DOI: 10.5961/jhes.2019.361

Anxiety and Sources of Anxiety in Chinese Doctoral Students

Çinli Doktora Öğrencilerinde Anksiyete ve Anksiyete Kaynakları

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ABSTRACT

Anxiety has proved to be a complicated yet serious issue in learners at all educational levels. Thus, how to handle it becomes significant given the critical importance of education to both individuals and society, which justifies continuous research on it. The present study investigated anxiety and its sources in Chinese doctoral students. 322 students from various universities in China answered the Zung Self-Rating Anxiety Scale, the Student Stress Inventory, the background questionnaire and two open-ended questions. Analyses of the data revealed the following main findings: (1) the respondents were largely anxious both physically and mentally and experienced (high) stress in various situations, (2) a series of causes was identified for student anxiety, and (3) student anxiety and stress were highly related to each other. Based on these findings, implications on how to reduce student anxiety are discussed.

Keywords: Anxiety, Sources of Anxiety, Doctoral students

ÖZ

Anksiyete'nin, tüm eğitim seviyelerinde öğrenenler için karmaşık, ama ciddi bir sorun olduğu kanıtlanmıştır. Bundan dolayı, bununla nasıl başa çıkılacağı konusunda bireylere ve topluma verilecek eğitimin üzerinde durulması önemli olmaktadır. Bu çalışmada Çinli doktora öğrencilerinde anksiyete ve anksiyete kaynakları incelenmiştir. Çin'deki çeşitli üniversitelerden 322 öğrenci Zung Öz Değerlendirme Anksiyete Ölçeğini, Öğrenci Stres Envanteri, arka plan anketini ve iki açık uçlu soruyu yanıtlamıştır. Verilerin analizleri şu temel bulguları ortaya çıkarmıştır: (1) Katılımcılar hem fiziksel, hem de mental olarak büyük ölçüde anksiyeteli ve çeşitli durumlarda (yüksek) strese sahiplerdi, (2) öğrenci anksiyetesi için bir dizi neden tespit edildi ve (3) öğrenci anksiyetesi ve stres birbirleriyle oldukça ilişkiliydi. Bu bulgulara dayanarak, öğrenci anksiyetesinin nasıl azaltılacağına dair öneriler tartışılmıştır.

Anahtar Sözcükler: Anksiyete, Anksiyete Kaynakları, Doktora öğrencileri

INTRODUCTION

Students confront numerous obstacles in study, one of which is anxiety (Vitasari, Wahab, Othman, & Awang, 2010; Khoshlessan, & Das, 2017). The current literature shows that anxiety extensively exists in students in various disciplines such as mathematics, statistics, engineering, business and language learning (Dunn, 2014; Holmes, Waterbury, Baltrinic, & Davis, 2018; Liu, 2016, 2018; Macher, Paechter, Papousek,

Liu M., & Abliz A., (2019). Anxiety and sources of anxiety in chinese doctoral students. *Journal of Higher Education and Science/Yükseköğretim ve Bilim Dergisi, 9*(3), 640-650. https://doi.org/10.5961/jhes.2019.361

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Received/*Geliş Tarihi* : 27.08.2019
Accepted/*Kabul Tarihi* : 30.10.2019

& Ruggeri, 2012; Xiao, & Wong, 2014). Moreover, anxiety can lead to various consequences such as delayed assignments, lower academic achievements (Chapell et al., 2005; Macher et al., 2012; Xiao, & Wong, 2014) and decreased satisfaction and burnout (Boyd, Lewin, & Sager, 2009; Eshel, & Kadouch-Kowalsky, 2003). All these demonstrate that anxiety is a critical issue in education and deserves continuous research considering the importance of education in both personal life and society as well as the number of learners at various educational levels. Furthermore, it is beneficial to explore sources of anxiety in students to better understand it and consequently handle it. Thus, the present study aimed to examine anxiety and its sources in Chinese doctoral students.

Literature Review

According to Hughes and Gullone (2008), anxiety is a state of fear, uneasiness, nervousness, worry, apprehension or tension and is a normal and understandable reaction to stressing situations. It is also related to mental and physical fatigue (Jiang et al., 2003), fear of uncertainty (Cloninger, Pryzbeck, & Svrakic, 1991), stress and depression (Stewart et al. 1997). To explain anxiety, Pekrun (1984) developed the Expectancy-Value theory, stating that anxiety is closely related to one's expectancies and values of tasks/situations. Speilberger (1972) proposed the trait-state theory and made a distinction between state anxiety and trait anxiety. As he defined, state anxiety is "a transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time" (Spielberger, 1972, p. 39); trait anxiety is "relatively stable individual differences in anxiety proneness, that is, to differences in the disposition to perceive in a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with A-State reactions" (Spielberger, 1972, p. 39). As subsumed in these two theories, anxiety is situation-specific, has affective, cognitive and behavioral presentations and can lead to differing consequences related to individuals' study, daily activities and social life, such as poor(er) academic achievements, and behavior avoidance. To measure this anxiety, a number of scales have been developed, of which most widely used are the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), the Zung Self-Rating Anxiety Scale (SAS) (Zung, 1971), the Study Anxiety Scale (Vitasari et al., 2010), and so on.

