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The Effect of Stereotype Threat on Academic Success of Female Students

Ersin YAĞAN¹, Süleyman AVCI²

¹ Ministry of National Education, İstanbul, Türkiye  0000-0003-3957-2762

² Faculty of Education, Marmara University, İstanbul, Türkiye  0000-0003-3185-3914

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ABSTRACT

Stereotype threat occurs when educational institutions remind us of the stereotype that men are more successful in mathematics and that women's mathematics achievement is negatively affected. In this study, the effect of stereotype threat on the academic achievement of high school students was examined. In the designed experimental study, there are two experimental groups (threat 1 and 2) and a control group. The effects of two different stereotype threats were compared in the experimental groups. After the explanations to reveal stereotype threat in the experimental groups, a mathematics test was used and the "State Anxiety and Stereotype Awareness Scale" was administered at the end of the test. In this study conducted in the 10th grade of high school, data was also obtained from male students. According to the data, while there was no significant difference in terms of academic success between the study groups consisting of female students, it was seen that the academic success of the threat 1 group was higher among males. In terms of academic achievement, threat 1 group shows the greatest inequality between genders. It was observed that the state anxiety levels of female students in the experimental groups increased. According to the findings, in addition to a positive and low-level significant relationship between anxiety and academic success in female students, there is also a mediating relationship between anxiety and stereotype threat and academic success. There is no difference between male student groups. Awareness of stereotypes was low in both genders, and it was concluded that boys' awareness was higher than girls.

Keywords:

Stereotype, stereotype threat, academic success

1. Introduction

All over the world, including Turkey, male and female students achieve equal or higher success in all subjects except mathematics as a result of the fight against gender discrimination in education, the presence of women in all professions, and the fact that families provide equal opportunities without discriminating between their children. Although girls score higher than boys in international PISA and TIMSS exams in areas such as science and reading, the reasons for the results showing that they lag behind in mathematics have been the subject of scientific studies in sociology, psychology, and education for many years. Organized by the OECD since the late 1990s, PISA is an international test administered to students aged 15 years in countries of different cultures. Within the scope of the exam, students, teachers, and school administrators are given proficiency tests in reading, mathematics, and science, as well as questionnaires (Schleicher, 2019). According to the results of the 2018 PISA exam, while girls scored higher in reading (30 points) and science (2 points) than boys, they got lower (5 points) in mathematics. Although these results differ according to countries, a very similar result to the OECD average was observed in Turkey (OECD, 2019). Similar results were observed in terms of gender differences in PISA exams held in 2015 (Bijou & Liouaeddine, 2018) and 2012 (OECD, 2014).

¹ Corresponding author's address: Ministry of National Education, İstanbul /Türkiye

e-mail: ersinyagan@gmail.com

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Another international exam, TIMSS, provides applications for the 4th and 8th grades in mathematics and science. Boys scored higher than girls in terms of math achievement and math self-concept on this exam (Meja-Rodriguez et al., 2021). Males' higher success in mathematics has decreased compared to previous years but still exists, albeit slightly (Schleicher, 2019). In general, it can be said that the gap between girls and boys has narrowed to a large extent over the years (Else-Quest et al., 2010). Various reasons have been put forward in the research on the causes of this difference, which still exists. The first of these is that boys are more interested in professions within the scope of STEM (Science, Technology, Engineering, and Mathematics) that require higher mathematics knowledge than girls. The male-dominated reality in these professions and the fact that accessing and studying in these departments requires higher mathematics knowledge may lead to an increase in the interest of boys (boys) in mathematics from an early age (Charlesworth, & Banaji, 2019; Meja-Rodriguez et al., 2021). The fact that there is a gender disparity in mathematics success, particularly at high levels (high achievement), is assumed to be linked to girls' interest in STEM fields. The fact that the gap between girls and boys has been narrowing since the standardized tests were introduced (Lindberg et al., 2010), is also evidence that low achievement in girls does not have a biological source (Charlesworth & Banaji, 2019). Although there is almost no difference in mathematics success between boys and girls, the fact that boys are inclined towards STEM fields shows that the gender difference in this field and the stereotypes that these fields are for boys continue. Despite similar success in school exams, boys' higher self-concept (Goldman, & Penner, 2016; Lindberg et al., 2013; Parker et al., 2018), indicates the existence of stereotypes (Arens et al., 2017).

