Statistics Anxiety of Graduate Students

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Abstract

Commonly described by psychologists; anxiety is a psychological construct, as a state of apprehension, a vague fear that is only indirectly associated with an object (Scovel, 1991). A small amount of anxiety is believed to be needed for learners since it improves performance which is known as facilitating anxiety. Statistics anxiety is a feeling of anxiety when taking a statistics course or doing statistical analysis (Cruise, Cash, & Bolton, 1985). In general, statistics anxiety is a debilitating anxiety which negatively affect students' performance. Statistics is one of the compulsory courses in most graduate programs. Students entering to these graduate programs especially in social sciences such as education, usually do not have any math and statistical background which creates a negative perception towards statistics related courses. These negative feelings and perceptions are thought to be affect their level of success. The aim of this study is, therefore, to determine the anxiety related views of graduate students towards statistics course. Qualitative content analysis with purposeful sampling is used in the study. To this end, the research data were obtained with the help of 26 graduate students studying in Department of Educational Sciences at Çanakkale Onsekiz Mart University in the academic years of 2017-2018. A semi-structured interview form was used for data collection which aims to determine the anxiety related views of graduate students. Analysis of the results revealed five themes of statistics anxiety; (1) importance of the course, (2) math skills, (3) computer skills, (4) exam stress, and (5) foreign language skills. It can be concluded that defining and understanding the source of anxiety related behaviors will help to conduct more effective and efficient statistics courses.

Keywords: Statistics Anxiety, Graduate Student

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INTRODUCTION

Anxiety is one of the most investigated concepts in the field of psychology and has been defined so many times, so there is also an extensive literature on defining anxiety. Commonly described by psychologists; anxiety is a psychological construct, as a state of apprehension, a vague fear that is only indirectly associated with an object (Scovel, 1991). Both the fear and anxiety are unpleasant feelings but anxiety is distinguished from the fear. Usually fear is derived from a "real, objective danger in the external environment while the threatening stimulus of anxiety may not be known" (King, Heinrich, Stephenson, & Spielberger, 1976).

Although there is no general agreement on both definition and components of anxiety it could be said that there is a wide agreement that anxiety have two categories; trait anxiety, state anxiety (Baloğlu, 1999; MacIntyre & Gardner, 1991; MacIntyre & Gardner, 1989). Trait anxiety is a relatively stable personality characteristic, a person who is trait anxious would probably become anxious in many different kinds of situations, while state anxiety is momentary and thus not an enduring characteristic of an individual's personality (MacIntyre & Gardner, 1991; Horvitz, 2001). A third category; namely; situation-specific anxiety could be defined as the anxiety recurs consistently over time within a given situation (MacIntyre & Gardner, 1989).

A small amount of anxiety is believed to be needed for learners since it improves academic performance which is known as facilitating anxiety. It is associated with enhanced and proactive problem solving coping (Raffety, Smith, & Ptacek, 1997). It often directs students into studying; make them attend to courses, read the textbook, do assignments, and study for exams. Students approach their classwork carefully and think about their responses in a thoughtful and reflective fashion when asked to complete tasks with low levels of anxiety (Shipman & Shipman, 1985). However, a high level of anxiety is expected to negatively interfere with academic performance; which is known as debilitating anxiety.

Statistics anxiety has been defined as "a feeling of anxiety when taking a statistics course or doing statistical analysis; that is gathering, processing and interpreting data" (Cruise, Cash, & Bolton, 1985, p. 92). Statistics anxiety describes the apprehension that occurs when an individual is exposed to statistics content or problems and instructional situations, or evaluative contexts that deal with statistics (Macher, Papousek, Ruggeri, & Paechter, 2015). So, statistics anxiety is a type of situation-specific anxiety that can facilitate or hinder the performance in statistics courses.