A series of studies using these scales has revealed that anxiety pervades in students in various disciplines such as language studies, statistics, engineering, business and mathematics (Chapell et al., 2005; Dunn, 2014; Holmes et al., 2018; Jungbluth, MacFarlane, McCarty-Veach, & LeRoy, 2011; Liu, 2016, 2018; Xiao, & Wong, 2014), and can lead to various consequences such as delayed assignments and lower academic achievements (Chapell et al., 2005; Macher et al., 2012; Xiao, & Wong, 2014), decreased satisfaction and burnout (Boyd et al. 2009; Corrigan et al. 1995; Eshel, & Kadouch-Kowalsky, 2003). For example, Welch et al. (2015) studied statistics anxiety in 8 graduate dental hygiene students in the U.S. The results showed that the students experienced statistics anxiety, similar to their peers in other disciplines like education, nursing, personal financial planning, exercise sports sciences, mass communications and forensic science (Dunn, 2014; Jungbluth et al., 2011; Pan & Tang, 2004; Williams, 2010). Jungbluth et al.'s (2011) survey study of 225 genetic counseling graduate students revealed that though most students enjoyed learning and interacting with peers, they were anxious about certain academic and professional challenges such as time constraints, professional obligations, workload and clinical rotations.

Chapell et al. (2005) found that there was a significant but small inverse relationship between test anxiety and GPA in both undergraduate and graduate students. Huang's (2014) study of 20 graduate students in Taiwan found that most participants had high anxiety over writing academic papers. Ocak and Ataseven's (2016) study of 401 graduate students in Turkey revealed that uneasiness in information literacy had a significant effect on students' research anxiety. Xiao and Wong (2014) examined language anxiety in 87 Chinese heritage students studying in two American universities. The results showed that writing activities were more anxiety-provoking than other learning activities. Nevertheless, the study also found that having some degree of anxiety could facilitate learning and thus enhance performance, as found in earlier studies (Rueda, & Chen, 2005).

Students may also suffer from social anxiety (Crozier, 2001; Russell &Topham, 2012). For example, Russell and Topham's (2012) study of 787 university students revealed that they suffered from social anxiety and needed pedagogical support to deal with it. By contrast, Khoshlessan and Das's (2017) research on 85 international students found that social environment was not a significant source of the students' anxiety.

All these studies indicate that anxiety is an important issue in education and worth researching considering the critical importance of education to both individuals and society as well as the number of learners. In addition, it is conducive to explore sources of anxiety in students to better understand and handle the issue. Consequently the present study aimed to explore anxiety and sources of anxiety in Chinese doctoral students and sought to answer the following research questions:

(1) What are the profiles of anxiety in Chinese doctoral students?

(2) What factors cause anxiety in Chinese doctoral students?

METHODS

Context. As China develops fast and values science and technology, institutions of higher education, especially research-oriented ones, have been striving to do well in research and gain international reputation. To achieve this, an important strategy is to have more patents and publications in international, peer-reviewed journals, especially top-ranking journals (e.g., those indexed in SCI, SSCI, and A&HCI). Consequently, having such publications is the primary requirement for promotion for teachers; and doctoral students, those in science and technology in particular, are required to have more than two such publications, with at least one in a top-ranking journal, to graduate in time, in addition to

the completion of other requirements. Teachers and doctoral students are thus under (great) pressure in that they need to become competent researchers and to be proficient in both English and academic English writing.

Participants. Three hundred and twenty-two (165 male and 157 female) doctoral students from various universities in China participated in the present study. With a mean age of 27.89 (SD = 4.93), they were from various disciplines such as chemistry and chemical engineering, Chinese, civil engineering, earth system science, translation, electrical engineering, public policy, language studies, material engineering, psychology and environment engineering. Of these participants, 189 (58.7%) were first-year, 32 (9.9%) second-year, 40 (12.4%) third-year, 40 (12.4%) fourth-year, 13 (4%) fifth-year and eight (2.5%) other-year students; 135 had taken the Ph.D qualifying examination, of whom three failed (187 had not taken the exam).

Instruments. The participants answered a background questionnaire, the 22-item Zung Self-Rating Anxiety Scale, and the 18-item Study Stress Inventory. In addition, they were asked to answer two open-ended questions: "Do you often feel anxious?" and "Why do (not) you often feel anxious", to complement their responses to the survey items.

The Background Questionnaire. The background questionnaire aimed to collect such information about respondents like gender, age, year of study, major, university, and (not) passing the Ph.D qualifying examination.

The Zung Self-Rating Anxiety Scale. The 22-item Zung Self-Rating Anxiety Scale (ZSAS) (Cronbach coefficient α=.913) used in the present study was adopted from that developed by Zung (1971), aiming to measure respondents' anxiety levels in study at a specific point of time (see Table 1). This scale was selected in the present research in that it has proven to be highly valid and concerns various behaviors of anxiety (Brown & Zung, 1972; Jiang et al., 2003; Zung, 1971). Based on the results of the pilot study, two more items were added to the Scale: "I often doubt myself" and "I worry about not being able to graduate". All the items were placed on a 4-point Likert scale, ranging from 'a little of the time', 'some of the time', 'good part of the time', to 'most of the time' with values of 1 to 4 assigned to each of the alternatives respectively.