There is also a relationship between the perception of mathematical self-efficacy and career choices in the STEM field (Goldman & Penner, 2016). Stereotypes are common in daily life and shape the decisions of individuals. The problem with stereotypes in education is that they can affect students' academic success and career decisions. It is also possible that mathematics teachers and parents of students who have the stereotype that STEM fields are male-dominated professions may push male students more in mathematics, causing their success to be higher than female students (Charlesworth & Banaji, 2019). Another reason for the emergence of gender differences in mathematics achievement is the stereotype threat. Acting out or triggering the stereotype threat for any reason prior to the test may result in the girls' test results being lower. For the stereotype threat to emerge, it is only to state that gender differences will be examined in the relevant exam (Johns et al., 2005; Spencer et al., 1999). In order for the stereotype threat to take action and reduce success, the individual must have stereotypes about the relevant field (Spencer et al., 2016). The source of academic studies on the effect of stereotype threat on mathematics achievement in the field of gender is mostly western countries, and there is no study conducted in Turkey. Although there are no great differences in Turkey, the fact that men score higher in mathematics in PISA, TIMMS, and central national exams reveals the need to determine the source of the current situation. The goal of this study is to see how stereotype threats against female pupils affect math achievement in Turkish society. In addition, it was also aimed to determine the mediation effect of gender stereotypes and state anxiety levels on mathematics achievement and the mediation effect of these perceptions between stereotype threat and academic success.

1.1. Stereotype Threat

People use the schemas they have created based on their previous experiences to interpret the outside world. Schemas, which can also be called stereotypes, are the first thoughts that come to mind when the individual's own social group and other groups and generalizations are considered (Stangor, 2016). After discovering a few qualities about a new acquaintance, such as his hometown, occupation, degree of education, and religious beliefs, it is presumed that they share all of the group's characteristics by being included in the group. These stereotypes in the individual's mind allow him to learn about the world in a short amount of time and save him the bother of having to learn about each and every person he meets from the ground up. Although stereotypes are a natural aspect of life, putting them into practice can lead to inaccuracies in conduct and thought, as well as injustice. Stereotypes that are inaccurate and harmful might lead to social problems (Aronson et al., 2012). Stereotype threat is a negative effect of stereotypes in which an individual's fear of being treated unjustly, unfairly, or having a bad performance as a result of negative stereotypes about the group to which he belongs has a harmful effect on his performance (Aronson & Steele, 2005; Steele et al., 2002). It has been shown that the person who perceives the stereotypical threat performs below his or her current level of ability. To experience the stereotype threat, the individual must be aware of stereotypes that belong to his own group, believe that he would perform worse as a result of this feature, or sense this in the messages he receives

from others. As a result of the cognitive load caused by the allocation of cognitive capacity needed in activities such as solving a math test to negative emotions, the pressure put by the stereotype threat on the individual causes him/her to make more mistakes and not show his full ability (Rydell et al., 2009; Schmader, & Johns, 2003). Although research on stereotype threat has mostly been done to explain poor performance in the academic field (Spencer et al., 2016), research has also been conducted in the areas of memory (Barber, & Mather, 2014), employee performance (von Hippel et al., 2015), sports (Heidrich, & Chiviawsky, 2015), driving (Yeung & von Hippel, 2008), and financial decision (Carr & Steele, 2010) in older individuals. Gender, ethnicity, minority, immigration, and socioeconomic status are all issues of academic study (Appel & Kronberger, 2012; Pennington et al., 2016). When the stereotype that men are better at mathematics is emphasized before an exam, the stereotype threat that develops when girls and boys compete in the subject of mathematics causes women's academic performance to worsen (Spencer et al., 2016).

