Prevalence and Predictors of Statistics Anxiety Among Sociology and Social Work Students

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Abstract

Anxiety in the context of quantitative reasoning courses is a complex and highly prevalent problem, particularly among students majoring in the arts, humanities, and social sciences. Gaining an accurate understanding of the anxiety levels experienced by students enrolling in statistics courses can be regarded as one of the most important factors affecting students' learning and achievement in these courses. In the current study, the Statistical Anxiety Rating Scale was applied to explore the prevalence and predictors of statistics anxiety among sociology and social work undergraduate students at Sultan Qaboos University (n=142). The results show that almost 71% of the examined students had experienced some aspects of statistics anxiety, with sociology students scoring noticeably higher than social work students. The leading predictors of higher statistics anxiety levels found in this study were as follows: test and class anxiety (80.2%) and interpretation anxiety (79.1%). Moreover, Welch's test results show significant gender differences, with female students reporting higher levels of anxiety across all subscales than their male counterparts. Finally, some practical strategies of reducing statistics anxiety are discussed.

Keywords: Statistics anxiety, gender differences, sociology, social work, Oman.

انتشـار القلق الإحصائي بين طلبة علم الاجتماع والعـمل الاجـتماعي والمتغـيرات المفسـرة لـه

سليمان عبد الله

الملخص

يعتبر القلق المصاحب لعمليات التعلم في إطار المقررات ذات الطبيعة الكمية أحد المشكلات المعقدة وشائعة الانتشار، وبصفة خاصة بين الطلبة بكليات الآداب والعلوم الإنسانية والاجتماعية. ويعتبر الحصول على فهم دقيق لمستويات القلق التي يعاني منها الطلبة عند دراسة مقررات الإحصاء أحد أهم العوامل التي تؤثر في تعزيز عملية التعلم وزيادة تحصيل الطلبة في هذه المقررات الدراسية. في هذا السياق، استخدمت الدراسة الحالية مقياس القلق الإحصائي للتعرف على مدى انتشار قلق الإحصاء لدى عينة حجمها ١٤٢ من طلبة مرحلة البكالوريوس بقسم علم الاجتماع العمل الاجتماعي بجامعة السلطان قابوس. أشارت نتائج الدراسة إلى أن حوالي ٧١٪ من الطلبة قيد الدراسة قد تعرضوا لبعض جوانب القلق الإحصائي، وأن مستويات التعرض لقلق الإحصاء ترتفع بشكل ملحوظ لدى الطلبة بتخصص علم الاجتماع مقارنة بنظرائهم في تخصص العمل الاجتماعي. وأشارت النتائج إلى أن أبرز أبعاد القلق الإحصائي تمثلت في القلق المصاحب للاختبارات والفصول الدراسية (٨٠,٢٪) وقلق تفسير المادة العلمية (٧٩,١٪). بالإضافة إلى ذلك، أظهرت نتائج اختبار ويلش وجود اختلافات معنوية تعزى لمتغير الجنس، حيث سجلت الطالبات مستويات أعلى من القلق الإحصائي في جميع أبعاد المقياس مقارنة مع نظرائهن من الطلبة الذكور. وأخيراً، ناقشت الورقة بعض الاستراتيجيات العملية التي يمكن استخدامها للحد من القلق الإحصائي لدى الطلبة عند التحاق بأحد المقررات الإحصائية.

الكلمات المفتاحية: القلق الإحصائي، الفروق بين الجنسين، علم الاجتماع، العمل الاجتماعي، عمان.

1. Introduction

The growing need for statistical reasoning in various fields of human activity has led many universities to include statistics as a compulsory subject in almost all degree programmes (Gould, 2010). Students from different study areas are required to enrol in at least one introductory course in statistics to help them develop the statistical skills and competencies that they need to effectively address real-world situations. For sociology and social work majors in particular, statistics courses are expected to equip students with sound knowledge and practical skills for effective professional practice. For example, sociology students may need these skills to study and understand human society and behaviour (Paxton, 2006; Williams et al., 2016) while social work practitioners may need them to evaluate the effectiveness of the social services that they provide (Capshew, 2005).

Given the quantitative nature of statistics courses coupled with their compulsory nature in a wide range of academic degree plans, a significant proportion of both undergraduate and postgraduate students consider statistics to be a difficult subject to learn. In fact, many college students consider statistics courses to be the more anxiety-provoking courses included in their degree and study plans. This is especially true for students majoring the social sciences. A vast body of literature now exists on problems associated with learning statistics, indicating that statistics anxiety is highly prevalent among students majoring in areas of the social sciences such as political science, psychology, sociology, and social work relative to those studying other academic disciplines (DeCesare, 2007; Capshew, 2005; Hanna et al., 2008; Forte, 1995; North & Zewotir, 2006; Roberts and Bilderback, 1980; Paechter et al., 2017; Ruggeri, 2011; Slootmaeckers et al., 2014; Wiberg, 2009; Zeidner, 1991). As a consequence, students from these majors experience manifold problems when they enrol in statistics courses.

Several definitions of statistics anxiety have been presented in the literature. The definition most frequently quoted in the literature is from Cruise, Cash, and Bolton (1985), who define statistics anxiety as "the feelings of anxiety encountered when taking a statistics course or doing statistical analyses; that is, gathering, processing, and interpreting data". It has been well documented that statistics anxiety poses formidable obstacles for students wishing to effectively acquire statistical skills (Dalgleish and Herbert, 2003; DeVaney, 2010; Fitzgerald and Jurs, 1996; Kottke, 2000; Lalonde and Gardner, 1993; Mills, 2004; Onwuegbuzie and Wilson, 2003). For example, it is widely assumed that students experiencing high levels of anxiety towards statistics courses are more likely to demonstrate poor academic performance in these courses (Bell, 2001; Onwuegbuzie et al. 1997; Papousek et al., 2012; Vigil-Colet et al., 2008; Williams, 2010; Wise, 1985; Zanakis and Valenzi, 1997; Zeidner, 1991). Additionally, experiencing higher levels of statistics anxiety may lead many students to delay their enrolment in statistic courses (Rodarte-Luna and Sherry, 2008; Onwuegbuzie, 1997; Roberts and Bilderback, 1980). It has also been argued that statistics anxiety coupled with preconceived negative attitudes towards statistics negatively affect students' performance in other courses included in their curriculum such as research methodology courses (Davis, 2003; Baloglu, 2003; Lalonde and Gardner, 1993; Onwuegbuzie, 2004). Consequently, they accumulate less statistical knowledge and skills and become uncertain about the effective use of statistical methods in real-world settings.