The Study Stress Inventory. Folkman and Lazarus (1985) defined stress as "a relationship between the person and the environment that is appraised by the person as relevant to his or her well-being and in which the person's resources are taxed or exceeded" (p. 152). As found in research, stress and anxiety are closely related to each other (Lindesay et al., 2006; Uskun, Kisioglu, & Ozturk, 2008). Hence, the 18-item Study Stress Inventory (SSI) (α = .938) was also implemented in the present research, intending to measure respondents' levels of stress in a variety of situations. This 18-item SSI was adapted from that designed by Boyle, Borg, Falzon and Baglioni (1995), which is closely related to individual students' study, daily activities and social life, such as the Ph.D qualifying examination, study load, income, research, personal development, and peers (see Table 1). All the items were placed on a five-point Likert scale, ranging from 'no stress', 'mild stress', 'moderate stress', 'much stress' to 'extreme stress' with values 0 to 4 assigned to each of the alternatives respectively.

Procedure and Data Analyses

The initial questionnaires were translated into Chinese and then piloted on five doctoral students. The results led to the addition of two items to the ZSAS, the present 18-item SSI, and two open-ended questions. The resulted questionnaires were translated into Chinese and double-checked by two assistant researchers proficient in both Chinese and English, which, together with a consent form, were then made available online to doctoral students in universities in China.

The collected quantitative data were analyzed via SPSS 20. The ZSAS and SSI were first subjected to rotated (varimax) principal components analyses to reveal their underlying dimensions. Then correlation analyses were run to reveal the relations within and between ZSAS and SSI scales. After that, means and standard deviations of ZSAS and SSI scales were calculated to measure student anxiety and stress levels. Meanwhile, responses to the open-ended questions were analyzed in terms of themes (e.g., causes for anxiety such as research, publication, study load, and personal development). To protect students' privacy, a number was assigned to each respondent and used when their remarks were reported in this paper.

RESULTS

Principal Factor Analyses of the ZSAS and SSI Scales

Both the Zung Self-Rating Anxiety Scale (ZSAS) and the Study Stress Inventory (SSI) were subjected to rotated (varimax) principal components analyses before any statistical analysis was conducted. The loadings are shown in Table 1.

The analysis of the ZSAS yielded two factors, with eigenvalues ranging from 1.92 to 9.11, which accounted for 41.41% and 8.73% of the total variance respectively. Factor 1 (ZSAS1), called Physical Reactions, had 14 items reflective of physical reactions to anxiety such as headache, faint and stomachache. The second factor (ZSAS2), called Mental Reactions, and consisted of eight items indicative of mental feelings of anxiety or ease. The analysis of the SSI produced two factors, with eigenvalues ranging from 1.671 to 12.589, which accounted for 29.62% and 26.15% of the total variance respectively. The first factor (ISS1), Miscellaneous Sources of Stress, had 11 items concerned with various sources of stress other than research such as study, social life, salary, personal development and workload. The second factor (ISS2), Research-related Stress, covered seven items suggestive of stress related to research like the qualifying exam, dissertation, and literature review. Items of writing and English abilities were grouped into this factor in that Chinese doctoral students were generally required to publish in international journals in English to graduate in time.

As reported in Table 1, the loadings of the items in each factor of the ZASA or SSI generally exceeded .3, meaning that they were highly related to their factors. Moreover, as shown in Table 2, the two ZSAS factors were highly correlated with

Table 1: Principal Component Analyses of ZSAS and SSI (*n*=322)

ZSAS & SSI items	ZSAS1	ZSAS2	SSI1	SSI2
1. "I feel more anxious than usual"	2.39	**.253**		
2. "I feel afraid for no reason at all"	1.83	**.262**		
3. "I get upset easily or feel panicky"	2.12	**.191**		
4. "I feel like I'm falling apart and going to pieces"	1.61	**.248**		
5. "I feel that everything is all right and nothing bad will happen"	2.59	**.686**		
6. "My arms and legs shake and tremble"	1.26	.121		
7. "I am bothered by headaches, neck and back pain"	2.06	.064		
8. "I feel weak and get tired easily"	2.30	.201		
9. "I feel calm and can sit still easily"	2.56	**.779**		
10. "I can feel my heart beating fast"	1.75	.136		
11. "I am bothered by dizzy spells"	1.57	.095		
12. "I have fainting spells or feel like it"	1.30	.172		
13. "I can breathe in and out easily"	1.91	.721		
14. "I get feelings of numbness and tingling in my fingers & toes"	1.36	.151		
15. "I am bothered by stomach aches or indigestion"	1.71	.063		
16. "I have to empty my bladder often"	1.86	-.017		
17. "My hands are usually dry and warm"	2.48	-.597		
18. "My face gets hot and blushes"	1.57	.163		
19. "I fall asleep easily and get a good night's rest"	2.39	.631		
20. "I have nightmares"	1.68	.170		
21. "I often doubt myself"	2.21	**.274**		
22. "I worry about not being able to graduate"	2.30	**.142**		
23. "Pressure from passing the qualifying examination"			.028	**.754**
24. "Heavy study load (e.g., difficult courses, demanding course requirements)"			**.315**	.663
25. "Pressure from the supervisor(e.g., lack of supervision, extra work required by the supervisor)"			**.327**	.514
26. "Pressure from the degree dissertation (e.g., having no idea, lacking support)"			.442	**.587**
27. "Pressure from literature review(e.g., difficulty in searching for related literature, too much literature, difficult literature)"			.427	**.607**
28. "Pressure from research (e.g., little knowledge of research methods, no ideas, publication requirements)"			.568	**.535**
29. "Pressure from personal development(e.g., opportunities and resources)"			**.693**	.362
30. "Inadequate salary"			**.689**	.115
31."Pressure from teaching (e.g., not knowing how to teach, little support)"			**.202**	.659
32."Too much work to do (e.g., study, work, entertainment)"			**.387**	.660
33."Pressure from social life (e.g., interpersonal communication, social activities)"			**.584**	.451
34. "Pressure from families(e.g., family support and care, little time with family members)"			**.502**	.466
35. "Pressure from peers"			**.696**	.283
36. "Pressure from the Department and the University"			**.614**	.509
37. "Pressure from academic writing (e.g., poor writing ability, little knowledge of writing conventions)"			.584	**.546**
38. "Pressure from English (e.g., poor English proficiency)"			.590	**.320**
39. "Pressure from finding a job"			**.837**	.139
40. "Pressure from academic activities (e.g., fear of speaking up in the activities, lack of financial support, etc.)"			.659	**.490**