1.2. Gender Differences in Mathematics Achievement in Turkey

National exams are used in Turkey for entrance to higher education and recruitment to state institutions. In exams for the transition from secondary school to high school (LGS), associate degree and undergraduate education (YKS), postgraduate education admission (ALES), and entry into the civil service (KPSS), students are also asked questions in the field of mathematics. Turkey also takes part in all PISA and TIMSS examination applications. Girls have a higher average in 2019 and 2020 than boys in 2021, according to the answers to math questions. Girls outperformed boys in all other subject areas on these exams (science, social studies, language, and religion) (Ministry of National Education [MoNE], 2020). The results are given under the title "quantitative" (mathematics, physics, and chemistry) in the YKS exams, not just data on the mathematics test results. In the YKS exam, the number of boys doubles that of girls, especially in the upper achievement group, and there is no difference in the lower achievement groups (OSYM, 2020). In the ALES and KPSS exams, the number of males in the high achievement group is much higher than the number of women (OSYM, 2018). As can be observed, there is a disparity in favor of men in terms of mathematics achievement between men and women in high-achieving groups, especially among adults. National exam differences are similar to PISA and TIMSS exam results (Meja-Rodriguez, Luyten, & Meelissen, 2021; OECD, 2019).

1.3. The Impact of Stereotype Threat on Academic Success

The use of experimental studies to determine the harmful impact of stereotype threat on academic success is common. In meta-analysis studies conducted on different dates, it was concluded that the threat of stereotypes affects academic success. Walton and Spencer (2009) found that under the stereotype threat, women scored far below their potential in a meta-analysis study based on the results of 39 experimental studies. In the second phase of the same study, the participants were able to reveal their full potential as a result of the treatments to minimize the stereotype threat. In a meta-analysis of 47 studies, Flore and Wicherts (2015) found that stereotype threat lowers girls' academic success. Shewach et al. (2019) found that stereotype threat has a negative influence on test results in their meta-analysis study, which included 59 studies with adult samples.

1.4. Mediation Effect of Anxiety in Stereotype Threat (State anxiety)

Anxiety is one of the factors that is commonly highlighted in studies on the effects of stereotype threat on academic success. The findings of the study showed that anxiety plays a mediating role in the link between stereotype threat and academic success. In the link between the two variables, the academic performance of more anxious individuals tends to be weaker (Flore & Wicherts, 2015). In their experimental study, Mrazek et al. (2011) found that anxiety and stereotype threat have a mediating effect on women's mathematics achievement. Increased anxiety levels in women were found to play a mediation effect in diminishing mathematics achievement in a different experimental study conducted by Gerstenberg et al., (2012). There are numerous researches that back up these claims (Ben-zeev et al., 2005; Delgado, & Prieto, 2008; Osborne, 2007). Furthermore, numerous studies have concluded that anxiety has no mediating effect (Chung et al., 2010; Pennington et al., 2016; Spencer & Steele, 1994).

1.5. Evaluating the Stereotype Threat

In studies on stereotype threat, experimental research methods are frequently used. Academic success was evaluated with multiple-choice or open-ended questions in experimental studies with a control group after a stimulus was presented to indicate the stereotype threat. Applications such as saying that the

difference between boys and girls is evaluated through written text and verbally (Keller & Dauenheimer, 2003) and that the test shows gender differences (O'Brien, & Crandall, 2003) are used as interventions before the test. Self-reported scales are another way of determining the degree of stereotype threat that an individual perceives towards his or her group (Owens & Massey, 2011; Pseekos et al., 2008). The scales were primarily designed to evaluate the explicit stereotype, but there are also scales that evaluate the implicit stereotype (Galdi et al., 2014; Kiefer, & Sekaquaptewa, 2007). Answers to the following hypotheses were sought in line with the study's goal:

- The stereotype threat has a negative impact on girls' math performance.
- The relationship between stereotype threat and academic success is mediated by state anxiety.

