chinese universities in the northern China. Among them, 156 were from the first university, 106 in education majors and 50 in history, and 45 were from the second university majoring in education. All the participants are aged from 18 to 23.

Instrument and procedure

The instrument used in this study was the STARS. The STARS, which was developed by Cruise and Wilkins (1980), was a 51-item instrument. The first 23 items asked about respondents' experiences that may cause their anxiety. These items were measured on a 5-point Likert-format scale that ranged from *1 = no anxiety* to *5 = very much anxiety.* The remaining 28 items asked about respondents' feelings toward statistics. These items were also measured on a 5-point Likert-format scale that ranged from *1 = strongly disagree* to *5 = strongly agree*. A high score on each of the six subscales represents high anxiety in that area. The translation-back translation method (Herrera, DelCampo & Ames, 1993) was used to translate the STARS from English to Chinese. First, the questionnaire was translated into Chinese. Then, the Chinese version of the scale was translated back into English in order to compare the original and the back-translated scales to evaluate the accuracy of the initial translation. Both of the translators were bilingual.

The data were collected in the middle of the fall semester of 2007. The questionnaire was given to the instructors, who then distributed the questionnaire to their students during the class time. All the students responded to the instrument.

Results

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Table 1 presented the means, medians, and standard deviations for the STARS total scale score and subscale scores, as well as the intercorrelations among these variables. After applying the Bonferroni adjustment (i.e., α = .05/21 = .00238), It can be seen from the table that all the Person product-moment correlation coefficients were statistically significant (p < .0024). Using Cohen's (1988) criteria, low to high correlations were found among the subscales, ranging from .28 to .64. The correlations between the total scale score and the six subscales ranged from .65 to .85, which indicated that all the six factors contributed significantly to the total scale.

ISSN: 1444-5530

Table 1: Means, medians, standard deviations, and intercorrelations of the STARS

Scale	1	2	3	4	5	6
1. Worth of statistics	---					
2. Interpretation anxiety	.31**	---				
3. Test and class anxiety	.46**	.62**	---			
4. Computational self-concept	.70**	.33**	.47**	---		
5. Fear of asking for help	.28**	.77**	.59**	.37**	---	
6. Fear of statistics teachers	.64**	.25**	.35**	.51**	.30**	---
Total Scale Score	.85**	.70**	.76**	.77**	.65**	.67**
M	40.12	22.78	18.97	17.55	8.42	11.61
SD	12.25	7.20	6.01	4.86	3.02	3.68
Median	39	21	18	17	8	11
MPRES	68	39	31	64	60	50

** $p < .01$

Median percentile rank equivalent scores (Onwuegbuzie, 2004) were calculated by comparing the median anxiety scores in the present study to the percentile rank norms of the undergraduate students reported by the developers of the STARS (Cruise et al., 1985). The MPRES ranged from 31 to 68, indicating a low to moderate statistics anxiety for the Chinese sample. Specifically, these Chinese participants reported a low anxiety on the dimensions of *Interpretation anxiety* and *Test and class anxiety.*

Comparisons of means and standard deviations were also undertaken between different studies, even though the sample size, student status (undergraduates vs. graduates), and countries of these studies were different. Table 2 presented the means and standard deviations for the STARS six subscales from different studies that were conducted in the United States, the United Kingdom, and China.

Table 2: Comparisons of means and standard deviations among studies

Scale	**Present Study (Undergraduates *n* = 201, China)**	**Walsh and Ugumba-Agwunobi (2002) (Undergraduates; *n* = 93, London)**	**Onwuegbuzie (2004) (Graduates n=135, USA)**	**Baloglu and Zelhart (2003) (55 Graduates, 191 undergraduates, USA)**
Worth of Statistics	40.12(12.25)	32.22(14.94)	42.53(14.03)	35.55(13.70)
Interpretation Anxiety	22.78(7.20)	28.44(13.37)	31.76(8.39)	27.96(8.34)
Test and Class Anxiety	18.97(6.01)	20.12(10.00)	27.10(7.12)	24.94(7.52)
Computational Self-Concept	17.55(4.86)	14.13(6.97)	18.33(6.21)	15.99(6.30)
Fear of Asking for Help	8.42(3.02)	11.99(6.04)	8.21(3.59)	10.66(3.40)
Fear of Statistics Teachers	11.61(3.68)	9.38(4.87)	12.21(4.07)	11.36(4.25)