Table 2: Correlations within and between ZSAS and SSI Scales (*n*=322)

	ZSAS1	ZSAS2	ZSAS	SSI1	SSI2	SSI
ZSAS2	.736**	1	.913**	.620**	.550**	.614**
ZSAS	.948**		1	.656**	.568**	.644**
SSI1	.606**	.620**	.656**	1	.851**	.975**
SSI2	.514**	.550**	.568**		1	.946**
SSI	.591**	.614**	.644**			1

***Notes:** ** = p ≤ .01; **coefficient of determination:** small = r ≤ 0.1; medium = r = 0.3; large = r ≥ 0.5 (Cohen, 1988)*
***ZSAS** = Physical Reactions; **ZSAS2** = Mental Reactions; **ZSAS** = Zung Self-Rating Anxiety Scale; **SSI1** = Miscellaneous Sources of Stress; **SSI2** = Research-related Stress; **SSI** = Study Stress Inventory.*

each other (*r*=.736, = *p*≤ .01) and to the ZSAS (*r*=.913 ~ .948, = *p*≤.01), so were the two SSI factors (*r*=.851 ~ .975, = *p*≤ .01). Furthermore, the ZSAS and SSI scales were highly related to each other as well, with coefficients ranging from .514 to .656, implying that a respondent who was under greater stress felt more anxious, or vice versa.

Anxiety and Stress Levels

To explore the participants' anxiety and stress levels, means and standard deviations of ZSAS and SSI scales were computed. When computing the scores, items indicating low/little anxiety were reverse-coded. As previously described, the ZSAS was a four-point while the SSI was a five-point Likert scale, with values of 1-4 and 0-4 assigned to each of the item descriptors, respectively. Thus, a score of more than 3, 2.5-3 and below 2.5 on a ZSAS scale meant high, medium and low anxiety respectively, and a score of more than 3, 2-3 and below 2 on a SSI scale meant high, medium and low stress respectively. Thus, the higher a ZSAS score, the more anxious the respondent was; the higher a SSI score, the greater the stress. The results are presented in Table 3, which shows that the participants scored 1.80 to 2.20 on the ZSAS scales and 2.97 to 3.04 on the SSI scales. The ZSAS scores were all below the scale midpoint 2.5 while all the SSI scores far exceeded the scale midpoint 2. This indicated that around one third of the participants suffered from anxiety both physically and mentally and that they generally were under (high) stress in various situations.

As shown in Table 3, male students scored 1.81 to 2.19 on the ZSAS scales and 3.00 to 3.11 on the SSI scales; female students scored 1.796 to 2.21 on the ZSAS scales and 2.93 to 3.19 on the SSI scales. It seemed that female students experienced higher research-related stress than their male counterparts while being at a similar level at other aspects of stress and anxiety. Nevertheless, the difference was statistically insignificant. A similar pattern was observed for first-year students and those in other years of study. It seemed that first-year students displayed less anxious physical and mental reactions and suffered greater stress than their peers in other years of study, but no statistically significant difference occurred.

Statistically significant difference was observed when the participants fell into groups depending on whether they had taken, passed or failed the Ph.D qualifying exam. As seen in Table 3, students who had passed the exam scored 1.83 to 2.26 on the ZSAS scales and 2.93 to 3.09 on the SSI scales; students who had not taken the exam scored 1.77 to 2.16 on the ZSAS scales and 2.98 to 3.18 on the SSI scales; and those who had failed the exam scored 2.19 to 2.38 on the ZSAS scales and 3.85 to 3.95 on the SSI scales. It seemed that students who had failed the exam were the most anxious and experienced the greatest stress; those who had not taken the exam were the least anxious but experienced greater stress in all aspects than their counterparts who had passed the exam. ANOVA test results showed that significant differences occurred in all SSI scales between the participants who failed the exam and the other two groups. No statistically significant difference was observed in any scale between students who had passed and those who had not taken the exam.