2. Method

2.1. Research Model

Within the framework of the quasi-experimental model, an experimental design with a post-test matched control group was used in this study. A 3x2 design was applied in this research, which included gender (female-male) and test application types (experiment 1, experiment 2, control). The experimental design model used by Keller and Dauenheimer (2003) and O'Brien and Crandall (2003) was used in the design of the study. While research uses only one way to reveal stereotypical threat, in this study, the effects of two different types of threats were compared. In addition, no manipulation technique was used in the control group.

2.2. Participants

The study involved 209 students in the 10th grade from two different high schools (Anatolian High School). One class from one school and two classes from the other were included in the study for each of the three test application types. Despite the fact that each class had 30 pupils, data was not obtained from those who did not volunteer to participate in the study. As a result, there are variations in the number of groupings (Table 1). Females account for 57.4 percent of students, while males account for 42.6 percent, with an average age of 14.3 percent. The number of female students is slightly higher than the number of male students since the schools where the research was done accept students based on their secondary school graduation grades. The average mathematics course grade averages of the three groups in the study did not differ ($F=833, p=437$). Power analysis (G Power 3.1 software was used) was used to determine the sample size. For the analysis, the effect size was taken as large (.40) in line with the Cohen (2013) criteria. In order to calculate the main effect and interaction effect between the three groups in terms of variables, the required sample size is $N=100$ at the effect value determined for a statistical power of .95 level at $\alpha=0.05$. The number of samples reached within the scope of the study is well above the needed. Experimental studies on stereotype threat can also be done only on female students. In this study, both female and male students were included in the study, and even the number of female students ($N=120$) is above the minimum number.

The two schools included in this study were taken from Pendik and Küçükçekmece districts in Istanbul, where families live in middle socio-economic and cultural terms. Istanbul mostly consists of individuals coming from all regions of Turkey through internal migration. For this reason, those living in Istanbul are cosmopolitan in terms of ethnicity and belief. Since it is not right to ask questions about the ethnic origin and beliefs of the participants in the scientific studies conducted in Turkey, no questions were asked in this study, and it was assumed that the distribution reflects Turkey. Students are also above average in terms of academic achievement. At the end of secondary school in Turkey, the high school entrance exam (HSEE [LGS]) is applied to students who want to attend. The most successful students prefer science high schools and Anatolian high schools. In Istanbul, these students constitute 10 percent of the whole (MoNE, 2021). Students who do not take the LGS exam and cannot score enough points despite taking the exam, prefer the Anatolian high schools closest to their residence according to their secondary school diploma grades. Students who cannot be placed in academic high schools are placed in vocational high schools at different levels according to their success. The two schools included in this study continue to Anatolian high schools preferred by students with a diploma grade above 90 out of 100. The participants of this study consist of students who plan to study at university and are among the top 10-20% in terms of academic success (MoNE, 2021).

2.3. Application Procedure

During regular teaching hours and in the students' own classrooms, the measurement tools were used. Two questionnaires were designed with the sequence of the questions changed to prevent pupils from cheating on each other. The assignment of classes to the experimental or control groups was selected by drawing lots in the two schools where the application was placed. The number of branches in the 10th grade is eight at both schools. Four of these classes were assigned to the experimental group and two to the control group in the classroom. Male mathematics teachers at both schools gave their support. Before the application, all groups were informed that an experimental study was carried out. After that, the teacher stated to the first experimental group that the aim of the scientific study was to see if there was a difference in math achievement between girls and boys in order to reveal the stereotype threat. Men had previously scored higher on the applied test in the second experimental group, according to the findings. In the control group, no explanation was given. The test was given to the students with a time limit of 20 minutes. This time is determined by considering the amount of time students will need to answer each question. The Gender Stereotype Scale, Personal Information Form, and Mathematics Self-Assessment Scale were given to the students after the exam session ended.