A wide variety of measures have been developed for the purpose of measuring statistics anxiety. These measures include but are not limited to the Statistical Anxiety Rating Scale (STARS; Cruise, Cash, and Bolton, 1985), Statistics Anxiety Inventory (SAI; Zeidner, 1991), Statistics Anxiety Scale (SAS; Pretorius & Norman, 1992), and Statistical Anxiety Scale (Vigil-Colet, Lorenzo-Seva, & Condon, 2008). Based on a factor analysis, Cruise et al. (1985) identified six subscales for measuring different aspects of statistics anxiety, including: test and class anxiety, interpretation anxiety, computational self-concept, fear of asking for help, fear of statistics teachers and the perceived worth of statistics. Zeidner (1991) identified a two-dimensional context to satisfactorily measure students' levels of statistics anxiety that considers content and examination anxiety.

Along with the discussion of statistics anxiety measures, various antecedents of statistics anxiety are also well documented in the literature. Generally, these antecedents have been classified into three distinct categories: dispositional, situational, and environmental (Baloglu & Zelhart 2004; Onwuegbuzie & Wilson, 2003). Dispositional antecedents of statistics anxiety refer to psychological and emotional traits of students, which include their attitudes towards statistics (Chiesi & Primi, 2010), their perceptions and self-concept (Pan & Tang, 2004), procrastination

(Dunn, 2013; Onwuegbuzie, 2004), and learning strategies and students' reading abilities (Collins & Onwuegbuzie, 2007; Kesici, Baloglu, & Deniz, 2011). For example, the literature suggests the presence of a significantly positive correlation between academic procrastination and statistics anxiety. Onwuegbuzie (2004) indicated that as a consequence of their task aversiveness and fear of failure, many students are far more likely to report engaging in some level of academic procrastination in relation to learning activities (e.g., submitting assignments, taking quizzes, writing term papers, and studying for exams). This in turn may substantially increase students' propensities to report higher levels of statistics anxiety. It has also been well established that statistics anxiety can be predicted from students' reading abilities. In reference to this context, Collins and Onwuegbuzie (2007) demonstrated that students experiencing comprehension difficulties with reading statistics textbooks and related learning materials tend to be more anxious and particularly when they are required to make decisions based on statistical data.

Situational antecedents refer to factors resulting immediately from engagement in statistics courses and include variables such as the nature of a given course (i.e., elective or required),prior knowledge of statistics (DeVaney, 2010; Onwuegbuzie & Wilson, 2003; Pan & Tang, 2004), prior mathematical experiences and skills (Baloglu, 2003; Zeidner, 1991), statistics instructors (Baloglu, 2003; Zeidner, 1991), instructional pacing and delivery used in statistics classes (Onwuegbuzie et al., 1997), and terminologies and symbols related to statistics (Onwuegbuzie et al., 1997). In this regard, DeVaney (2010), Onwuegbuzie and Wilson (2003), and Pan and Tang (2004) indicated that students enrolled in statistics courses without previous knowledge or experience with mathematical and statistical reasoning tend to be more prone to reporting higher levels of statistics anxiety.

Finally, environmental antecedents refer to inherent socio-demographic characteristics such as age, gender, ethnicity, and academic major (Baloglu et al., 2011; Bui & Alfaro, 2011; Chew & Dillon, 2014; Chiesi & Primi, 2010; Onwuegbuzie et al., 1997).In this respect, it is worth noting that a vast body of literature suggests that female students are far more likely to experience noticeably higher levels of statistics anxiety than their male counterparts. However, this could not be considered a potential factor contributing to the low academic performance of female students in statistics courses.

In sum, it is very clear that environmental or dispositional antecedents are largely beyond the control of academic departments or instructors teaching statistics courses. This is exactly why most research on statistics anxiety has targeted course-related dimensions (situational antecedents) to address this form of anxiety.

2. The current study

As indicated by Cashin and Elmore (2005) and Gal and Gingsburg (1994), many college students frequently enrol in statistics courses with overwhelmingly unjustifiable negative attitudes towards learning statistics. This is particularly apparent among students majoring in social sciences such as sociology and social work. According to Macher et al., (2013), Onwuegbuzie et al., (2000), Onwuegbuzie (2004) and Pan and Tang (2004), almost 80% of students majoring in the social sciences seem to report experiencing negative feelings about learning statistics and are more likely to experience intense levels of statistics anxiety.

Keeping this in mind, twenty-eight students taking an introductory statistics course in sociology and social work at Sultan Qaboos University (Oman) were surveyed by the course instructor in the fall 2017 semester regarding their readiness to learn statistical skills and their attitudes towards statistics overall. Four statements of Wise's (1985) Attitudes Towards Statistics scale (ATS) were applied to investigate students' responses. These include: "I feel that statistics will be useful to me in my profession", "I wish that I could have avoided taking my statistics course", "Studying statistics is a waste of time", and "Statistical training is not truly useful for most professionals".