A further look of the scores indicated that the respondents, whatever specific group they were in, scored higher on ZSAS2 than on ZSAS1 and higher on SSI2 than on SSI1. This meant that the respondents, whether they were male or female, in year 1 or other years of study, had passed, failed or not taken the qualifying exam, suffered more anxiety mentally than their physical reactions displayed, and experienced greater research-related stress than that from other sources.

Correlations between Anxiety and Stress

To examine the relations between anxiety and stress, correlational analyses were run between ZSAS and SSI items (To avoid Type I errors, Bonferroni correction was carried out in the analyses, with the threshold of p lowered from .05 to be at .00125 and from .004 to be at .00025.).

As presented in Table 4, ZSAS item 17 was not significantly negatively related to any SSI item; ZSAS item 5 was significantly positively related to SSI items 29, 36 and 39 (*r*=.199 ~ .200, *p*≤.00025); ZSAS item 13 was significantly positively related to SSI items 33 and 34 (*r*=.197 ~ .208, *p*≤.00025); the other ZSAS items were largely significantly positively correlated with SSI items, with coefficients ranging from .177 (*p*≤.00125) to .529 (*p*≤.00025). These findings suggested that the more anxious a student was, the greater stress he/she experienced in various situations, or vice versa, though the stress tended to be unrelated to 'dry and warm hands' (ZSAS item 17), and not much related to 'feeling alright' (ZSAS item 5) or 'breathing easily' (ZSAS item 13). For example, the greater stress a student experienced in a situation, he/she tended to feel more anxious,

Table 3: Means and Standard Deviations (SDs) of ZSAS and SSI Scales (n = 322)

	General (*n*=322)		Gender						Year of Study						The Qualifying Examination								
	Mean	SD	Male (*n*=165)		Female (*n*=157)		*t*	*p*	1st-year (*n*=189)		Other-year (*n*=133)		*t*	*p*	Passed (*n*=132)		Not taking (*n*=187)		Failed (*n*=3)		*F*	*p*	Location of sig. difference
			Mean	SD	Mean	SD			Mean	SD	Mean	SD			Mean	SD	Mean	SD	Mean	SD			
ZSAS1	1.80	.496	1.81	.51	1.796	.483	.163	.871	1.79	.490	1.81	.507	-.259	.796	1.83	.504	1.77	.489	2.19	.536	1.54	.217	/
ZSAS2	2.20	.676	2.19	.677	2.21	.678	-.297	.767	2.16	.664	2.26	.692	-.136	.174	2.26	.675	2.16	.678	2.38	.650	.904	.406	/
ZSAS	1.95	.524	1.95	.532	1.95	.517	-.041	.967	1.93	.517	1.97	.535	-.794	.428	1.99	.530	1.91	.520	2.26	.407	1.32	.268	/
SSI1	2.97	.842	3.00	.856	2.93	.828	.776	.438	3.01	.842	2.91	.841	1.09	.275	2.93	.881	2.98	.807	3.85	1.06	1.77	.172	F & P; F & NT
SSI2	3.15	.896	3.11	.895	3.19	.898	-.839	.402	3.23	.895	3.04	.889	1.89	.059	3.09	.896	3.18	.894	3.95	.577	2.09	.125	F & P; F & NT
SSI	3.04	.831	3.04	.839	3.03	.826	.128	.898	3.09	.838	2.96	.818	1.47	.143	2.99	.846	3.05	.816	3.94	.873	2.02	.134	F & P; F & NT

Notes: F: *failed;* ***P:*** *passed;* ***NT:*** *not taken.*

Table 4: Correlations between ZSAS Items and Lead SSI Items (*n*=322)