2.4. Measures

The mathematics test, the state anxiety assessment, and stereotype awareness were used to collect data within the scope of the study. Additionally, students were asked about their age, gender, and mathematics achievements from the previous semester.

Mathematics Test: To assess students' mathematics skills, 15 multiple-choice questions were prepared. Mathematics teachers with more than 20 years of experience assisted in the preparation and selection of the questions. The questions were based on the topic of "functions," which the students had studied prior to the application. Five of the questions were chosen from past years' TYT exam questions, while the other ten were made by the teachers. The average difficulty level of the questions is 0.36, and the level of discrimination is 0.44, according to the application's findings. The difficulty levels of the questions are compatible with the students' grade point averages in mathematics classes ($M=55$). The effect of stereotype threat can be shown best in difficult assessments, according to Spencer et al. (1999). The questions in this study have difficulty levels that can be classified as "challenging."

State Anxiety Scale: The State Anxiety Inventory, established by Spielberger et al. (1971) and adapted into Turkish by Öner and LeCompte (1985), was used in this study. The inventory contains 20 items that express the participants' feelings at the time. On a 4-point Likert-type scale, participants described their feelings as none (1), a little (2), a lot (3), and completely (4). The state anxiety level is obtained by subtracting the sum of negative emotion items (1, 2, 5, 8, 10, 11, 15, 16, 19, and 20.) from the sum of positive emotion items (3, 4, 6, 7, 9, 12, 13, 14, 17 and 18.). To recover from a negative value, 50 points are added to the final result. An increase in the score indicates that anxiety levels are rising (Öner & LeCompte, 1985).

Stereotype Awareness: The scale developed by Pseekos et al. (2008) and adapted into Turkish by Saltürk and Güngör was used to assess students' stereotype awareness (2020). The Stereotype (27 items), The Mathematics (16 items), and The Equality (3 items) sub-dimensions make up the scale. In this study, just The Stereotype sub-dimension was used. The sub-dimension evaluates women's exposure to and acceptance of mathematics performance stereotypes. On a Likert scale, participants indicate their replies as never (1), rarely (2), usually (3), generally (4), and almost always (5). In the Turkish adaptation study of the scale, the Cronbach alpha internal reliability coefficients for the Stereotype, Mathematics, and Equality sub-dimensions were .97, .94, and .81, respectively.

2.5. Data Collection and Analysis

In the study, the Helsinki Declaration on the protection of the participants was acted upon. Students voluntarily participated in the research. In March 2022, the study was conducted face to face using printed papers. A 2x3 (gender: Male-Female), (Stereotype threat: group1, group1, control) two-way ANOVA test was conducted to investigate the influence of stereotype threat on academic success. Simple linear regression analysis was applied only to female participants in the experimental groups to examine the effect of state anxiety and stereotype awareness on academic success. The differences between study groups were

determined using a one-way ANOVA, while the differences between gender groups were determined using a *t* test for independent groups.

2.6. Ethics

In this study, all rules were complied with within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive". In this study, all rules were complied with within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive".

3. Findings

Findings Related to Test Performance

The average values of the 2x3 Two-Way ANOVA test for the groups are shown in Table 1 in order to determine the main effects of the group and gender factors on test success as well as the interaction impact of the two variables.