Several authors have expressed that most of the students identify statistics related courses as the most anxiety-provoking courses in their curriculum (Zeidner, 1991; Onwuegbuzie & Wilson, 2003; Paechter, Macher, Wimmer, & Papousek, 2017; Ruggeri, et al., 2008; Cruise, Cash, & Bolton, 1985; Blalock, 1987). Statistics anxiety is especially widely spread among students in the field of social sciences such as psychology, education, business and etc. (Onwuegbuzie & Wilson, 2003; Onwuegbuzie A. J., 2004). This anxiety can negatively affect students' performance in statistics classes, and cause feelings of inadequacy and low level of self-efficacy for statistics course activities (Blalock, 1987).

Onwuegbuzie, DaRos, & Ryan (1997) found that statistics anxiety is related to math anxiety, however some other researches differentiate statistics anxiety from math anxiety (Baloğlu, 1999; Benson, 1989; Cruise, Cash, & Bolton, 1985; Zeidner, 1991). Statistics anxiety involves more than math anxiety (Williams, 2010) while math anxiety has been defined as anxiety only over manipulating numbers (Richardson & Suinn, 1972). Statistics is more closely related to verbal reasoning than it is to mathematical reasoning (Zerbolio, 1999).

Although Zeidner (1991) conceptualized statistics anxiety as a bi-dimensional construct, consists of content-related anxiety and assessment-related anxiety (Baloğlu, 1999). Cruise, Cash, & Bolton (1985) defines statistics anxiety as a multi-dimensional construct, comprised of six different types of anxiety: (1) worth of statistics, (2) interpretation anxiety, (3) test and class anxiety, (4)

computation self-concept, (5) fear of asking for help, and (6) fear of statistics teachers. In their phenomenological study Onwuegbuzie, DaRos, & Ryan (1997) stated that statistics anxiety is a multidimensional construct and consists of four main components; instrument anxiety (computational self-concept and statistical computing anxiety), content anxiety (fear of statistical language, fear of application of statistics, perceived usefulness of statistics, recall), interpersonal anxiety (fear of asking for help and fear of statistics teachers), and failure anxiety (study-related anxiety, test anxiety, and grade anxiety).

Although statistics anxiety may rarely function as motivators (Meyers & Martin, 1974), in general, statistics anxiety is a negative emotion and it can negatively affects students' performance in statistics classes, and cause feelings of inadequacy and low level of self-efficacy for statistics course activities (Blalock, 1987). For the purpose of this paper, the term "statistics anxiety" will be conceptualized as a debilitating anxiety.

Onwuegbuzie, (1997) observed anxious behaviors such as nail-biting, anger, and tears during the experimental statistics course and also stated that students taking an intermediate level statistics course were reporting psychological symptoms such as depression, frustration, panic, and worry, as well as physiological signs of headaches, muscle tension, perspiration and feeling sick.. In another study, Onwuegbuzie (2004) stated that 80% of graduate students, has been found to debilitate performance in statistics and research methodology and 45% of the students reported procrastination problems in areas such as reading assignments, studying for tests, and writing papers. Other studies also report negative effects of statistics anxiety on students (Lalonde & Gardner, 1993; Zanakis & Valenzi, 1997; Onwuegbuzie A. J., 2000).

Studies state that statistics anxiety can be decreased by; encouraging students to talk about their fears, and then suggesting ways that they can cope with their anxiety (Dillon, 1982) using of humorous cartoons in statistics classes (Schacht & Stewart, 1990). Wilson (1999) reports five anxiety reducers in statistics course as perceived by students; (1) allowing students to use their books and notes while taking tests, (2) encouraging students to work with partners in the computer lab, (3) conveying positive expectations to all students and then structuring the work so that they do succeed, (4) Permitting but not requiring groupwork and (5) acknowledging students' anxiety.

Aim of the Research

At least one course in statistics has become a core component in most graduate level degree programs in most universities (Hong, Chew, & Dillon, 2014). Students entering graduate programs, especially in social sciences such as education, usually do not have any math and statistical background. So that statistics courses are often considered high staked and students may create a negative perception towards statistics related courses. As one of the instructors teaching statistics courses, researcher himself observed that students somewhat worrying and fearing from the course which possibly affect their level of success. From this starting point, the main objective of this study is to determine the anxiety related views of graduate students towards statistics course.