Items	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	.314**	.366**	.351**	.383**	.393**	.377**	.401**	.387**	.246**	.376**	.387**	.366**	.389**	.432**	.378**	.290**	.298**	.316**
2	.323**	.294**	.305**	.362**	.333**	.323**	.423**	.343**	.285**	.338**	.439**	.376**	.422**	.449**	.364**	.261**	.306**	.323**
3	.291**	.322**	.348**	.365**	.375**	.342**	.390**	.360**	.213**	.424**	.439**	.303**	.411**	.444**	.378**	.278**	.304**	.340**
4	.209**	.297**	.306**	.325**	.325**	.295**	.396**	.317**	.235**	.395**	.392**	.372**	.357**	.440**	.333**	.275**	.292**	.302**
5	.138	.093	.081	.143	.124	.045	.200**	.142	.068	.118	.164	.171	.154	.199**	.080	.121	.199**	.136
6	.182*	.280**	.291**	.238**	.279**	.180*	.293**	.271**	.316**	.279**	.406**	.338**	.336**	.379**	.254**	.284**	.274**	.339**
7	.169	.235**	.274**	.337**	.351**	.302**	.334**	.274**	.209**	.304**	.356**	.285**	.334**	.349**	.344**	.263**	.235**	.262**
8	.261**	.332**	.285**	.333**	.342**	.361**	.380**	.343**	.261**	.396**	.371**	.316**	.369**	.475**	.412**	.372**	.277**	.339**
9	.134	.101	.081	.232**	.221**	.158	.240**	.201**	.158	.220**	.254**	.250**	.228**	.252**	.187*	.177*	.278**	.228**
10	.264**	.348**	.341**	.368**	.369**	.340**	.387**	.300**	.315**	.348**	.427**	.361**	.412**	.427**	.353**	.304**	.275**	.324**
11	.177*	.306**	.270**	.253**	.307**	.260**	.316**	.261**	.272**	.232**	.382**	.336**	.279**	.392**	.339**	.311**	.294**	.340**
12	.195**	.238**	.241**	.187*	.223**	.188*	.273**	.298**	.323**	.178*	.350**	.357**	.330**	.392**	.273**	.273**	.271**	.290**
13	.032	.104	.027	.091	.125	.035	.156	.155	.161	.124	.197**	.209**	.176	.173	.094	.166	.169	.131
14	.228**	.213**	.282**	.162	.230**	.177*	.301**	.240**	.364**	.226**	.374**	.352**	.324**	.367**	.293**	.260**	.257**	.319**
15	.135	.322**	.241**	.205**	.221**	.222**	.297**	.208**	.261**	.263**	.305**	.260**	.290**	.341**	.289**	.229**	.263**	.294**
16	.151	.241**	.191*	.209**	.225**	.224**	.271**	.262**	.161	.257**	.216**	.237**	.253**	.317**	.272**	.160	.237**	.263**
17	-.048	-.037	-.014	-.037	-.023	.031	-.092	-.082	-.052	-.009	-.130	-.167	-.115	-.088	-.039	-.105	-.127	-.053
18	.207**	.243**	.182*	.286**	.291**	.291**	.366**	.307**	.234**	.264**	.342**	.266**	.376**	.383**	.311**	.277**	.357**	.390**
19	.139	.143	.179*	.215**	.247**	.183*	.276**	.222**	.186*	.216**	.358**	.321**	.247**	.308**	.273**	.246**	.295**	.340**
20	.178*	.334**	.226**	.300**	.315**	.282**	.334**	.315**	.178*	.333**	.331**	.218**	.330**	.400**	.348**	.249**	.328**	.327**
21	.303**	.349**	.384**	.448**	.409**	.423**	.512**	.371**	.256**	.391**	.438**	.314**	.481**	.551**	.475**	.371**	.443**	.459**
22	.337**	.371**	.385**	.511**	.403**	.433**	.437**	.360**	.274**	.362**	.401**	.326**	.420**	.529**	.457**	.341**	.356**	.421**

Notes:* = *p ≤. 00125;* ***** =*** *p ≤. 00025;* ***coefficient of determination:*** *small = r ≤ 0.1; medium = r = 0.3; large = r ≥ 0.5 (Cohen, 1988). 1-22 are ZSAS items; 23-40 are SSI items.*

more panicky, and had more such physical reactions as feeling weak and headache. These findings were consistent with the strong correlations between ZSAS and SSI scales reported in Table 1, further revealing the strong relationship between anxiety and stress in the participants of this study.

Sources of Student Anxiety

Of 322 survey respondents, 318 responded to the open-ended questions, of whom 149 (46.86%) reported often feeling anxious, 75 (23.58%) feeling anxious sometimes and 94 (29.56%) not feeling anxious. On the whole, around 70% of the participants reported feeling anxious when studying for Ph.D degrees, especially prior to the oral defense of their dissertation proposals/dissertations. For example, "… I am anxious day by day. It is always like this. I can't find any good solution. I particularly need to talk to someone to let out my pressure" (No.60). Some students were so anxious that they had already been diagnosed of depression. When asked about reasons for anxiety, the respondents reported a number of causes, which are summarized in Table 5.

As seen from Table 5, paper publication was the primary reason for student anxiety, followed by research, graduation, study, the future, graduation dissertation, the supervisor, and being too busy with too much work respectively. As reported by the participants, they were anxious about publication in that they were unable to write out (satisfying/good) papers or meet the requirements of paper publication, and that it was difficult to get a paper published, especially in top-ranking journals (e.g., those indexed in SSCI, A&HCI, SCI, IEEE, EI and so on). In addition, in order to foster doctoral students with great competence and enhance academic reputation, most universities and departments specified the number of papers and the type of journals a student had to publish in order to graduate in time. This was (rather) challenging to most students. Similar to paper publication, research was reported to be another important cause for anxiety by the respondents in that there was too much to do, or there was little progress in their projects, or they did not know how to do research, or the projects were (too) challenging. For example, "… Problems often occur in experiments but I can't find out reasons and don't know how to improve" (No. 144). Highly related to publication and research, to graduate in time was also anxiety-provoking to many participants, mainly because it was difficult to meet graduation requirements. As a student confided, "It is too difficult to graduate. I can't publish a paper, no way to get it published. … I'll have to quit" (No. 51).