Table 1. *The Distribution of The Number of Correct Answers by Groups*

			Group		
			Threat 1	Threat 2	No Threat
Gender	Female	M (Sd)	4,8 (2,3)	4,3 (2,2)	5,1 (1,8)
		N	40	39	41
	Male	M (Sd)	6,8 (2,5)	4,7 (2,5)	4,4 (2,4)
		N	22	39	28

Table 2. *Two Way ANOVA Results*

Source	Type III Sum of Squares	f	Mean Square	F	Sig.	η_p^2
Group	54,532	2	27,266	5,367	,005	,050
Gender	15,954	1	15,954	3,141	,078	,015
Group * Gender	56,137	2	28,068	5,525	,005	,052
Error	1031,230	203	5,080			

As a result of the study, the interaction effect between the group and gender variables was found to be significant ($F=5,080$, $p=.005$, $\eta_p^2=.052$; $F=5,080$, $p=.005$, $\eta_p^2=.052$). There is a difference between the threat 1, threat 2, and no threat groups ($F=5,367$, $p=.005$), according to the results of the group main effect test (Table 2). Despite the fact that female students in the no threat group answered more questions correctly than in the threat 1 and threat 2 groups, the difference was not statistically significant ($F_{(2\ 117)}=1,338$, $p=.266$). Male students have a higher number of correct answers in the threat 1 group than the other two groups ($F_{(2\ 86)}=6,675$, $p=.002$). Female students had more correct answers than males in the no-threat group, but the difference is not significant ($t=-,784$, $p=.436$). Male students have a larger percentage of correct answers in threat 2 groups than female students. While the difference in the threat 1 group ($t=-3,176$, $p=.002$) is statistically significant, it is not in the threat 2 group ($t=1,321$, $p=.193$).

Findings Regarding Mediator Variables

The research included state anxiety and stereotype awareness as mediator variables in this study. A basic linear regression analysis was applied just to the data of the female students in the threat group.

Table 3. *Result of Simple Linear Regression Analysis*

	R	R ²	F	p	B	t	p
Anxiety	.235	,055	4.032	,049	0,57	2,008	,049

The Pearson correlation analysis revealed a positive and significant relationship between state anxiety and mathematics achievement without including the no threat group ($r=.232$, $p=.015$) and including it ($r=.232$, $p=.015$). According to the results of simple linear regression analysis, state anxiety is a significant determinant of mathematics achievement in female students ($F_{(1\ 69)}=4.032$, $p=.049$, $p_2=.053$). Approximately 6% of the total variance in academic success is predicted by state anxiety (Table 3). No further regression analysis was conducted because there was no significant link between stereotype awareness and mathematics achievement ($r=.146$, $p=.200$).

Findings on Gender Differences in Mediator Variables

Table 4. Levels of State Anxiety and Stereotype Awareness by Groups

Scales	Groups		Grup		
			Threat:1	Threat:2	No Threat
State Anxiety	Female	M (Sd)	53,5 (7,8)	51,5 (10,6)	47,5 (11,3)
		N	36	35	38
	Male	M (Sd)	56,2 (9,6)	54,6 (10,8)	53,3 (11,1)
		N	21	39	27
Stereotype Awareness	Female	M (Sd)	1.45 (.56)	1.56 (.61)	1.49 (.55)
		N	40	39	40
	Male	M (Sd)	2,27 (.71)	2,17 (1.05)	2,37 (.99)
		N	22	39	26

The interaction impact between the group and gender variables was not significant ($F=1,116$, $p=.330$), according to the results of the anxiety variable analysis. Furthermore, whereas the main effect result for gender was significant ($F_{(1\ 195)}=9,425$, $p=.002$, $\eta_p^2=.047$), the main effect result for the group was not ($F_{(2\ 1924)}=1,548$, $p=.215$). Female students in the threat 1 ($M=53,5$) and threat 2 ($M=51,5$) groups have higher state anxiety than those in the no threat ($M=47,5$) group. The difference in mean values across groups ($F_{(210)}=3,301$, $p=.041$, $\eta_p^2=.059$) is statistically significant. The no threat group's mean was dramatically higher than the threat group's ($p<0.05$) according to the findings of the Bonferroni test used to determine the difference between the groups. There was no difference between the groups in terms of state anxiety among male students ($F_{(2,84)}=.146$, $p=.864$). While there was no difference in state anxiety between girls and boys in the threat 1 ($t=-1,306$, $p=.197$) and threat 2 ($t=-1,252$, $p=.214$) groups, there was no difference in the treat ($t=-2,752$, $p=.008$) groups, and boys' anxiety was higher.