According to the survey, a large proportion of students (89.3%) consider statistics courses to be a formidable obstacle in their study plans. In total, 71.4% of the surveyed students did not realize the relevance of statistical skills to their specializations. The survey results also show that 82.1% of students believe that they would enjoy their degree programmes more if statistics were designated an elective course. The majority of students (92.9%) prefer to take statistics in the final semester of their degree study plans. These results are particularly concerning and prompt a need for profound changes made to course content and delivery systems to foster more positive attitudes towards statistics among sociology and social work students. Empirical investigations of specific factors playing a role in these preconceived negative attitudes towards statistics courses that represent the next

logical step for department of sociology and social work.

It is worth noting that the pervasiveness of statistics anxiety and negative attitudes towards statistics among university students can have negative effects on student learning and performance in statistics courses and other related courses such as those focused on research methodologies. Towards this end, the current study was designed to explore the prevalence and predictors of statistics anxiety among sociology and social work undergraduate students. The study is motivated by the fact that an accurate understanding of particular aspects of statistics anxiety prevailing among sociology and social students could significantly help departments and statistics instructors successfully implement prevention and intervention strategies. The findings of the current study could also prove very useful in enhancing students' learning and achievements in research methodology courses, as departmental degree plans require students to successfully apply a wide range of statistical methods to their own research projects during the final two semesters of study.

3. Method

3.1 Participants

Two samples (Stratified sampling) of undergraduate students enrolled in a compulsory module in statistics were invited to participate in this study. Sample 1 consisted of 80 students (69% female) enrolled in a social statistics course (hereafter referred to as the sociology sample). Sample 2 includes 62 students (56% female) enrolled in a statistics course for social work (hereafter referred to as the social work sample). Regarding overall academic performance based on grade point average, the majority of participants fall under the 2.00 to 3.00 category (81.3% of the sociology sample and 74.2% of the social work sample). Sociology and social work students have been selected in this study for the purpose of obtaining some indicators that can be used by the department in improving the instructional techniques used in statistical courses.

3.2 Measures

To explore the prevalence and predictors of statistics anxiety among sociology and social work undergraduates, we applied the Statistical Anxiety Rating Scale (STARS) initially designed by Cruise Cash, and Bolton, 1985. As stated in the STARS, statistics anxiety can be measured with fifty-one items classified into two distinct components. Part one includes 23 items measuring anxiety levels experienced by students. Students' responses to any item of this part were measured on a 5-point Likert scale (1= no anxiety to 5= high anxiety). For the second part, 28 items were used to assess respondents' levels of agreement regarding statistics course-related situations rated on an agreement scale of 1-5. The reliability of items (internal consistency of the instrument) is measured by Cronbach's alpha coefficient; the results ranged between 0.789 and 0.873 demonstrating that the instrument is reliable and can be used to measure statistics anxiety.

The prevalence of statistics anxiety among university students can be measured, as indicated by the STARS, using a six-subscale structure that includes the following: test and class anxiety, interpretation anxiety, computational self-concept, fear of asking for help, fear of statistics teachers, and the perceived worth of statistics. Hence, lower scores given on a specific component of the STARS subscale indicate lower levels of anxiety except for responses given to 'fear of statistics teachers', for which lower values reflect higher anxiety levels.

As indicated by Cruise et al.(1985), the test and class anxiety subscale includes 8 items designed to measure anxiety experienced by students while taking statistics tests or while attending statistics classes (e.g., "Finding that another student in class got a different answer than I did to a statistical problem"). The interpretation anxiety subscale of the STARS contains 11 items designed to assess levels of statistics anxiety reported by students upon being required to draw conclusions or make decisions based on statistical results (e.g., "Determining whether to reject or retain the null hypothesis"). Furthermore, the computation self-concept subscalemeasures7 items closely associated with a student's level of self-belief in his/her abilities to properly use statistical calculations and terminology (e.g., "I am too slow in my thinking to get through statistics").The subscale on fear of asking for help includes 4 items designed to assess anxiety levels reported when a student intends to seek help from his/her colleagues or from the course instructor to understand a given statistical problem (e.g., "Asking my statistics teacher for individual help with material I am having difficulty understanding"). The subscale related to fear of statistics teachersuses5 items to assess levels of anxiety associated with instructors teaching statistics courses (e.g., "Statistics teachers speak a different language"). The final subscale, the

subscale on the worth of statistics, covers16 situations designed to measure the perceived usefulness and importance of statistics courses (e.g., "I wish the statistics requirement would be removed from my academic programme"). Accordingly, the total statistics anxiety score is calculated from the mean value of responses given on respective situations, resulting in a possible range of 55–255. Higher mean values denote higher levels of anxiety and lower scores denote lower levels of anxiety.

3.3. Procedure

Data collection took place in the fall and spring semesters of the 2017/2018 academic year. Students from three sections of a statistics for social work course (SOWK4110) and from four sections of a social statistics course (SOCY3230) were recruited to participate in the study. They were informed about the aims of the study and that participation is voluntary. All students agreed to participate. Participants were reminded of the importance of being truthful when responding to the STARS items and were informed of the confidentiality of their responses. The study questionnaire was administered over a 16-week semester. Students responded to the 23 scenarios included in part one of the STARS during the third week of classes and responded to part 2 during week 14.

4. Results

The mean scores and standard deviations of the six subscales and the total anxiety score for the subsamples of female and male students of both majors (sociology and social work) are presented in Table 1. Mean values associated with the six subscales were converted into percentages to provide further clarification on the measurement of statistics anxiety as experienced by sociology and social work students participating in this study. Based on these calculations, the highest anxiety levels were associated with test and class anxiety and interpretation anxiety as reported by females of the sociology sample (83.4% and 82.3%, respectively) compared to values of 78.2% and 76.8% found for males of the same area of study, respectively.

