

The Relationship between Preservice Teachers' Attitudes towards Statistics and Their Research Anxiety

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Abstract: The aim of this study was to investigate the relationship between preservice teachers' attitudes towards statistics and their research anxiety. The population of the study consisted of the students of a public university in Turkey who were studying at the Guidance and Psychological Counseling, and the Preschool Education programs. From this population, 257 participants were sampled for this research based on scale sampling method. In order to determine the attitudes and the anxiety of the participants towards statistics and research, two separate scales were to the participants. The scale of attitudes towards statistics consisted of 33 items, which assessed five subscales. The scale of research anxiety consisted of 12 items measuring a single factor. The data were analyzed through independent samples t-test and correlation analyses. The study results suggested that the female preservice teachers had more positive attitudes towards statistics than the male preservice teachers. On the other hand, the male preservice teachers' research anxiety levels were lower than the female preservice teachers. Moreover, the attitudes and the anxiety levels showed significant differences based on the departments of the preservice teachers in favor of the Guidance and Psychological Counseling department. Finally, a positive correlation found between the research anxiety and the attitudes towards statistics levels of the participants.

1. INTRODUCTION

While traditional statistical teaching methodology focuses on formulas, calculations and processes, it is usually criticized because of not using statistics to solve real life problems, and because of not focusing on interpreting, criticizing and evaluating skills of students (Mvududu, 2005; Büyüköztürk, 2000; Barnet, 1999; Köklü, 1996; Köklü, 1994; Hogg, 1992; Watts, 1991; as cited in Doğan, 2009).

Statistics is stated as a central science that is used in educational and social sciences (Ridgway, Nicholson, & McCusker, 2007). It is also emphasized that there is no scientific field without statistics (Griffith, Adams, Gu, Hart & Nichols-Whitehead, 2012). Nowadays, statistics is an

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interdisciplinary science that is constantly evolving with new research and methodologies, and it can be applied to every scientific field. Statisticians bring healthy marketing openings to many areas of their countries such as finance, health, economy, agriculture and education with their researcher identities. They also provide notable contribution to solve existing social problems. Especially in our country, the importance of statistics and statisticians is gradually increasing within the scope of European Union studies (Salihova & Memmedova, 2017).

An examination of the students' attitudes towards statistics is important because it might be relevant to learning process (Griffith et al., 2012). It is a fact that students' attitudes towards statistics are known to have the power to influence their success of statistics course. It is stated that statistics courses have the power to affect many university students' academic career (Parker, Pettijhon, & Keillor, 1999; Potter, 1995). Ramirez, Schau and Emmioğlu (2012) emphasize that positive attitudes towards statistics are important for learning. Moreover, individuals with negative statistical attitudes are likely not to use statistics in the future. Dweck (2002) suggests that positive attitudes have a positive effect on students' behaviors, motivations and achievements. In order to investigate the results of technological development on statistics education, Cebeci and Bek (1999) have founded the first school, which provides online statistical education in Turkey, the Alfa Virtual Statistics School. Doğan (2009) conducted a research to determine whether computer supported statistics education effects students' achievement levels in statistical courses and their attitudes towards statistics. The study resulted that the use of computers in the statistics course (using internet, visual materials, statistical software) increased the positive attitudes towards statistics and the achievement level in the statistics course.

Anxiety is another variable of this research that is defined as a condition that can result in unpleasant emotional situations accompanied by physiological symptoms (Feist, 1990). It is also expressed as a sense of tension, which emerges with sadness, worrying thoughts, concern, and the thoughts of something bad is going to happen (TDK, 2017). Today, anxiety is a reaction of human being to various destructive and disruptive situations directed towards the individual's own being or the things he or she identifies (Canbaz, Sünter, Aker, & Peksen, 2007). Anxiety is a complex feeling of unknown origin (Başaran, 2005).