In comparison to the averages, stereotypical awareness of girls' mathematics achievement remains low in both girls and boys (Table 4). The interaction effect between the group and gender variables was not significant ($F=.645$, $p=.526$), according to the analysis for the stereotype awareness variable. Furthermore, whereas the main effect result for gender was significant ($F_{(1\ 205)}=50,672$, $p=.000$, $\eta_p^2=.202$), the main effect result for the group was not significant ($F_{(2\ 204)}=.151$, $p=.860$). Both girls ($F_{(2\ 116)}=.416$, $p=.661$) and boys ($F_{(2\ 84)}=.332$, $p=.718$) had F. There is no significant difference between threat 1, threat 2, and no threat groups in terms of stereotype awareness. Boys have higher stereotypical awareness than girls in the threat 1 ($t=-5,275$, $p=.000$), threat 2 ($t=-3,121$, $p=.003$), and no treat ($t=-4,112$, $p=.000$) groups.

4. Discussion

The effect of stereotype threat on female students' academic success was assessed in two ways in this study: by comparing female students' correct answers in different groups and by comparing male and female students' correct answers. Although female students in the threat 1 and threat 1 groups performed worse than male students in the control group, the difference was not statistically significant. The threat group's success rate was shown to be much greater than the other groups of male students. Male students in the threat groups have greater scores than female students, whereas female students in the control group have better scores. Only the difference in the threat 1 group is statistically significant among these variables. The stereotype threat disclosed by stating that the scores of girls and boys would be compared motivates boys to be successful, according to these findings. Because of the possibility of stereotyping, girls' partially lower achievements have resulted in a widening of the gender achievement gap. The explanation that the girls had previously failed the test had a more negative impact on the girls in the threat 2 group but did not impress the boys as much as the threat 1 explanation. According to the findings, the stereotype threats toward female students in mathematics courses diminish female students' success while also motivating male students to be more successful, leading to a widening of the gender gap. The observed differences between the groups illustrate the effect of the stereotype threat. According to studies on the subject, female students who sense stereotype threat have lower math achievement. Students' stereotype awareness must be high in order for stereotype threat to decrease success (Rydell et al., 2009; Schmader & Johns, 2003). The impact of stereotype threat on academic success may have been limited in this study because female students' awareness of stereotypes was so low. The findings of this study show that the type of manipulation that reveals the stereotype threat may have different effects on

academic achievement. This result shows that the effect of stereotype threat on academic achievement may belong to the type of stimulus. In their meta-analysis study, Flore and Wicherts (2015) exemplified the use of different types of manipulation for the experimental and control groups in the studies and suggested comparing the effects of these stimulus types on the outcome. Experimental studies have preferred the technique of revealing one type of stereotype threat in different ways. O'Brien and Crandall, (2003), Spencer et al. (1999) and Keller and Dauenheimer (2003), emphasized that the test applied for manipulation reveals gender differences. Cimpian et al. (2012) stated that men are better in the applied game. In the study of Stricker and Ward (2004), participants marked their gender on the test. Although many different types of manipulation are used in studies, when comparing the results, these differences are not emphasized and the focus is on the results of whether stereotype threat has an impact on academic achievement or not. The results of this research revealed that the effects must be classified according to the types of manipulation.