The results also indicate that female students majoring in social work experience higher levels of anxiety as measured through test and class anxiety (81.4%) and interpretation anxiety (80.1%) compared to values of 74.3% and 73.4% found for males of the same major, respectively. The lowest level of statistics anxiety was reported on "the fear of statistics teachers" for both male and female students majoring in social work (42.2% and 47.1%, respectively) relative to anxiety levels of 50.4% and 55.4% reported by their counterparts in majoring in sociology. The results shown in Table 1 also suggest that female students from both majors experience higher levels of statistics anxiety as indicated by all subscales of the STARS (74.9% for females majoring in sociology and

Table 1
Descriptive statistics for the individual subscales and the overall statistics anxiety measure

Subscales	Sociology sample (n=80)		Social Work sample (n=62)	
	Gender			
	Female (n=55)	Male (n=25)	Female (n=35)	Male (n=27)
Worth of Statistics	(5.49)59.35	(9.37)53.76	(6.00)54.34	(6.80)49.04
Interpretation Anxiety	(1.08)45.25	(2.67)42.24	(5.93)44.03	(4.95)40.37
Test and Class Anxiety	(1.65)33.35	(2.73)31.28	(4.50)32.54	(4.03)29.20
Computational Self-Concept	(3.65)25.96	(5.44)23.04	(3.90)23.20	(3.23)23.30
Fear of Asking for Help	(2.08)13.22	(2.74)13.00	(2.61)12.66	(2.59)12.11
Fear of Statistics Teachers	(2.92)13.84	(3.03)12.60	(2.77)11.77	(3.71)10.56
Total Statistics Anxiety	(8.07)190.96	(15.09)175.92	(13.94)178.54	(13.55)165.07

Note: Standard deviations are presented in parentheses.

Table 2
Mean sores of STARS by gender and area of study

Subscales	Gender		Area of study		Overall
	Female (n=90)	Male (n=52)	Sociology (n=80)	Social Work (n=62)	
Worth of Statistics	57.40(71.8%)	51.31(64.1%)	57.69(72.1%)	52.03(65.0%)	55.17(69.0%)
Interpretation Anxiety	44.78(81.4%)	41.27(75.0%)	44.31(80.6%)	42.44(77.2%)	43.49(79.1%)
Test and Class Anxiety	33.03(82.6%)	30.46(76.2%)	32.70(81.8%)	31.31(78.3%)	32.09(80.2%)
Computational Self-Concept	24.89(71.1%)	23.17(66.2%)	25.05(71.6%)	23.24(66.4%)	24.26(69.3%)
Fear of Asking for Help	13.00(65.0%)	12.54(62.7%)	13.15(65.8%)	12.42(62.1%)	12.83(64.2%)
Fear of Statistics Teachers	13.03(52.1%)	11.54(46.2%)	13.45(53.8%)	11.24(45.0%)	12.49(50.0%)
Total Statistics Anxiety	186.13(73.0%)	170.29(66.8%)	186.26(73.0%)	172.68(67.7%)	180.33(70.7%)

70.0% for females majoring in social work) compared to values of 69.0% and 64.7 found for male students, respectively.

After estimating levels of statistics anxiety associated with each subscale of the STARS, the next step involved the estimation of overall levels of statistics anxiety. Table 2 shows total differences in statistics anxiety by gender and field of study for the whole sample. The students of this study report an overall level of statistic anxiety of 70.7% with the highest forms of anxiety observed for the test and class anxiety (80.2%) and interpretation anxiety subscales (79.1%). It is very clear that female students of both majors report higher levels of statistics anxiety (73.0%) than their male classmates (66.8%), confirming the results shown in Table 1. In the same way, sociology students report noticeably higher levels of anxiety (73.0%) than social work students (67.7%). These findings are further confirmed by 95% confidence intervals for mean scores of the six subscales and for overall statistics anxiety shown in Table 3.

An additional illustration of the prevalence of statistics anxiety among sociology and social work students is provided for all individual items of the STARS. Figures 1 and 2 present mean scores (in percentages) for individual items of each subscale by area of study and gender, respectively. As indicated by Figure 1, sociology students report higher mean scores for all individual items with the exception of only two (one for the interpretation anxiety subscale and the other for the test and class anxiety subscale). Regarding gender differences found based on individual items, Figure 2 shows that female students score higher than males on all items with the exception of only one item associated with the subscale on fears of statistics teachers. In addition, a series of Welch-tests was applied to investigate differences observed in individual items of each STARS subscale by gender and academic major. The null hypothesis of no significant difference found between mean scores reported by sociology and social work students is rejected for 24 items, representing nearly 47% of the items. Similarly, significant gender differences were found for approximately 67% of the STARS items. These results confirm the results presented in Tables 1 and 2.

Furthermore, a Welch-test was conducted to examine differences among sociology and social work students and between female and male students for all subscales and for the overall scale. Corresponding results are presented in Table 3. With the exception of those for the subscale "fear of asking for help", the Welch test results show significant differences between sociology and social work students and between female and male students for the rest of the STARS subscales and for overall levels of statistics anxiety.

Comparisons of mean scores of statistic anxiety (in percentages) as measured by the six STARS subscales were drawn across different studies despite their use of different sample sizes and focus on different areas of study. Corresponding results are provided in Table 4. In general, the results show that both sociology and social work students examined in the current study experience higher levels of statistics anxiety than undergraduates from the USA, Turkey, Singapore, South Africa and Austria. This conclusion is true for all subscales with the exception of that for "fear of statistics teachers", for which students majoring in social work experience slightly less anxiety than psychology undergraduate students from the USA and Singapore and business students from South Africa.