In addition, some participants worried about their future. To them, their future, including future development, seemed unpredictable, or they did not have a specific goal for their future. Meanwhile, their supervisors imposed (great) stress and anxiety on the participants. As they reported, their supervisors often shouted at them or took it out on them when they were in bad moods, or demanded too much of them which could hardly be satisfied, or did not supervise them properly, or asked them to do errands or things unrelated to their research, and so on. Example comments were: "My supervisor is not emotionally stable, he is likely to take it out on me or shout at me anytime" (No. 32). "… The supervision I receive is messy and my supervisor frequently changes my projects" (No. 173). Moreover, course assignments, projects, tasks set by supervisors, and so on kept the students busy, leaving them little free time and driving them anxious. "I always have a lot to do. They seem to be endless. Gradually, I get tired, my efficiency becomes low, and I become anxious. Then a vicious circle comes" (No. 153). Furthermore, the respondents reported feeling anxious because they were unable to look after their parents or there were limited resources available for their research. As they remarked, "I often worry that my progress can't catch up with the aging of my parents" (No. 168). "The lab sets highly challenging requirements for graduation, but provides limited resources. For example, we are extremely short of computers" (No. 233).

Concurrently, the participants who reported feeling little/no anxiety also elicited reasons for their lack of anxiety (see Table 5), the most important of which were proactive attitudes, companion, comfort/support from friends, boy-/girl- friends and family members, persistent hard work, support from supervisors, and so on. To many participants, being proactive, including being contented with and grateful to what they had, made them not anxious but satisfied and happy with their life and study. For example, "I work hard every day, and I achieve something every day. So I don't feel anxious" (No. 315). Planning time and balancing well between study, work and entertainment made them not anxious as well.

DISCUSSION

Reliability analyses, factor analyses and correlation analyses revealed that both ZSAS and SSI scales were highly reliable, as found in many current studies (Macher et al., 2012; Russell & Topham, 2012; Welch et al., 2015; Khoshlessan & Das, 2017).

Statistical analyses revealed that around one third of the participants suffered from anxiety both physically and mentally and that they were generally under (high) stress in various situations, as found in many existing studies (Holmes et al., 2018; Huang, 2014; Jiang et al., 2003; Welch et al., 2015; Xiao & Wong, 2014). It was the same with male, female and first-year students as well as those in other years of study and those who had passed, failed or not taken the Ph.D qualifying examination. Analyses of the participants' responses showed that around 70% of them were anxious and many were highly anxious, not only further supporting the survey findings but indicating that greater anxiety might exist in more doctoral students. This suggests that anxiety is an important issue which deserves further research in that it involves a huge group of learners who strive to be talents in various fields in the future.

Though no statistically significant difference was observed in either anxiety or stress levels between genders, or between first-year students and those in other years of study, partially consistent with that in Vitasari et al. (2010), students who had failed the qualifying examination reported to be under significantly greater stress than their peers who had passed or had not taken the exam. This might be because the qualifying

examination was indeed a threshold for them and failure in it scared them. Nevertheless, since only three of the participants failed in the exam, this sample was too small compared with the numbers of those who had passed (*n*=132) and who had not taken the exam (*n*=197). Consequently, this issue needs to be further researched on a larger sample to obtain more understanding.

Table 5: Causes for Anxiety Identified by the Respondents

Causes for anxiety (*n*=224)	Causes for little/no anxiety (*n*=94)
Paper publication (52/23.21%)	Proactive attitudes (Feeling contented and grateful) (25/26.6%)
Research (42/18.75%)	Companion, comfort/support from friends, boy/girlfriends, family members (16/17.02%)
Difficulty in graduation (40/17.86%)	Persistent hard work (9/9.57%)
Study (23/10.27%)	Support from the supervisor (8/8.51%)
Being unsure of the future (19/8.48%)	Self-adjustment (5/5.32%)
Finding jobs (18/8.04%)	Self-confidence (5/5.32%)
Graduation thesis (17/7.59%)	Clear goals (4/4.26%)
Pressure from the supervisor (17/7.59%)	Good prospect of on-time graduation (3/3.19%)
Too busy with two much work (12/5.36%)	Be approved by supervisors (2/2.13%)
Finance (inadequate salary) (9/4.02%)	Progress in projects (2/2.13%)
Getting married/Finding girl/boyfriends (8/3.57%)	Ph.D study being enjoyable (1/1.06%)
Chores in life/Pressure from life (6/2.68%)	Living a regular life (1/1.06%)
Peer pressure (5/2.23%)	Belief (1/1.06%)
Poor research ability (4/1.79%)	Being capable (1/1.06%)
Writing English papers (4/1.79%)	Predictable future (1/1.06%)
Few/Lack of ideas (4/1.79%)	Being clear about own research (1)
Lack of confidence (4/1.79%)	No pressure from looking for jobs (1/1.06%)
Poor health (3/1.34%)	Having enough time to study and do research (1/1.06%)
Balancing study and family (3/1.34%)	
Balancing work, family and Ph.D study (3/1.34%)	
Career development (3/1.34%)	
Too much to learn (2/0.89%)	
Going abroad (2/0.89%)	
Looking after parents (2/0.89%)	
The qualifying examination (2/0.89%)	
Lack of communication, concern and support from friends and family members (2/0.89%)	
Large amount of data (1/0.45%)	
Poor interpersonal relationship (1/0.45%)	
Not working hard (1/0.45%)	
Fear (1/0.45%)	
Being unable to stay with families (1/0.45%)	
Too much pressure (1/0.45%)	
Not understanding the instruction in class (1/0.45%)	
Low study efficiency (1/0.45%)	
Poor relationship with parents (1/0.45%)	
Bad sleep (1/0.45%)	
Limited resources (1/0.45%)	