Research anxiety arises from behaviors such as not doing research unless you have to, feeling bored when you need to do research, feeling uncomfortable with the idea of doing research, and feeling nervous and not trusting yourself when doing research (Çokluk-Bökeoğlu & Yılmaz, 2005). It is also stated that individuals' academic potential beliefs are influential on their academic achievement (Patall, Awad & Cestone, 2014).

The previous research findings about the students' attitudes towards research and the students' research anxiety concluded that the college students had negative attitudes towards research (Büyüköztürk, 1997) and their research anxiety levels were found moderate (Çokluk-Bökeoğlu & Yılmaz, 2005). A study showed that the graduate students' research anxiety levels differentiated across universities, faculties, their grade level, and whether the students took statistics and measurement courses or not (Saracaloğlu, Varol & Evin, 2003). The graduate students showed high research anxiety levels, and their research competence levels decreased as their research anxiety levels increased (Tekin, 2007). Different studies agreed that students experienced high and intense levels of anxiety in statistics and research methods courses (Onwuegbuzie & Wilson, 2003; Sanders, 2001; Trimarco, 1997), and taking a research methods course reduced their research anxiety (Unrau & Beck, 2004). On the other hand, Saracaloğlu (2008) conducted a research over graduate students and contrarily found that their level of academic motivation was adequate, research anxiety was low and attitudes towards research was positive.

The objective of our study is to investigate the relationship between the attitudes of preservice teachers towards statistics and their research anxiety. Within this scope, the following research questions have been developed:

- Q1: Are the attitudes of preservice teachers towards statistics differentiated across gender?
 Q2: Are the attitudes of preservice teachers towards statistics differentiated across their departments?
 Q3: Is there a significant relationship between the attitudes of preservice teachers towards statistics and their research anxiety?

2. METHOD

2.1. Research Model

The methodology of this study was survey research. Survey research design enables researchers to depict population tendencies, attitudes or opinions qualitatively or quantitatively through the studies applied on the sampled units that were obtained from the population itself (Creswell, 2013).

2.2. Population and Sample

The study population existed of the undergraduate students that are studying in the Preschool Education and the Guidance and Psychological Counseling departments at a state university in Turkey. The sample consisted of 257 preservice teachers determined according to the criterion sampling method. The sample in the study was chosen according to a certain criterion which was to take a statistics course in the semester when the study was conducted. The distribution of the sample according to the variables is given in Table 1.

Table 1. *Distribution of Sample According to Gender and Department*

Variables		N	%
Gender	Female	186	72.4
	Male	71	27.6
	<i>Total</i>	<i>257</i>	<i>100.0</i>
Department	Preschool Education	107	41.6
	Guidance and Psychological Counseling	150	58.4
	<i>Total</i>	<i>257</i>	<i>100.0</i>

2.3. Instruments

In the course of the study, the data were obtained by applying two different scales to determine preservice teacher attitudes towards statistics and their research anxiety.

2.3.1. Attitudes towards Statistics Scale

The scale developed by Yaşar (2014) consists of 33 items and 5 subscales. The subscales of the scale are named as the Relation of Statistics and Professional Life (7 items), Statistical Anxiety-Fear (9 items), Enjoying Statistics (6 items), the Importance of Statistics (6 items), and Statistical Difficulty Perception. The scale is a 9-point Likert-type scale with a level of agreement varying from "I do not agree" (1) to "I definitely agree" (9). Receiving a high score from the scale is an indicator of a positive attitude towards statistics, but it is opposite for a low score. The calculated Cronbach-Alpha internal consistency coefficient for the data obtained from this research sample is $\alpha = .92$.

2.3.2. Research Anxiety Scale

The "Research Anxiety Scale" developed by Büyüköztürk (1997) is a five-point Likert-type scale consisting of 12 items that are loading on a single factor. The scale has five positive (items

1, 5, 6, 7, 9, 10, and 12) and seven negative (items 2, 3, 4, 8, and 11) items. Negative items are encoded in reverse order. Receiving a high score on the scale indicates low research anxiety, while the low score indicates high research anxiety. The Cronbach-Alpha internal consistency coefficient calculated for the data obtained from this research sample is $\alpha = .93$.