Correlation coefficients for the six STARS subscales were calculated to further investigate properties of the STARS subscales. Corresponding results are presented

Table 3

Welch's-test results for STARS subscale differences by gender and major

	Welch Statistics		95% confidence interval for mean							
	Gender	Major	Gender				Major			
			Female		Male		Sociology		Social work	
			LB	UB	LB	UB	LB	UB	LB	UB
Worth	20.85**	21.66**	56.11	58.69	48.97	53.65	55.96	59.24	50.29	53.77
Interpretation	6.58*	17.34**	43.98	45.58	40.13	42.41	43.82	44.81	40.79	43.90
Test	5.41*	7.14**	32.39	33.68	29.48	31.44	32.20	33.20	30.16	32.45
Self-Concept	19.19**	4.99*	24.06	25.72	21.95	24.39	24.06	26.04	22.33	24.16
Fear	1.13	3.36	12.55	13.45	11.79	13.28	12.64	13.66	11.81	13.03
Teachers	25.52**	5.86*	12.40	13.67	10.56	12.52	12.78	14.12	10.42	12.07
Total	41.07**	31.94**	183.56	188.71	166.06	174.52	183.42	189.10	168.81	176.54

Worth= Worth of Statistics; Interpretation = Interpretation Anxiety; Test= Test and Class Anxiety; Self-Concept = Computational Self-Concept; Fear = Fear of Asking for Help; Teachers = Fear of Statistics Teachers; Total = Total Statistics Anxiety. LB= Lower bound; UB=Upper bound

* $p<0.05$, ** $p<0.01$

in Table 5. The worth of statistics subscale was found to be significantly correlated with all subscales with the exception of that for fear of asking for help. As the most notable result of the correlation analysis, we found that interpretation anxiety is substantially intercorrelated with test and class anxiety. This indicates that the more students experience test and class anxiety, the higher their levels of anxiety and worry concerning the interpretation of statistical results. The findings also show that a fear of asking for help is not significantly intercorrelated with any of the STARS subscales. Correlations between the six subscales and the total anxiety measure were also calculated. The results reveal statistically positive intercorrelations of 0.174 to 0.831, denoting significant contributions of the six subscales to the overall statistics anxiety scale.

To further illustrate levels of statistics anxiety reported by sociology and social work students in this study, our results were compared to those of Cruise et al.(1985). To this end, median percentile rank equivalent scores (MPRES) were calculated for each subscale of the STARS. Table 4 presents corresponding results. MPRES were calculated for the sociology and social work samples and were then compared to the MPRES of Cruise et al.(1985). For example, the 79 MPRES value associated with the "interpretation anxiety" subscale for the sociology sample denotes that at least 50% of sociology students examined in the current study reported significantly higher levels than 79% of undergraduate students assessed by Cruise et al.(1985) in terms of interpretation anxiety. This shows that sociology students examined in the current study are more anxious concerning this subscale than the norm group. As MPRES generated through the present study range from 52 to 79, the present sample appears to include moderately to highly anxious individuals. The MPRES confirm that sociology students generally experience higher levels of statistics anxiety than social work students.

Table 4
Comparisons of mean and standard deviations of STAR subscales among different studies

	Current study		USA[a]	Turkey[b]	Singa-pore[c]	USA[d]	South Africa[e]	Austria[f]
	Sociology Sample	Social work sample						
Worth of Statistics	72.1%	65.0%	48.86%	37.75%	51.38%	56.24%	48.63%	44.13%
Interpretation Anxiety	80.6%	77.2%	56.51%	45.45%	53.09%	70.04%	48.73%	39.27%
Test and Class Anxiety	81.8%	78.3%	71.78%	58.50%	67.50%	74.73%	45.50%	51.75%
Computational Self-Concept	71.6%	66.4%	53.63%	41.14%	54.29%	66.91%	57.14%	45.14%
Fear of Asking for Help	65.8%	62.1%	49.65%	43.50%	46.00%	49.95%	39.00%	40.50%
Fear of Statistics Teachers	53.8%	45.0%	45.64%	44.00%	48.00%	44.28%	50.40%	38.80%

[a](Chew et al., 2018); 202 Psychology undergraduate students
[b](Baloglu, 2017); 305 Undergraduate students majoring in social sciences (different universities)
[c](Chew & Dillon, 2014); 65 Psychology undergraduate students
[d](Kareen, 2018); 113 Social work undergraduate students
[e](Mij, 2009); 226 Undergraduate business students
[f](Papousek et al., 2012); 400 Undergraduate students majoring in Psychology/Educational Science

Table 5
Intercorrelations, reliability coefficients and descriptive statistics of the STARS subscales

Variables	Variables					
	1	2	3	4	5	6
1. Worth of Statistics	1					
2. Interpretation Anxiety	.217*	1				
3. Test and Class Anxiety	.243**	.890**	1			
4. Computational Self-Concept	.247**	.011	.013	1		
5. Fear of Asking for Help	.056	.006	-.027	-.014	1	
6. Fear of Statistics Teachers	.681**	.095	.115	.159	.005	1
Internal consistency coefficients	0.83	0.70	0.72	0.84	0.74	0.77
Mean(Sociology sample)	57.60	44.31	32.70	25.05	13.15	13.45
Mean(Social work sample)	52.03	42.44	31.31	23.24	12.42	11.24
Actual range	28-80	29-55	23-40	10-35	4-17	5-20
Potential range	16-80	11-55	8-40	7-35	4-20	5-25
Median(Sociology sample)	58	45	33	25	13	14
Median(Social work sample)	54	44	32	23	13	12
MPRES(Sociology sample)	74	79	70	58	55	64
MPRES(Social work sample)	71	75	64	52	79	60

* p<0.05, ** p<0.01

(A)

(B)