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It can be seen from the table that among all the studies presented above, the Chinese population reported the lowest anxiety levels with the smallest standard deviation on the dimension of *Test and class anxiety*, a low anxiety with the smallest standard deviation on *Fear of asking for help* and *Interpretation anxiety,* a moderate value on *Computational self-concept*, and a high value on *Worth of statistics.*

Score reliability

Table 3 presented the Cronbach’s alpha internal consistency reliability coefficients for each of the original six subscales as well as the total scale of STARS, along with the confidence intervals (CI). The confidence intervals were calculated using SPSS syntax provided by Fan and Thompson (2001).

Table 3: Cronbach’s alpha value, and confidence interval

Scale	**N**	**Alpha Value**	**95% CI**
Worth of Statistics	16	.91	.89-.93
Interpretation Anxiety	11	.86	.83-.89
Test and Class Anxiety	8	.85	.82-.88
Computational Self-Concept	7	.74	.68-.79
Fear of Asking for Help	4	.72	.65-.78
Fear of Statistics Teachers	5	.69	.62-.75
Total Scale Score	51	.94	.93-.95

According to Kline (1999), values below .70 were acceptable when dealing with psychological constructs. Thus, we set a criterion of .70 for a cut-off point of acceptable score reliability. The total scale and the first five subscales produced reliable scores. Among them, the total scale (.94) and the first subscale *Worth of statistics* (.91), generated very high score reliability. The last subscale *Fear of statistics teachers* just fell short of the criterion.

Comparisons were undertaken to see whether the internal consistency values revealed in the present study were consistent with those reported in the literature of statistics anxiety. The Cronbach’s alpha values for the present study and the other four selected studies are presented in Table 4. It can be seen from the table that the present internal consistency values for the total score (.94) and for five of the six subscales (.91, .86, .85, .72, and .69) were mostly consistent with those reported in the other four studies. That is, in the majority of cases (i.e. 19/27 = 70.4%), there was overlap between the confidence intervals reported for the present study and those reported for other investigations. On the subscale, *Computational self-concept*, the current values (.74) was statistically significantly lower than all those reported in the other studies. Further, for the subscale, *Test and class anxiety*, the score reliability coefficient in the present study (.85) was statistically significantly lower than that reported by Onwuegbuzie (2004) but higher that that reported in Cruise et al. (1985). For the subscale, *Fear of asking for help*, the score reliability coefficient in the present study (.72) was lower than that reported by Cruise et al. (1985). Finally, for the subscale, *Fear of the statistics teacher*, the score reliability coefficient in the present study (.69) was lower than that documented by Cruise et al. (1985).

ISSN: 1444-5530

Table 4: Comparison of Cronbach's alpha values and confidence intervals*

Scale	Present study (n = 201)	Baloglu (2003) (n = 246)	Baloglu (2002) (n = 221)	Cruise et al. (1985) (n = 1150)	Onwuegbuzie (1993) (n = 26)
Worth of Statistics	.91 (.89-.93)	.94 (.93-.95)	.94 (.93-.95)	.94 (.93-.95)	.92 (.87-.96)
Interpretation Anxiety	.86 (.83-.89)	.91 (.89-.93)	.89 (.87-.91)	.87 (.86-.88)	.82 (.70-.91)
Test and Class Anxiety	.85 (.82-.88)	.90 (.88-.92)	.91 (.89-.93)	.68 (.65-.71)	.90 (.83-.95)
Computational Self-Concept	.74 (.68-.79)	.86 (.83-.89)	.85 (.82-.88)	.88 (.87-.89)	.93 (.88-.96)
Fear of Asking for Help	.72 (.65-.78)	.79 (.74-.83)	.62 (.53-.70)	.89 (.88-.90)	.83 (.69-.92)
Fear of Statistics Teachers	.69 (.62-.75)	.64 (.56-.71)	.79 (.74-.83)	.80 (.78-.82)	.85 (.73-.92)
Total Scale Score	.94 (.93-.95)	.96 (.93-.95)	.96 (.95-.97)		.96 (.93-.98)

* Confidence intervals are in parentheses below the score reliability coefficient.