Method

Qualitative research design is used in the study which adopts an interpreting approach to the problem of the research based on a holistic view of interdisciplinary (Altunışık, Coşkun, Bayraktaroğlu, & Yıldırım, 2010). In qualitative research, there is usually no attempt to generalize beyond a certain state; this situation is left to the reader to measure its applicability (Sönmez & Alacapınar, 2011; Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2012)

Study Group

The study group of this research is the graduate students studying in Department of Educational Sciences at Çanakkale Onsekiz Mart University in the academic years of 2017-2018. 13 of the participants were studying Curriculum and Instruction and 13 of the participants were studying Educational Administration and Supervision. Purposeful sampling, which aims to select information rich cases or situations that will enlighten the problems studied in the research (Tarhan, 2015) is used to determine the study group. Results of this study is limited to the expressions of the 26; 12 males and 14 female graduate students.

Table 1. Characteristics of participants

	Female	Male	Total
Curriculum and Instruction	7	6	13
Educational Administration and Supervision	7	6	13
Total	14	12	26

Data Collecting Tool

A semi-structured interview form was used for data collection which aims to determine the anxiety related views of graduate students in the light of relevant literature. This interview form then presented to three experts and their opinion taken into consideration before finalizing the interview form. In order to ensure the language validity of the form, interview form was examined by two academicians studying in the field of Turkish Language Education and determined deficiencies were corrected. A pilot study also carried out with eight graduate students and their opinions and recommendations were taken into consideration before finalizing the interview form.

Data Collection and Analysis Process

Data is collected by researchers themselves by interviewing graduate students. A short briefing was given to the participants before asking to fill out the semi-structured interview form. Qualitative content analysis method which verbal or written expressions are coded and integrated according to the messages and meanings they contain in an objective and systematic manner (Tavşancıl & Aslan, 2001) is used to analyze the data obtained within the scope of the research. After the data obtained from the interview forms are transferred to the electronic environment, and numbered as P1, P2, P3….P26 in order to follow the answers of the participants on an individual basis.

The four steps suggested by Corbin and Strauss (2007) were followed to analyze the data. The data are first coded, then the themes are created. In later stages, themes were arranged and interpretations of the findings were made. The center of the qualitative data analysis plan is coding and creating categories (Creswell, 2013). At the first stage the researcher starts with the conceptualization of the data in the coding process and then then, events and facts are compared based on answers and similar events are conceptualized under the same themes. Then the researcher defines various categories and themes by grouping the concepts related to each other at this stage (Corbin & Strauss, 2007; Creswell, 2013). In the process of coding and creating themes, all answers were read separately by three coders and codes and themes were created. A codebook which is a set of guidelines and examples of when to use, define, and use codes as a guide in data analysis (MacQueen, McLellan, Kay, & Milstein, 1998; DeCuir-Gunby, Marshall, & McCulloch, 2011) was created to ensure inter-encoder compatibility. Three steps suggested by DeCuir-Gunby, Marshall, & McCulloch (2011) were applied to create a codebook guide; (1) code development, (2) reviewing and revising the codes in context, (3) and determining reliability. Analyzing the results, coders created 5 themes. These themes are named as; (1) importance of the course, (2) math skills, (3) computer skills, (4) exam stress, and (5) foreign language skills.

FINDINGS

In this section, the findings from the participants' responses to semi-structured interview questions are presented.

Table 2. Students feeling a different anxiety than the other courses related to the statistics course

Answers	F	%
Yes	24	92,3
No	2	7,7
Total	26	100

According to Table 2, 24 (92,3%) of the 26 students stated that they are anxious about the statistics course. Only 2 (7,7%) of the students were not anxious about the course. Thus, findings of the study were based on the data from the remaining 24 students who expressed their statistics anxiety.

participants who reported having performed speaking skill assessment and evaluation.

Participants views on their anxiety about statistics course

The answers of the students about the anxiety of the statistics course are grouped under 5 themes; (1) importance of the course, (2) math skills, (3) computer skills, (4) exam stress and (5) foreign language skills. First category in "foreign language" theme could be considered as related to theme of "computer skills" however, since coders, after careful examination, decided expressions are mostly focused on the language skills than the computer skills it is grouped under the "foreign language skills".