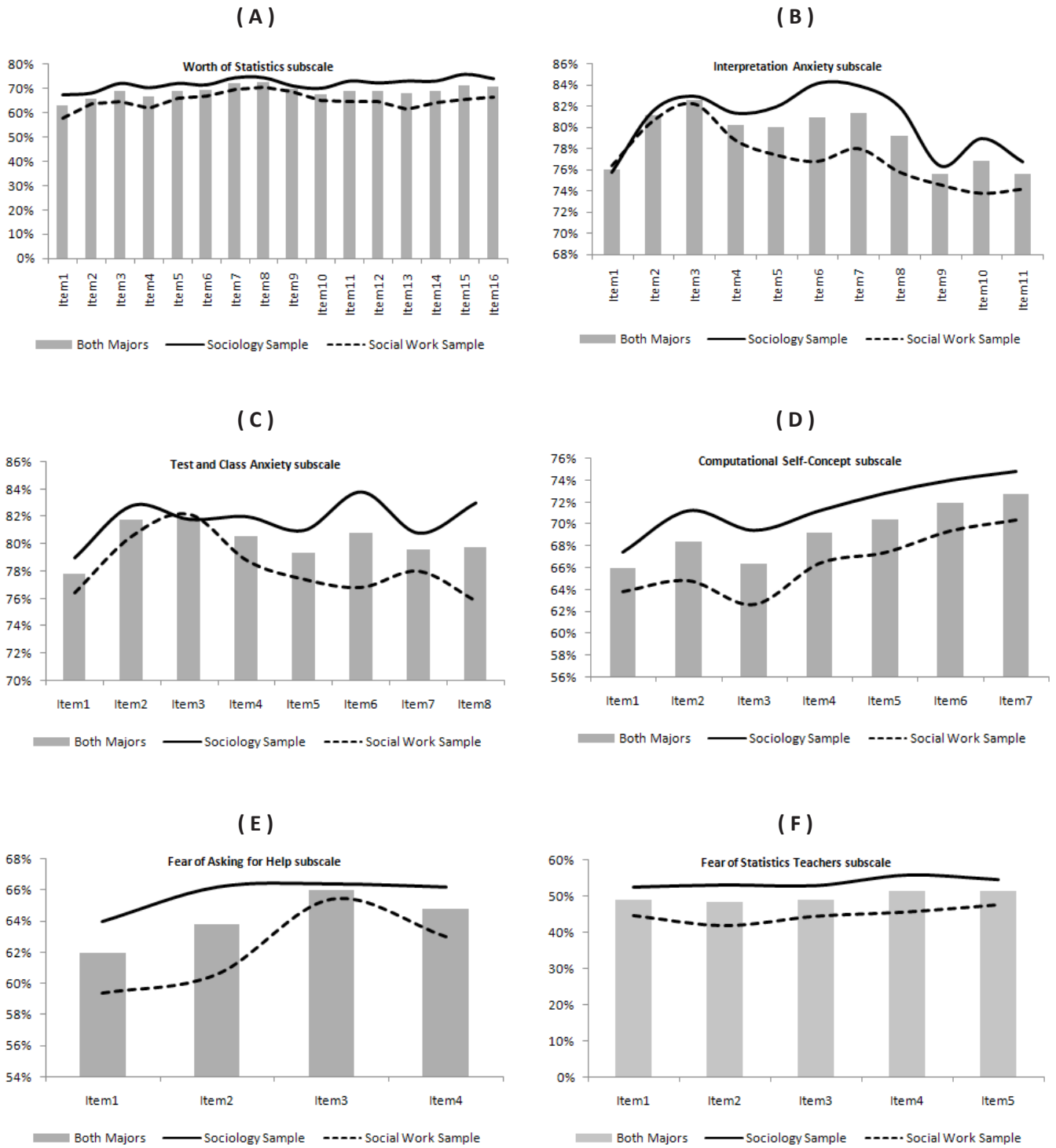**(C)**

(D)

(E)

(F)

Fig.1. Mean scores (%) for individual items in the STARS subscales by area of study
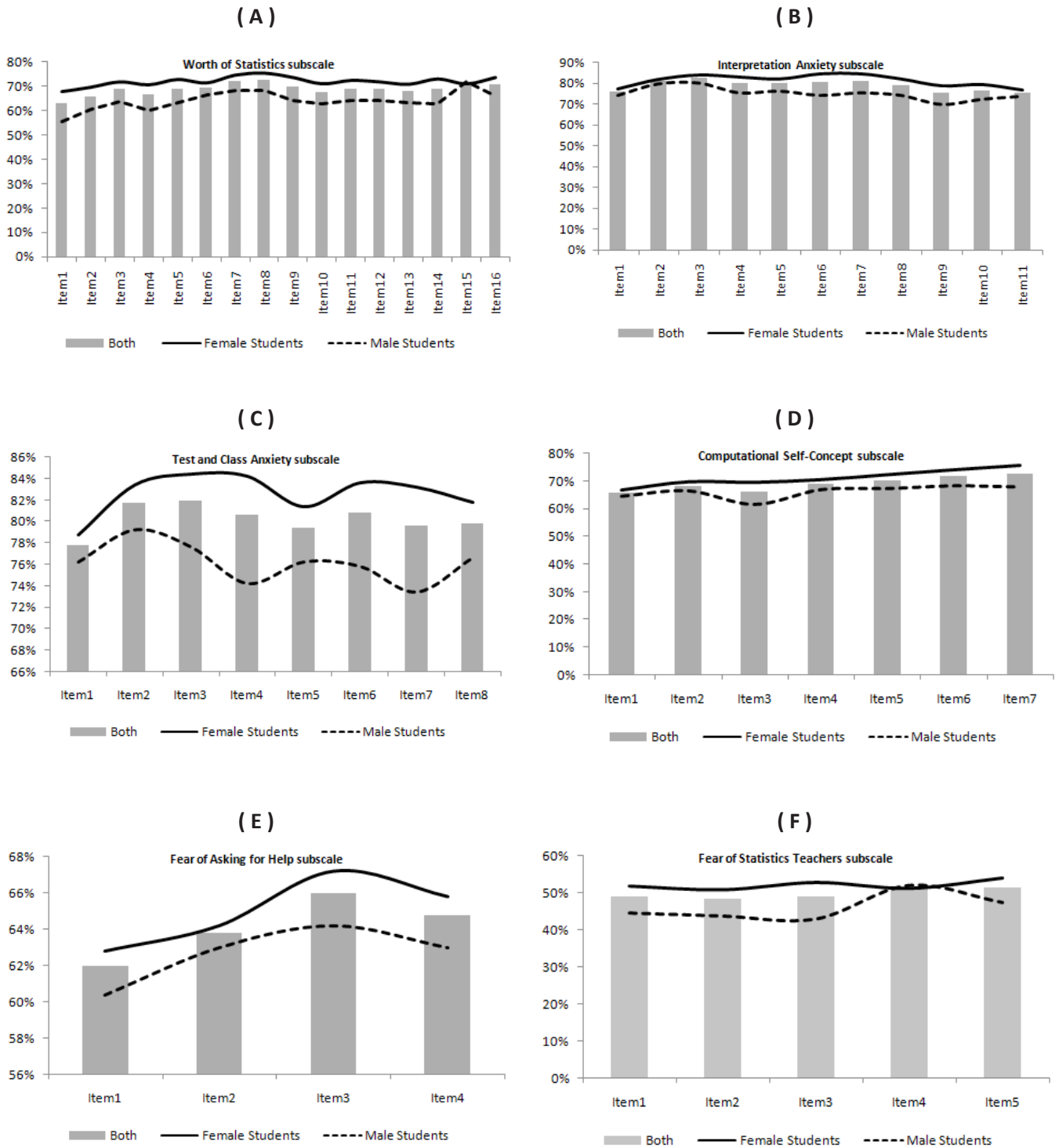
Fig. 2. Mean scores (%) for individual items in the STARS subscales by gender