The state anxiety assessment, which was conducted after the math test, revealed that stereotype threat increased state anxiety in female students. While the girls in the no threat group had a low degree of anxiety, the threat groups had a higher level of it. The statement that a gender comparison would be made, in particular, had a greater impact on anxiety. Anxiety levels in male students are similar in all three groups. Male students in the threat 1 group enhanced their success by being driven to compete with females, according to this finding, and this condition did not increase their anxiety. This finding demonstrates that the stereotype threat raises girls' anxiety levels. Duchesne and Ratelle (2016) point out that in competitive environments, girls' anxiety levels rise while guys' anxiety levels remain constant. Despite the fact that girls' state anxiety increased when they were threatened by stereotypes, academic success and state anxiety were found to have a beneficial association. The influence of state anxiety on academic success was significant, but at a low level, contrary to expectations (Flore & Wicherts, 2015). The research that looked into the role of anxiety in mediating the relationship between stereotype threat and academic success found that it either has no effect (Chung et al., 2010; Pennington et al., 2016; Spencer & Steele, 1994) or has a negative effect. (Ben-zeev et al., 2005; Delgado & Prieto, 2008; Flore & Wicherts, 2015; Mrazek et al., 2011; Osborne, 2007). While the results of this study are consistent with the findings that anxiety has a mediating effect, the direction of the effect is inconsistent. Studies on the relationship between anxiety and academic success show that the two variables have a low and positive relationship (Zile et al., 2021). Female students may have gotten similar results to the experimental and control groups due to the effect of anxiety levels on boosting academic success in the study.

Stereotype awareness is another aspect investigated as part of the research. The data suggest that there is no difference in stereotype awareness between groups. Simultaneously, there is no link between stereotype awareness and academic success. These data suggest that stereotype awareness does not play a role in mediating the relationship between stereotype threat and academic success. The students that took part in the study had a very low level of awareness of stereotypes. This could indicate that in Turkish society, the perception of girls failing in mathematics is low. Girls have a far lower perception of this than boys. This outcome could be due to either females' desire to protect their gender or boys' desire to dominate girls. There is no difference in mathematics between boys and females in the LGS exam taken after secondary school in Turkey (MoNE, 2020). Only in the upper achievement groups does there appear to be an increase in favor of males in university entrance examinations (OSYM, 2020) and postgraduate education entrance exams (OSYM, 2018). The low level of stereotype awareness may be due to a lack of equality in mathematics achievement on national exams and public awareness of these results. This research shows the feature of being the first study on the effect of stereotype threat on academic achievement in Turkey. The findings show that the stereotype threat in Turkish society has little effect on the academic achievement of female students. It shows that while girls are more successful in all academic fields, one of the reasons why the results are equal in some tests and partially behind boys in some tests may be stereotypes and the threat of stereotypes. The findings reached within the scope of this study were obtained from students who attend the 10th grade of academic high school, who plan to continue their education at the university level, who have above average academic success, and who are at middle socio-economic level. Therefore, the findings are representative of students at similar levels.

5. Conclusion

As a result, the findings of this study revealed that the stereotype threats in mathematics had no influence on girls' academic success. The stereotype threat, on the other hand, has increased men's success, resulting in the formation of gender differences. The partial decrease in girls' success in the experimental groups was due to

the gender disparity, even though there was no significant difference. In the threat 1 group, revealing the stereotype threat by stating that the exam scores of the two genders would be compared was beneficial in enhancing male students' success. The fact that boys were more successful in past test applications drove female students to get lower grades in the threat 2 group but did not impress male students as much as in threat 1. The fact that female students in the experimental groups had more state anxiety than those in the control group indicates that stereotype threat enhances state anxiety. Academic success and state anxiety have a modest level of positive and significant relationship among female students. In female students, anxiety has a minor mediating effect on the link between stereotypes and academic success. Anxiety appears to boost academic success, as expected, according to the findings of stereotype threat research. The study participants' awareness of the stereotype that boys are more successful in mathematics is quite low, and the average of female students is lower than that of male students. This study focused on 10th-grade students who were enrolled in academic high schools and were placed based on their secondary school graduation grades. As a result, the findings belong to this group of students who succeed academically. Similar studies with different groups of students with high and low academic success should be repeated.

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