2.4. Data Analysis

In the analysis process, first a missing values analysis was undertaken. Little's MCAR test indicated that the data were missing at random, $\chi^2 = 201.318, p = .860$. Therefore, the missing data were resolved replacing the missing values with the related variable mean. Then, it has been checked whether the data met the assumptions of normality (Shapiro-Wilk, $p > .05$) and equality of variances, which are among the assumptions of parametric tests. After testing the normality of the data, the independent samples t-test was conducted to compare the scores of the two different participant groups. The relationship between two variables was examined through Pearson's correlation coefficient.

3. RESULTS

Table 2 shows the results of the independent samples t-test that has been conducted to examine whether the preservice teachers' attitudes towards statistics and research anxiety differ across gender.

Table 2. *t-test Results Comparing Males and Females on Attitudes Towards Statistics and Research Anxiety*

Scale	Gender	N	\bar{X}	sd	t	df	p-value
Attitudes Toward Statistics	Female	186	188.51	39.04	2.461	255	.015
	Male	71	174.35	46.58			
Research anxiety	Female	186	41.16	11.54	-2.027	255	.044
	Male	71	44.39	11.13			

According to the results presented in Table 2, a statistically significant difference was found between the mean attitudes towards statistics scores of the female ($\bar{X} = 188.51$) and the male ($\bar{X} = 174.35$) preservice teachers, in favor of female individuals, [$t_{(255)} = 2.461, p < .05$]. On the other hand, the mean research anxiety scores of the female ($\bar{X} = 41.16$) and the male ($\bar{X} = 44.39$) preservice teachers were found significantly different in favor of male teachers, [$t_{(255)} = -2.027, p < .05$].

The results of the independent samples t-tests that are conducted to examine whether the attitudes of the preservice teachers towards statistics and their research anxiety levels differ across departments are given in Table 3.

Table 3 shows that a statistically significant difference was found between the mean attitudes towards statistics scores of the guidance and psychological counseling ($\bar{X} = 173.21$) and the preschool education ($\bar{X} = 192.72$) students, in favor of the preschool education students, [$t_{(255)} = -3.797, p < .05$]. On the other hand, the mean research anxiety scores of the guidance and psychological counseling ($\bar{X} = 45.15$) and the preschool education ($\bar{X} = 37.70$) students were found significantly different in favor of the guidance and psychological counseling students [$t_{(255)} = -5.3999, p < .05$].

Table 3. *t-test Results Comparing Departments on Attitudes Towards Statistics and Research Anxiety*

Scale	Department	N	\bar{X}	sd	t	df	Sig. Dif.
Attitudes Toward Statistics	Preschool Education	107	173.21	44.31	-3.797	255	.000
	Guidance and Psychological Counseling	150	192.72	37.74			
Research anxiety	Preschool Education	107	37.70	12.85	-5.399	255	.000
	Guidance and Psychological Counseling	150	45.15	9.29			

Pearson correlation coefficient was estimated to determine the relationship between the attitudes of preservice teachers towards statistics and their research anxiety is calculated. The obtained result is presented in Table 4 below.

Table 4. *Correlation Between Attitudes Towards Statistics and Research Anxiety*

		Attitudes Toward Statistics	Research anxiety
Attitudes Toward Statistics	Pearson Correlation		.328
	p		.000
Research anxiety	Pearson Correlation	.328	
	p	.000	

The finding of the relationship between the attitudes of preservice teachers towards statistics and their research anxiety levels are given in Table 4. The result shows that there is a significant positive correlation between the attitudes of the preservice teachers towards statistics and the anxiety about research [$r = .328, n = 257, p < .01$].

4. DISCUSSION

In this study, the relationship between the attitudes of preservice teachers towards statistics and their concerns about research was investigated. The results obtained from the research are explained below.