Table 3. Students definitions about their statistics course anxiety

Themes	Categories	f	f (in themes)
Importance of the course	Requirement of regular study and attendance	21	64
	Being a compulsory course	16	
	Being a last semester course	15	
	Required to conduct research and write thesis	12	
Math skills	Being not good ever with numbers	22	38
	Being away from mathematics for a long time	16	
Computer skills	Being unfamiliar to statistics software	20	29
	Being not good with computers	9	
Exam stress	Limited time on exams	15	26
	Not getting help during the exam/ being alone	11	
Foreign language skills	English required for software	12	22
	English required for textbook / content	10	
	Total	179	

According to Table 3, most common statistics course anxiety is the "importance of the course" which is grouped under four categories; "requirement of regular study and attendance", "being a compulsory course", "being a last semester course" and "required to conduct research / thesis".

Among these categories; "requirement of regular study and attendance" is the most common anxiety source. Regarding the category, 21 of the students expressed their views. One of the male student's expression of "*We have to attend and study on a regular basis every week in order to succeed however I am working I may not be able to attend sometimes…*" (P12), reveals the anxiety of regular study and attendance. 20 other students gave similar expressions stating the anxiety of regular study and attendance. Second most common anxiety category is "being a compulsory course". Where 16 students gave similar expressions to; "*It is a compulsory course, so that I have to take and pass it.*

If I can't, my school is will extend at least one semester..." (P6). From this expression it is deductible that this anxiety is not only related to statistics course but other compulsory courses as well. Third common anxiety category is "being a last semester course". 15 students gave similar expressions to; "*It makes me anxious because of being a last semester course. I must pass this course this semester in order not to extend my thesis...*" (P4). Again from this expression, it is deductible that this anxiety is not only related to statistics course itself but its place in the curriculum. Fourth and the last common anxiety category is "required to conduct research and write thesis". Twelve students expressed this anxiety. Responses are similar to "*I know that I will need statistics skills when writing my thesis, so I have to learn it well which makes me anxious...*" (P9) and "*makes me anxious since statistics knowledge is very important for a researcher...*" (P12).

Among the five themes, second most common statistics course anxiety is "math skills" which is grouped under two categories; "being not good ever with numbers" and "being away from mathematics for a long time". Of the 26 students, 22 expressed their anxieties regarding the category of "being not good ever with numbers". One of the students' expression was "*I do not know how to succeed in this course. I am anxious about it. My field is social sciences and I never been good at math...*" (P18). As seen from this expression, statistics is perceived as related to math and since they are studying a social science being not good at mathematics, make them anxious about the course. Similarly, another student expressed that "*statistics are far away from my skills as same as the mathematics. I don't think that I can pass this course at once...*" (P5). From this expression, it is deductible that student is really anxious about the statistics course because of it relation to mathematics. Regarding the second category "being away from mathematics for a long time" in this theme one of the students gave an expression of "*I do not know how to succeed in this course. I am 34 years old. Although I was not bad at math class in high school, I have not done any advanced math since high school years...*" (P21). As seen from this expression one of the anxiety sources about the statistics course is being away from similar content for a long time. Another student's expression was "*It's been years I have not done any statistics except match results. I remember from the undergraduate class that statistics requires some mathematics skills which somewhat makes me anxious. But I believe that I will succeed it. Even after all those years, I think I remember some things...*" (P19). Totally, graduate students gave 16 similar expressions under this category stated above.

