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A CURRENT STUDY ON GRADE/AGE AND GENDER-RELATED CHANGE IN MATH ANXIETY

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Abstract:
The purpose of this study is to reveal how math anxiety changes according to grade/age and gender. The study was carried out with a total of 1247 individuals consisting of 10 different grades from 3rd-grade to 12th-grade students studying in schools selected from different socio-economic environments in a province of Turkey. The Math Anxiety Scale (MAS) was used as a data collection tool. Evidence was found that math anxiety is significantly higher in female students than male students. It was also determined that math anxiety was classified in ascending order for the 5th, 3rd, 6th, 4th, 8th, 11th, 12th, 7th, 9th, 10th graders, respectively. Another result is that participants' math anxiety averages were less in comparison with the previous research results. Based on this important result, it can be said that math anxiety is decreasing over the years as a result of the constructivist education.

Keywords: math anxiety, grade/age, gender, 3rd- through 12th-grade students

1. Introduction

Researches in the field of mathematics education continue to investigate factors which are essential for learning mathematics and developing mathematical thinking. In addition to such studies, the fact that studies investigating the obstacles in mathematics education have been conducted is an important contribution to this field. Especially if these obstacles are composed of emotional factors, then learning math can further get difficult. One of these that arise while learning mathematics is *math anxiety*. Math anxiety was firstly defined by Dreger and Aiken (1957) as "*the presence of a syndrome of*

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emotional reactions to arithmetic and mathematics" (cited in Baloğlu & Koçak, 2006, p. 1326). In another study, math anxiety is defined as "*an illogical feeling of panic, embarrassment, flurry, avoidance, failing and fear, which are physically visible, and which prevent solution, learning and success about mathematics*" (Bekdemir, 2010, p. 312).

White (1997) has stated that math anxiety is learned later and math fear is not an innate situation. Indeed, even younger children who have not formally started to learn mathematics may experience math anxiety based on what they hear or observe from their social environment. Therefore, many students feel anxious by seeing mathematics as a difficult course that cannot be achieved, and they develop negative attitudes towards mathematics. Such negative attitudes or anxieties are usually a result of the prejudices towards learning mathematics and mathematics itself. While these prejudices exist nowadays, they made their effect be felt on people in the past. For instance, it is said that Napoleon revealed his uneasiness by saying *"My God, I've thought there was a math exam!"* when he was woken up due to the start of enemy attack (Yıldırım, 2011, p. 150). Is not Napoleon's feeling the fear of the vast majority of children who are learning mathematics or who will learn mathematics, is it?

What are the reasons for math anxiety? Many reasons are pointed out in the literature. For instance, teaching methods are stated to be one of the main reasons for math anxiety (Baloğlu, 2001; Birgin, Baloğlu, Çatlıoğlu, & Gürbüz, 2010; Fitzgerald, 1997; Şengül & Dereli, 2010; Williams, 1988). It can be said that the use of approaches aiming to establish authority and monotone learning instead of student-centered approaches that endear mathematics and provide enjoyable learning stirs up the math anxiety. The fact that characterization of students as successful or clever is mostly associated with the math class, the fact that mathematics has increasingly taken the form of an appearance which is separated and abstracted from everyday life are other reasons in the formation of such negative attitudes towards mathematics (Uğurel & Moralı, 2006). Baloğlu (2001) reported another reason, explaining the fact that mathematics includes complex formulas and terms by its nature is one of the factors that increase math anxiety.

The effects of mathematics teachers on students have been suggested to be one of the reasons for math anxiety (Lazarus, 1974). It was stated that mathematics teachers could transfer the math anxiety they had to students through conscious or unconscious ways (Baydar & Bulut, 2002). Some other researchers determined that previous mathematics teachers had an effect on individuals with math anxiety (Frank, 1990; Mutodi & Ngirande, 2014; Perry, 2004). It was emphasized that an authoritarian or oppressive teaching method adopted by mathematics teachers (Bekdemir, 2010; Fitzgerald, 1997) and negative teacher attitudes (Bekdemir, 2010; Erickson, 1993; Shodahl & Diers, 1984) are other reasons related to teachers. Based on these teacher-

induced reasons, first of all, primary teachers and then middle school mathematics teachers who are jointly responsible for the mathematics education at the elementary and middle levels have important duties and responsibilities to endear mathematics and to avoid the formation of math anxiety (Doruk & Kaplan, 2013). In addition to these reasons, it can be said that social oppressive state of mind in individuals caused by the inability to succeed in mathematics is effective in the formation of math anxiety, that is, mathematics is given a different value by the society in the form of "*Parents desire their children to get higher marks in mathematics. More time is allocated for mathematics in schools. Knowing mathematics is regarded as superiority. Most of the intelligence tests, general ability, and job examinations consist of special tests that measure the mathematical reasoning*" (Gür, 2011, p. 9).