Construct-related validity—specifically structural validity—for the STARS within the sampled Chinese population was assessed via an exploratory factor analysis (EFA). In theory, a confirmatory factor analysis (CFA) should be used to test directly the hypothesized six-factor structure of the STARS identified by Cruise et al. (1985).

However, to our knowledge this was the first use of the STARS in a Chinese population. Thus, the EFA was more appropriate for exploring its dimensions in China. The Kaiser-Meyer-Olkin measure of sampling adequacy was .88, which fell into the range of being great recommended by Kaiser (1974). In addition, the Bartlett's test was statistically significant (p < .001). Therefore, exploratory factor analysis was appropriate for these data.

A principal components analysis with varimax rotation was conducted. Multiple methods were used to determine the number of factors underlying the data. First, according to the criterion of eigenvalue-greater-than-one (Kaiser, 1958), 11 factors were extracted, which accounted for 63.94% of the variance. However, the criterion of eigenvalue-greater-than-one rile can overestimate (e.g. Zwick & Velicer, 1986) or underestimate (e.g. Humphreys, 1964) the number of factors to retain. The current study using the criterion of eigenvalue-greater-than-one generated four specific factors (a specific factor is a factor only consisting of one item) out of the extracted 11 factors. This indicated that the data set had been overestimated.

Second, because a scree plot suggested a four- to eight-factor model and the originally identified model was with six subscales (Cruise et al., 1985), we examined five-, six-, and seven-factor models, respectively. For all the EFAs, a pattern/structure coefficient of .30 was used as a cut-off point. The five-factor model explained 49% of the variance, but one item did not have a significant structure/pattern coefficient on any of the factors.

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The six-factor model explained 52% of the variance and the seven-factor model explained 54.86%. The difference between these two models was due to two items: Item 7, and Item 33in the six-factor model Item 7 belonged to Factor 2 and Item 33 had a significant structure/pattern coefficient on Factor 1, whereas in the 7-factor model the two items constituted a separate factor. Two criteria were used to select the six-factor model: Factors should be substantively meaningful, and a factor with only two or three items with significant structure/pattern coefficients should be eliminated (Brown, 2006).

Table 5 presented the rotated matrix from the six-factor solution, together with the Cronbach's internal consistency alpha coefficients and proportion of variance explained. The first factor consisted of 16 items, and the second included 17 items. Six items yielded significance coefficients on the third factor, whereas five items yielded significance coefficients on the fourth factor. The fifth factor comprised four items, and the sixth included three items.

Table 5: Six-factor model for STARS

Item		F1	F2	F3	F4	F5	F6	h2
42	I don't see why I have to clutter up my head with statistics. It has no significance to my life work.	.758						.674
29	I feel statistics is a waste.	.749						.655
40	I wish the statistics requirement would be removed from my academic program.	.747						.627
50	I never going to use statistics so why should I have to take it?	.734						.561
41	I don't understand why someone in my field needs statistics.	.724						.576
26	I wonder why I have to do all these things in statistics when in actual life I'll never use them.	.688						.548
49	Affective skills are so important in my profession that I don't want to clutter my thinking with something as cognitive as statistics.	.687						.528
27	Statistics is worthless to me since it's empirical and my area of specialization is philosophical.	.677						.514
28	Statistics takes more time than it's worth	.664						.515
37	Statistics is a grind a pain I could do without.	.579		.338	.421			.691
43	Statistics teachers talk a different language.	.550						.475
35	I don't want to learn to like statistics.	.499			.423			.543
24	Since I am by nature a subjective person the objectivity of statistics is inappropriate for me.	.480			.433			.449
31	I can't even understand seventh- and eighth-grade mathematics; how can I possibly do statistics?	.465			.435			.469
45	I can't tell you why but I just don't like statistics.	.457				.443	-.302	.519