5. Discussion

As indicated by the literature on difficulties associated with learning statistics, statistics anxiety has been described as one of the most prevalent attitudinal problems students may experience ineffectively acquiring statistical skills. This problem is especially apparent for students majoring in social sciences such as political science, psychology, sociology, and social work (e.g., Dalgleish and Herbert, 2003; DeCesare, 2007; Kareen; 2018; North & Zewotir, 2006; Wise, 1985; Zeidner, 1991). It has been widely reported that statistics anxiety impedes statistics instructors' capacities to successfully achieve intended learning outcomes (Rodarte-Luna & Sherry, 2008). It is therefore very important for statistics instructors to investigate students' levels of statistics anxiety and their attitudes towards statistics as an initial phase of instruction. This will help them identify the most appropriate interventions for reducing level of anxiety and for fostering more positive attitudes (Gal and Ginsburg, 1994; Garfield et al., 2002; Moore, 2001; Onwuegbuzie & Daley, 1996;). For example, Garfield et al. (2002) suggest that the achievement of students learning outcomes related to statistics courses should focus not only on knowledge and skills but also on students' levels of readiness to persist in their learning. In the same way, Gal and Ginsburg (1994) show that statistics instructors should focus on the expectations and attitudes students may bring into their classes or develop later while taking statistics course. According to Gal and Ginsburg, this would mitigate levels of statistics anxiety and help students develop statistical skills more effectively.

With this background, the current study applied Cruise et al.'s STARS multidimensional construct to assess levels of anxiety towards statistics experienced by sociology and social work students. Satisfactory reliability coefficients of the Arabic version of the STARS were provided through the current study. The internal consistency coefficients examined are generally consistent with many other findings of the literature on statistics anxiety (e.g., Baloglu, 2003; Chew & Dillon, 2014; Cruise et al., 1985; Kareen; 2018; Onwuegbuzie and Wilson, 2003; Vigil-Colet et al., 2008). For example, Cruise et al. (1985) recorded an internal consistency value of 0.68 for "test and class anxiety" subscale; a value of 0.87 for "interpretation anxiety" subscale; a value of 0.88 for "computational self-concept" subscale; a value of 0.89 for "fear of asking for help" subscale; a value of 0.80 for "fear of statistics teachers" subscale; and a value of 0.94 for

the "worth of statistics" subscale. Internal consistency coefficients derived from this study range from 0.72 to 0.84 (Table 5).

The findings of this study show that sociology students report noticeably higher levels of anxiety than social work students. This finding can be partially interpreted as follows: students enrolling in the departments of sociology and social work at Sultan Qaboos University are required to take one statistics course, but students vary considerably in their ability and readiness to take this course. Social work students in particular come with some previous learning experiences related to basic concepts of statistical reasoning. In fact, they learn some basic information on data collection and analysis through their enrolment in the course Tests and Measures of Social Work. This course helps these students develop a degree of confidence and provides them with adequate tools to learn statistical skills unlike students majoring in sociology who do not have this relevant prior knowledge upon enrolling in their statistics course.

The study also investigated gender differences observed across the six subscales of statistics anxiety and for individual items of each subscale. The results reveal statistically significant gender differences across all subscales except for that for the fear of asking for help, with females reporting noticeably higher mean scores than male students. This conclusion is true for females of both majors: sociology and social work students with females of the latter group presenting slightly higher levels of anxiety. Female students were found to be more anxious when attending statistics classes, taking statistics exams and interpreting statistical results. These gender differences can be partially attributed to the fact that female students are under high levels social pressure to successfully complete their degree programmes, consistently strive for academic excellence and are more afraid of failing their exams than their male counterparts. Consequently, this fear of failure may lead them to unconsciously experience higher levels of anxiety and particularly in exam-related situations. When individual items of the STARS were considered, the results show that female students are significantly more anxious concerning 33 of the 51 STARS items (roughly 65% of the items as provided by the Welch-test). However, this higher level of statistics anxiety cannot be regarded as a potential predictor of poorer academic performance or achievement among female students. It worth noting here that female students surveyed in this study had received higher final exam

scores as measured by mean values and had scored more (–A) and (A) grades than their male counterparts. This reflects, as noted by Hembree (1988), the fact that female students are more likely to manage higher levels of statistics anxiety by employing more effective test-taking strategies. These findings are consistent with those of prior research on gender differences in statistics anxiety levels (e.g., Bui & Alfaro, 2011; Chew & Dillon, 2014; Chiesi & Primi, 2010; DeCesare, 2007; Macher et al., 2013; Paechter et al., 2017; Rodarte-Luna & Sherry, 2008; Zeidner, 1991).