Excessive anxiety negatively affect students' mathematics performance and attitudes towards mathematics in the long-term (Baloğlu, 2001). Students with math anxiety cannot obtain adequate knowledge of mathematics and perform short-term learning by memorizing the knowledge without comprehending, assimilating and understanding. This judgement is also supported by the studies conducted on math anxiety, for example, a major meta-analysis by Hembree (1990) found that math anxiety is related to poor performance on mathematics. Many studies' (Andrews & Brown, 2015; Arıkan, 2004; Ashcraft & Faust, 1994; Ashcraft & Krause, 2007; Betz, 1978; Birgin et al., 2010; Clute, 1984; Ho et al., 2000; Jansen et al., 2013; Ma, 1999; Ramirez, Gunderson, Levine, & Beilock, 2013; Wahid, Yusof, & Razak, 2014; Zakaria & Nordin, 2008; Zakaria, Zain, Ahmad, & Erlina, 2012) findings have also demonstrated that there is a significant negative relationship between math anxiety and mathematics performance. In the present study, how math anxiety changes according to the variables of grade/age and gender has been examined. Therefore, it is thought that referring findings of some researches that address variables affecting the math anxiety is necessary.

1.1. Literature of the effect of grade/age and gender on math anxiety

Studies related to math anxiety began to be performed at the beginning of the 1970s. It is possible to see that math anxiety was addressed from different perspectives when these studies are analyzed. For example, Betz (1978) demonstrated that math anxiety occurs frequently among college students and that it is more likely to occur among women than among men and among students with inadequate high school math backgrounds. In this study, it was also indicated that higher levels of math anxiety were related to lower mathematics achievement test scores. In a study carried out with 6th- through 12th-grade children by Wigfield and Meece (1988), girls reported stronger negative affective reactions to math than did boys and ninth-grade students reported experiencing the most worry about math and sixth graders the least. The study by

Baya'a (1990) of 9th to 12th graders revealed that females demonstrated a significantly higher level of mathematics anxiety than males, and students of the low Socio-Economic Status (SES) demonstrated a significantly higher level of math anxiety than students of the high SES, showing that math anxiety and gender differences are SES-related.

An increasing trend by grades is supported by the finding of Randolph (1997) who found that eighth-grade students were more anxious than seventh-grade students. Arıkan (2004) focused on middle school students' math anxiety levels and found that math anxiety levels of eight grade students as the highest in comparison with those in lower grades, and there was not a significant difference between the gender and the students' math anxiety. Findings of Baloğlu and Koçak (2006) showed that evaluative situations related to mathematics arouse more anxiety in women than men; however, doing basic mathematical activities such as multiplication or division arouses more anxiety in men compared to women. It was also found that, in total mathematics anxiety scores, the older students scored higher than the younger ones. Yüksel Şahin's (2008) study of 4th and 5th graders revealed that female students reported significantly higher mathematics anxiety than males, and any significant difference in students' math anxiety with respect to their grade level was not obtained.

On the other hand, there were significant differences according to class, perceived ability and perceived success levels. Findings of the study of sixth through eighth graders by Birgin et al. (2010) showed that math anxiety levels increased as grades increased; however, there was not a significant main effect of gender. Another study conducted with secondary school pupils by Devine, Fawcett, Szucs and Dowker (2012) found out that female pupils reported significantly higher mathematics anxiety than males. Findings of the study by Ramirez et al. (2013) carried out with first and second-grade elementary students presented no significant effect of grade on math anxiety. Goetz, Bieg, Lüdtke, Pekrun, and Hall (2013) showed that female students reported higher levels of math anxiety than do male students, however, no gender differences were observed for state anxiety. The study of Mutodi and Ngirande (2014) conducted with first-year students at a tertiary institution demonstrated that there was a significant difference in math anxiety levels of students according to gender, showing that on average female students experienced higher levels of math anxiety than males and age, showing that older students (21 years and above) experienced higher levels of math anxiety than younger students (16-20 years). In another study Primi, Busdraghi, Tomasetto, Morsanyi and Chiesi (2014) determined that high school girls tend to report more anxiety about mathematics than boys.

1.2. Aim and Significance

As it can be understood from the results of the researches referred above, grade/age and gender variables have different effects on math anxiety. The present study has been conducted to fill three gaps in the literature on math anxiety. (1) Math anxiety can be suggested to be affected by grade/age and gender from different aspects in past studies, (2) Studies investigating how math anxiety changes depending on age and gender in a wide range from the 3rd-grade to 12th-grade level were not often encountered in the literature, (3) In comparison with past studies, the effects of grade/age and gender on math anxiety was revealed on more samples (N=1247) and at different education levels (primary, middle, and high school) in this study. This study aims at revealing how math anxiety of students from the 3rd grade to 12th grade changes according to grade/age and gender variables.

2. Methodology

2.1. Research Design

The current study is descriptive. A quantitative design is used to explore students' experience of math anxiety. Indeed, many educational studies are descriptive; that is, they set out to describe and to interpret what is (Cohen, Manion, & Morrison, 2000). A descriptive research design is one in which the major emphasis is on determining the frequency with which something occurs or the extent to which two variables covary (Mutodi & Ngirande, 2014).