Meanwhile, analyses of the data showed that the respondents, whatever specific groups they were in, reported higher mental anxiety than their physical anxiety, which might be because mind came before action. This also indicates that students might not beware of the anxiety they are experiencing, which further justifies the complex nature of the issue and the importance of continuous research on it. Moreover, the participants suffered greater research-related stress than that from other sources, partially similar to the finding in Ocak and Ataseven (2016) who found research anxiety was high in Turkish graduate students. Consistent with the respondents' responses to the open-ended questions, this was largely because Ph.D study was meant to educate researchers and scientists whose primary task was to do research (well). This was further supported by the reasons for anxiety identified by the respondents. As summarized in Table 5, the most commonly identified causes for anxiety all centered around research like publishing papers, graduating in time, and graduation dissertation, characteristic of Ph.D study. Furthermore, as found in other studies (Desouky & Allam, 2017; James & Perry, 1978; Resell & Topham, 2012), income, relationship with others and self-confidence all led to anxiety and stress in the participants to varying degrees.

In addition, the present study revealed that student anxiety and stress were highly related to each other. High coefficients were obtained between ZSAS and ISS scales and individual items, similar to those between anxiety and stress in situations with other sample populations like teachers and tourists (Ahmed & Julius, 2015; Desouky & Allam, 2017; Stewart et al., 1997). And the causes for anxiety identified by the participants were also the stress they experienced in different situations such as pressure from supervisors, research, peers and family members, low income and worry about the future, including self-development, as discussed in Cloninger et al. (1991) and Jungbluth et al. (2011).

CONCLUSIONS and IMPLICATIONS

The present study investigated anxiety and sources of anxiety in Chinese doctoral students. The study revealed that the respondents were largely anxious both physically and mentally and experienced (high) stress in various situations, and that the anxiety was attributed to a number of causes such as research, study load, graduation and the future. The study also showed that student anxiety and stress were highly related to each other.

These findings, as well as those in the current literature (Chapell et al., 2005; Dunn, 2014; Holmes et al., 2018; Hughes & Gullone, 2008; Liu, 2016, 2018; Xiao & Wong, 2014), further indicate that anxiety is a serious issue in (doctoral) students, which causes both mental and physical reactions in them, especially in highly stressful situations. To cope with anxiety, self-awareness is crucial before other strategies are executed. Then students themselves can adopt various strategies to reduce anxiety, such as establishing friendly and supportive relations with friends and families, communicating and sharing ideas, being proactive, living a regular life, doing exercises, setting clear goals, and becoming (more) competent, as suggested by the participants in the present research. Meanwhile, doctoral students should empower themselves with various kinds of knowledge and skills required to do research well, so that they might suffer less from research anxiety or the qualifying examination, as found in this research. Their life might be more enjoyable if their supervisors could focus on supervision more rather than ask them to run errands and be empathetic and supportive to them.

In addition, studies have shown that anxiety can be reduced by training or methods like humor and other interventions (Berk, 2000; Pan & Tang, 2004; Pelton, 2014; Ratanasiripong, Kaewboonchoo, Ratanasiripong, Hanklang, & Chumchai, 2015; Yusufov et al., 2019). For example, Berk's (2000) 6-year long study showed that humor reduced anxiety in both undergraduate and graduate students and improved their performance. The researcher thus suggested integrating humorous elements into tests. Pan and Tang (2004) examined the effectiveness of innovative instructional methods on reducing statistics anxiety in 21 graduate students in social sciences. The results indicated that application-oriented teaching methods and instructors' attentiveness to students' anxiety helped reduce the students' anxiety. Student anxiety can also be reduced by teaching seminars (Pelton, 2014) and biofeedback intervention (Ratanasiripong et al., 2015). Ratanasiripong et al.'s (2015) study of 60 graduate students proved that biofeedback intervention was a cost-effective tool to help graduate students manage their anxiety and stress. This finding was further supported by a subsequent similar study (Yusufov et al., 2019) which examined the effectiveness of stress reduction interventions for undergraduate and graduate students. The study showed that interventions, like relaxation training, mindfulness-based stress reduction, and psychoeducation were (more) effective in reducing students' anxiety. Hence, interventions can be used in teaching and learning to help reduce anxiety at all educational levels.

What is discussed above lends further support to the belief that anxiety is complex (Fimian, 1984) and deserves continuous research. Since doctoral students differ from one another in various aspects such as gender, age, program, goal, research training and ability, relationship with friends, family members and supervisors, research on anxiety with different learners will help us better understand the issue and then better empower us to handle it. Moreover, as anxiety is situational and dynamic (Buitink & Kemme, 1986), longitudinal studies will help elicit more information on how student anxiety changes over time and what contributes to the changes. Moreover, studies employing other scales and/or mixed methods are needed to confirm the findings of the present research, which may also help reveal other interesting findings.

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