The study shows that the leading predictors of statistics anxiety experienced by sociology and social work students are test and class anxiety and interpretation anxiety, for which mean scores were reported at 80.2% and 79.1% for each subscale, respectively. In addition, mean scores for these two subscales are summed to 75.57, representing approximately 42% of anxiety experienced by students surveyed in this study. This result is also confirmed by the highly statistically significant correlation coefficient found between the two subscales, showing that when students experience higher levels of test and class anxiety, they are more likely to report experiencing higher anxiety levels as measured by the interpretation subscale. These results are consistent with numerous studies conducted on statistics anxiety (e.g., DeVaney, 2010; Kareen, 2018; Onwuegbuzie & Wilson, 2003; Baloglu, 2003).

These aspects of statistics anxiety can be adequately explained when individual items of the STARS are considered. As evidenced from mean scores for each item of the test and class anxiety subscale, the following 3 items generated higher mean scores than the other items: (a) "enrolling in a statistics course", (b) "doing an examination in a statistics course", (c) "going over a final examination in statistics after it has been marked", and (d) "studying for an examination in a statistics course". Similarly, (a) "determining whether to reject or retain the null hypothesis", (b) "making an objective decision based on empirical data", (c) "trying to decide which analysis is appropriate for my research project", and (d) "interpreting the meaning of a probability value once I have found it" are leading factors contributing to anxiety associated with statistical results interpretation.

6. Conclusion and implications

The current study generally shows that sociology and social work students experience higher levels of statistics anxiety. The estimated mean scores for each subscale of the STARS show that

situational antecedents represented by test and interpretation subscales are major driving forces behind higher anxiety levels reported by these students. Furthermore, some anxiety was found to be experienced in relation to subscales on the perceived worth of statistics and computational self-concept. These findings suggest that the examined students are considerably less likely to acknowledge the relevance and importance of learning statistics and tend to experience noticeably lower degrees of computational self-concept. Additionally, the results show that the sociology sample experiences significantly higher levels of anxiety than the social work sample. This is partially attributed to the fact that the sociology students come to statistics course without previous experience in quantitative reasoning and with lower levels of self-efficacy than the social work students examined.

Given these findings, it is more important to identify effective prevention and intervention strategies for effectively addressing higher levels of statistics anxiety reported by students of the current study and to help them effectively learn statistical knowledge and skills. This is particularly important as the departments' degree plans require students to successfully apply a wide range of statistical methods to their own research projects during the final two semesters of study.

Overall, the current study confirms that instructors responsible for teaching statistics courses should prioritize the assessment of students' levels of statistics anxiety and their attitudes towards statistics as an initial phase of instruction. To this end, instructors can use short surveys based on course-related situations extracted from the STARS instrument at the start of each semester. They may also consider developing their own assessment tools for determining level of statistics anxiety among their students. After having identified the level and nature of statistics anxiety involved, instructors should then implement a wide range of instructional strategies that could potentially reduce students' levels of anxiety and help them feel comfortable when learning statistical skills. In doing so, the following strategies may prove helpful. (a) A stronger emphasis should be placed on the application of statistical knowledge and skills to real-world situations. This strategy is of particular importance for students majoring in social sciences such as political science, psychology, sociology, anthropology, and social work among many others. (b) Statistics instructors should strive to limit their focus on completing mathematical computations by hand in

statistics courses. In this regard, they might consider informing students at the beginning of each semester that a ready-to-use sheet of statistical equations and formulas will be provided during quizzes, mid-terms, and final examinations, as the learning of statistics emphasizes the application of knowledge and skills rather than their memorization. (c) Instructors should encourage students to work together in co-operative groups and should allow them to select their own groups when solving statistical problems or performing computer-based statistical analyses. (d) For students reporting higher levels of statistics anxiety as indicated by the "fear of asking for help" subscale, instructors should try to allow students to ask anonymous questions. Anonymous forms may be used to encourage students to ask their questions. Taking this into consideration, instructors might consider encouraging their students to post their questions through the Learning Management System. Instructors can then answer students' questions during class time or on the forum. (e) Instructors should create a positive learning environment in which students can discuss difficulties and challenges faced while learning statistics and that allows them to experience a sense of accomplishment while participating in classroom activities. (f) Given the bidirectional relationship between academic procrastination and statistics anxiety, statistics instructors should work to manage and overcome tendencies towards procrastination. In this respect instructors might consider delivering more frequent quizzes, assignments, and collaborative in-class projects to encourage students to remain more engaged with their course materials. This should be accompanied by the implementation of formative assessment strategies. Finally, (g) instructors should consider increasing their use of verbal and nonverbal immediacy behaviours. As indicated by Williams (2010), the use of immediacy behaviours by statistics instructors significantly decreases levels of statistics anxiety.

Finally, the findings of this study may have important practical implications for academic departments of colleges at Sultan Qaboos University, where degree programmes require students to enrol in at least one statistics course. For example, instructors responsible for teaching statistics courses in these departments should recognize that developing an accurate understanding of particular forms of statistics anxiety that prevail among their students is essential to enhancing student learning and achievement in statistics courses.

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