ISSN: 1444-5530

33	I lived this long without knowing statistics. Why should I learn it now?	.424				.319		.345
18	Seeing a student poring over the computer printouts related to his/her research.		.735					.574
19	Asking someone in the computer center for help in understanding a printout.		.734					.572
6	Reading a journal article that includes some statistical analyses.		.727					.588
20	Trying to understand the statistical analyses described in the abstract of a journal article.		.712					.586
23	Asking a fellow student for help in understanding a printout.		.679					.483
14	Figuring out whether to reject or retain the null hypothesis.		.633					.487
5	Making an objective decision based on empirical data.		.591					.398
12	Arranging to have a body of data put into the computer.		.591					.475
16	Asking one of your professors for help in understanding a printout.		.578					.467
9	Reading an advertisement for an automobile which includes figure on gas mileage compliance with population regulations, etc.		.574					.389
11	Interpreting the meaning of a probability value once I have found it.		.574	.324				.552
21	Enrolling in a statistics course.		.540		.316		.322	.547
17	Trying to understand the odds in a lottery.		.530					.408
2	Interpreting the meaning of a table in a journal article.		.492					.318
7	Trying to decide which analysis is appropriate for your research project.		.488			.309		.520
22	Going over a final examination in statistics after it has been graded.		.448	.396				.414
3	Going to ask my statistics teacher for individual help with material I am having difficulty understanding.		.398		.353			.409
10	Working into the classroom to take a statistics test.			.813				.787
8	Doing the final examination in a statistics course.			.772				.689
1	Studying for an examination in a statistics course.			.732				.627
15	Waking up in the morning on the day of a statistics test.		.392	.655				.641
4	Doing the homework for a statistics course.		.411	.430	.327			.500
25	I haven't had mathematics for a long time. I know I'll have problems getting through statistics.	.305		.343	.336	.301		.434
51	I'm too slow in my thinking to get through		.305		.630			.558

ISSN: 1444-5530

	statistics.							
38	I don’t want to learn to like statistics.		.349		.622			.602
39	I could enjoy statistics if it weren’t so mathematical.				.584			.512
36	Statistics is for people who have a natural learning toward mathematics.	.469			.495			.573
34	Since I’ve never enjoyed mathematics. I don’t see how I can enjoy statistics.	.437		.316	.442			.548
46	Statistics teachers talk so fast you cannot logically follow them.					.529		.342
47	Statistical figures are not fit for human consumption.					.520		.300
48	Statistics isn’t really bad. It’s just too mathematical.					.489		.362
44	Statisticians are more number oriented than they are people oriented.	.379				.446		.445
32	Most statistics teachers are not human.	.353					.641	.627
30	Statistics teachers are so abstract they seem inhuman.	.336					.637	.610
13	Finding that another student in class got a different answer than you did to a statistical problem.		.384	.313			.481	.489
Alpha		.92	.90	.84	.76	.50	.61	
% of Variance		15.52	14.05	7.52	6.64	4.49	3.87	

Note: Only pattern/structure coefficients > .30 are shown.

Although the present study also revealed a six-factor structure, the items with significant structure/pattern coefficients on each factor are not exactly same as the ones identified by Cruise et al. (1985). Table 6 presented the comparison results between the two models in terms of how many and what items had significant structure/pattern coefficients on each factor. There were not many differences between the present and the original models for the first four factors; however, there were extremely large differences for the last two factors.

Table 6: Comparison between the present and the original six-factor models

Factors	Items
Original Factor 1 (N=16)	24 26 27 28 29 33 35 36 37 40 41 42 45 47 49 50
Present Factor 1 (N=16)	24 26 27 28 29 31 33 35 37 40 41 42 43 45 49 50
Original Factor 2 (N=11)	2 5 6 7 9 11 12 14 17 18 20
Present Factor 2 (N=17)	2 3 5 6 7 9 11 12 14 16 17 18 19 20 21 22 23
Original Factor 3 (N=8)	1 4 8 10 13 15 21 22

ISSN: 1444-5530

Present Factor 3 (N=6)	1 4 8 10 15
Original Factor 4 (N=7)	25 31 34 38 39 48 51
Present Factor 4 (N=5)	34 36 38 39
Original Factor 5 (N=4)	3 16 19 23
Present Factor 5 (N=4)	44 46 47 48
Original Factor 6 (N=5)	30 32 43 44 46
Present Factor 6 (N=3)	13 30 32

Discussion

The present study has examined the psychometric properties of the STARS in a Chinese population. The results of this study provide support that the Chinese version of the STARS is a suitable instrument for use among Chinese college students.