According to the analyses results that were examining the relationship between the attitudes of preservice teachers towards statistics and their research anxiety across gender, it was concluded that the female preservice teachers had more positive attitudes towards statistics than the male preservice teachers. As the literature is examined, while some research results indicate that the attitudes of female students towards statistics are more positive (Mahmud & Zainol, 2008), some other studies prove that male students' attitudes towards statistics are more positive (Baloğlu, 2003; Tempelaar & Nijhuis, 2007; Zeidner, 1991). More interestingly, some researchers claim no difference across gender in terms of the students' statistical attitudes (Cherian & Glencross, 1997; Martins, Nascimento, & Estrada, 2011; Mji, 2009; Tomazic & Katz, 1988). It can be argued that the variability in these research results can be caused by sample differences. In terms of research anxieties, male preservice teachers were found to have less research anxiety than female preservice teachers, yet there are earlier studies that contradict this finding (Aslan & Karagül, 2016; Büyüköztürk, 1999; Çokluk-Bökeoğlu & Yılmaz, 2005; Saracaloğlu, Varol & Evin-Ercan, 2005; Saracaloğlu, 2008; Trimarco, 1997; Yılmaz & Çokluk, 2010).

The analysis examining the differentiation of both the attitudes of preservice teachers towards statistics and their research anxiety levels across the department variable showed a significant difference for both variables in favor of the guidance and psychological counseling students. In other words, the preservice teachers from the guidance and psychological counseling program showed more positive attitudes towards statistics and were less anxious about doing research compare to those from the preschool education program. This difference might be due to the fact that the major of guidance and psychological counseling is more concentrated on psychology and research, and the students of this program are required to take related courses more intensely. Also, as a result of the requirements of the national university entrance exam, the students who become qualified for admission to the Guidance and Psychological Counseling programs most likely to have positive attitudes towards mathematics, which might be a cause of difference as well. This interpretation is supported by literature which provides evidence of the relationship between attitudes towards statistics, research anxiety, and mathematical background, (Chiesi & Primi, 2010; Lalonde & Gardner, 1993; Nasser, 2004),

It is proven that there is a significant positive relationship between the attitudes of the preservice teachers towards statistics and their research anxiety. This result can be interpreted as the degree to which the preservice teachers having a positive attitude towards statistics will lead them lower research anxiety levels. This finding is supported by literature (Baloğlu, Kocak & Zelhart, 2007; Khavenson, Orel & Tryakshina, 2012; Rosli, Maat, & Rosli, 2017). Similarly, related studies are suggesting that as the positive attitude toward statistics increases, the anxiety level towards statistics reduces. The results of this study are supported by the results of the existing research, which claims to prove that statistical courses and their course exams cause a high degree of anxiety on the students and consequently students' academic performances decrease (Carmona, Martínez & Sánchez, 2005; Chiesi & Primi, 2010; Macher, Paechter, Papousek, & Ruggeri, 2012; Tremblay, Gardner, & Heipel, 2000). In addition, some research results have proven that the students' statistical attitudes and anxiety levels are also related to their mathematical background (Chiesi & Primi, 2010; Lalonde & Gardner, 1993; Nasser, 2004). Sesé, Jiménez, Montaña and Palmer (2015) stated that the students' statistical performances were affected by their math background and statics related anxiety. Zhang et al. (2012) also stated that the attitudes of the students towards statistics could be influenced by age, statistical knowledge, research experience, and mathematical background. The findings of Onwuegbuzie (2000) that claims that roughly 75-80% of the graduate students are concerned about statistics also reveal the importance of graduating from college with a positive attitude towards statistics.

Based on the results of this study, future comparative research is suggested on the statistical attitudes of the preservice teachers and the reasons of the research anxiety differentiations across gender and department variables. In addition, the variables that might influence the attitude towards the statistic should be identified, and the tendencies of the students regarding these variables can be examined.

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