Theme of "Computer skills" is the third common one of the five themes and grouped under two categories; "being unfamiliar to statistics software" and "being not good with computers". Most common of these two categories is "being unfamiliar to statistics software" which is stated by 20 of the students similar to one's "*for me, most anxious side of the statistics course is the software that I heard of. I just have basic computer skills like browsing and some word processing. I have heard from friends that software is somewhat different than we are familiar with and difficult to understand. Frankly, I'm worried about this...*" (P18). Another student gave an expression of "*I saw a program at my school similar to MS Excel, which seems complicated to me. It will be somehow difficult to learn a new program like that at this age. I don't know if I can deal with young classmates...*" (P21). As seen clearly, one of the graduate students' concerns is the software that they heard to be used in statistics course. Second common of these two categories is in this theme is "being not good with computers" which is stated by 9 of the students, which is relatively low comparing the first category. One of the graduate students expressed that "*I have never been good at computers. I do not like them. But I have to frequently use it which makes me anxious...*" (P17). Similarly, another student gave an expression of "*the worst and the most worrying side of the course is being have to use a computer. I am a mathematician I do not fear this side but computers make me nervous. They crash often and you are helpless...*" (P11). From these expressions it is deductible that one aspect of the statistics anxiety is computers and feeling low self-efficacy about them.

"Exam stress" is the fourth common one among the five themes which is grouped under two categories; "limited time on exams" and "not getting help during the exam / being alone". Regarding the first category "limited time on exams", students' expressions are similar to "*I believe there will be an exam in this course which we, as students, do not like. It will be stressful. I may not be able answer*

the questions in time…" (P9). Another student expressed that "*I've heard that the exams lasts as long as 3-4 hours in this course. Hope time given would be enough for me…*" (P18). Second category under this theme is "not getting help during the exam / being alone" which is expressed by one of the students as "*I am not sure if I can succeed in the exam since I won't be able get any help from anyone…*" (P24). Similarly, another student gave an expression of "*I will be alone in the exam and that makes me anxious. I mean being helpless…*" (P11). As seen from the expressions above graduate students care about both the exam itself and being helpless during the exam.

Last of the five themes is "foreign language skills" which is stated by 22 students and grouped under two categories; "English required for software" and "English required for textbook / content". Of the 26 students, 12 expressed their anxieties regarding the category of "English required for software". One of the students gave an expression of "*I believe that I will have difficulties on understanding both the content and the program that we will use. Because it is in English and I do not know enough English…*" (P21). As seen clearly students are worried about their English language knowledge. This expression is also related to the second category in these theme which is also counted for. Regarding the second category under these theme "English required for textbook / content" one of the students expressed that "*English language will be important in this course because most of the terms are in English. It will be difficult to remember all those words…*" (P13). Nine other students expressed similar anxieties of their knowledge about English language.

DISCUSSION AND CONCLUSION

As it can be seen from the research findings, graduate students have a feeling of anxiety regarding taking the compulsory statistics course. Considering the reasons for the anxiety under this research "importance of the course", "math skills", "computer skills", "exam stress" and foreign language skills" have has an important place. This result of the study supported in multiple relevant studies (Cruise, Cash, & Bolton, 1985; Raffety, Smith, & Ptacek, 1997; Zeidner, 1991; Hong, Chew, & Dillon, 2014; Raffety, Smith, & Ptacek, 1997; Malik, 2015; Onwuegbuzie, DaRos, & Ryan, 1997; Onwuegbuzie A. J., 1997; Onwuegbuzie A. J., 2000). However, "fear of statistics teachers" which is defined as a dimension of statistics anxiety (Cruise, Cash, & Bolton, 1985; Onwuegbuzie, DaRos, & Ryan, 1997; Williams, 2010) was not determined in this study. This may be due to the fact that the research was conducted before the students took the statistics course and did not know the future instructor of the course. Another explanation to this result could be that graduate students' perceptions towards the statistics course was independent from the instructor.

In summary, graduate students think that the statistics content is important in terms of regularly attending and studying the course, being a compulsory course, being a last semester course and including the skills they will need to use in the future research. Graduate students also think that their current math skills may not be enough to succeed the statistics course. In the emergence of this result, it can be said that the selection of the study group could be effective, since it is sampled from educational sciences majors and students entering these programs usually comes from social fields. Results related to computer skills, and foreign language skills could be explained by inadequacy of prior education of the graduate students and in these contents. Exam stress which possibly experienced in all other courses may be due to expectations of students, their families, and teachers. This result could be explained by psychological constructs of graduate students' such as self-efficacy, self-regulation, self-esteem and etc.

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