First, acceptable score internal consistency reliability has been found in this study, which is mostly consistent with the results reported in other studies (e.g. Baloglu, 2002; Baloglu & Zelhart, 2003; Cruise et al., 1985; Onwuegbuzie, 1993). For example, Cruise et al. (1985) reported score reliability coefficients for the subscales ranging from .68 to .94, and those reported in the present study ranged from .69 to .94. Specifically, scores pertaining to *Worth of statistics* in this study produced the best score reliability estimate (.91). This was followed by the *Interpretation anxiety* (.86) and *Test and class anxiety* (.85), as well as *Computational self-concept* (.74) and *Fear of asking for help* (.72) scale scores. The worst score reliability estimate in the present study was *Fear of statistics teachers* (.69), but it is still close to the acceptable criterion. Second, the EFA from this study has identified an acceptable six-factor model. This model differs from the one identified by Cruise et al. (1985) in terms of how many and what items yielded significant pattern/structure coefficients on each factor.

The STARS has been found to possess good psychometric properties in a Chinese population. This implies that it can be used in China to measure college student statistics anxiety in the future.

In addition to examining the reliability and validity of the STARS scores in a sample of Chinese college students, a comparison of the means on the six original subscales from different studies also has been conducted. The results of the comparison are very interesting (see Table 2). A high value on *Worth of statistics* reported by the Chinese

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students might be related to the use of statistics in real world in China. Over the past decades not many Chinese research studies have been empirical. Thus, statistics has not seemed as useful to Chinese students and scholars as to their Western peers.

It is understandable that the Chinese college students reported the lowest anxiety on the dimension of *Test and class anxiety* and a low anxiety on *Interpretation anxiety*, because they have been widely recognized as a population with a strong math background (Cai, 2005). As a result of Chinese students' strong math background, it is reasonable to expect them to get the highest value on *Computational self-concept.* Surprisingly, a moderate value on *Computational self-concept* was found in the present study in comparison of other studies. This might be related to the low score internal consistency reliability on this subscale presented in Table 4. The value (.74) for the present study is lower than all those reported in the other studies.

This study confirms that the STARS could be used for both research and practice in China. As more and more Chinese universities provide statistics courses for social science students, we believe that statistics anxiety research would catch Chinese researchers' attention. Although Chinese researchers (e.g. Guo, Si & Zhao, 2009) have recently conducted literature reviews of statistics anxiety research; the STARS, however, with its quality examined in our study, will be a useful tool for Chinese researchers to conduct empirical studies. For example, the STARS could be used to collect data in China to explore statistics anxiety of graduate students.

Meanwhile, our study also complements current studies (e.g. Jiang & Mei, 2003; Li & Wu, 2004; Bi, Duan & Liu, 2005; Luo, 2009) which only focus on pedagogical improvements to reduce college students' fears in advanced mathematics and statistics. At practical level, the STARS should help instructors understand the levels of statistics anxiety their students might have. In particular, we suggest that statistics instructors who work at low-ranking universities (e.g. state level or below) should consider to use the STARS to test the students' statistics anxiety at the beginning of the class. In recent years, many low-ranking universities in China have recruited some low-performing students in order to increase their enrollment. These students were not well prepared for college. The STARS scores will help statistics instructors understand the key factors affecting students' learning. Specifically, statistics instructors should pay attention to two of the six factors in the STARS: *Fear of asking for help* and *Fear of statistics teachers*. These two factors are culture-sensitive to Chinese students. Studies (e.g. Liu & Meng, 2010) showed that Chinese students have low self-concept which might cause them to fear asking for help. Also, the Chinese traditional relationship between a teacher and the students is hierarchal with the teacher being an authority. This could cause Chinese students to fear their statistics instructors. We suggest that statistics instructors should adopt the constructivist pedagogy and establish an equal relationship with their students. We believe that an appropriate pedagogy and an equal social relationship will be helpful for reducing Chinese students' statistics anxiety.

The main limitation of this study is that not many demographic variables have been collected. This, to some extent, limits more statistical analyses that otherwise would have

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been undertaken. Some suggestions for future studies on statistic anxiety in China include:

1. Sample: A larger sample size with more demographic variables (e.g. majors, gender, and graduate students) should be used

2. Construct-related validity should be examined by correlating scale and subscales on the STARS with scale and subscales on another instrument such as the Attitudes toward Statistics (ATS) (Wise, 1985)

3. The CFA should be used to confirm the six-factor model identified in this study.

ISSN: 1444-5530

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