2.2. Subjects

The study group (N=1247) was recruited from ten schools (two elementary schools, four middle schools, and four high schools) in a city center located in Southeast Anatolia Region of Turkey. The distribution of participants according to grade and gender is given in Table 1. In Turkey, the educational context is structured into four levels: preschool education (aged 3–6), elementary education (primary, *from first to fourth grade*, aged 6–9, and middle schools, *from fifth to eighth grade*, aged 9–13), which is compulsory, secondary education (lycees or senior high schools, *from ninth to twelfth grade*, aged 14–17), and higher education (universities). Attention was paid to include schools from different socio-economic environments at all levels (primary, middle and high) to prevent the quality of the school from affecting the results of the research. The reason for starting from the 3rd-grade level is the concern that students before this level may not grow mature enough to have reading comprehension and that the absence of performing a detailed mathematics education up to this level would not have too much effect in assessing math anxiety in a meaningful way.

Table 1: The distribution of participants according to Grade and Gender

Grade	Male N (%)	Female N (%)	Total (N)
Third	77 (50%)	78 (50%)	155
Fourth	65 (54%)	55 (46%)	120
Fifth	66 (54%)	57 (46%)	123
Sixth	54 (51%)	51 (49%)	105
Seventh	40 (49%)	42 (51%)	82
Eighth	57 (55%)	46 (45%)	103
Ninth	66 (44%)	83 (56%)	149
Tenth	63 (46%)	75 (54%)	138
Eleventh	60 (47%)	69 (53%)	129
Twelfth	65 (45%)	78 (55%)	143
Total	613 **(49%)**	634 **(51%)**	**1247**

2.3. Instrument

The data were collected via the Math Anxiety Scale (MAS) (Bindak, 2005). This scale included demographic items such as gender and grade/age. The scale includes 10 items which are rated on a 5-point Likert scale (1 to 5), and one item (the ninth) is reversed before scoring. Item scores are added for the total scale score, which can range from 10 to 50, higher score means indicating higher levels of math anxiety. Bindak (2005) tested the reliability and validity of this scale by applying it to 117 seventh-grade students. However, the Cronbach's alpha coefficient was determined for each grade level to test the usability of the scale since students at different grade levels were included in the present study. Accordingly, the calculated Cronbach's alpha coefficient values show that this scale can be used for all students, as it is seen in Table 2. Furthermore, it was seen that especially 3rd and 4th-grade students could understand the scale items from the answers they gave to the questions of "What do you understand from the question in this item?", "Is there a question item you do not understand?", "How else can you express this question?" which were posed to them during application.

Table 2: The reliability coefficients of the scale according to grade

Grade	Cronbach's alpha	N of Items
Third	,807	10
Fourth	,760	10
Fifth	,855	10
Sixth	,864	10
Seventh	,797	10
Eighth	,906	10
Ninth	,865	10
Tenth	,876	10
Eleventh	,871	10
Twelfth	,878	10

2.4. Data Analysis

Short statements were made about the purpose of the research before distributing scale forms to students. It was pointed out that participants would be guided without affecting their opinions. Scale forms were distributed during the class hours and collected after 25 min. Students were seated individually so as not to be able to see what other students marked. Participant responses were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics and inter-correlations on the study variables were computed. Kolmogorov-Smirnov normality test demonstrated that data did not show a normal distribution (See Table 3).

Table 3: Normality Test (Kolmogorov-Smirnov) Results

		Value
N	1247	
Normal Parameters	Mean	2,1635
	Std. Deviation	,86472
Most Extreme Differences	Absolute	,112
	Positive	,112
	Negative	-,089
Kolmogorov-Smirnov Z	3,954	
p	,000	

The *Mann-Whitney U test* was used in the comparisons regarding the gender variable since data did not show normal distribution. The *Kruskal-Wallis Test* was used in the comparisons regarding the grade/age variable. If any significance was found, analysis proceeded with the Dunnett's C post hoc test to assess the importance of each independent variable.

3. Results

In this section, statistical results regarding gender and grade/age variables are given in detail. The results are presented in tables for a better understanding of the findings. The results about the gender are given in Table 4 and Table 5, and the results on the grade/age are given in Table 6, Table 7, and Table 8.

Table 4: Mean ranks for math anxiety, by gender

Gender	**N**	**Mean Rank**	**Sum of Ranks**
Female	634	658,17	417286,00
Male	613	580,52	355860,00
Total	1247		

The statistical results on how math anxiety changes according to the gender are as following: As seen in Table 4, female students' mean rank values appeared to be greater than that of male students. As a result of the analysis, math anxiety of female students was determined to be significantly (z=-3,924, p=,000) higher compared to male students (See Table 5). This finding shows that female students significantly have more math anxiety than male students.

Table 5: Test Statistics

	Value
Mann-Whitney U	168282,000
Wilcoxon W	355860,000
Z	-3,924
p	,000

The statistical results on how math anxiety changes according to grade/age are as following: As seen in Table 6, the lowest mean rank value appeared at the 5th grade level, and the highest mean rank value appeared at the 10th grade level. It was determined by this finding that math anxiety is in 5th grade at least and in 10th grade at the most. When this finding was detailed, math anxiety was classified in ascending order for the 5th, 3rd, 6th, 4th, 8th, 11th, 12th, 7th, 9th, 10th graders, respectively.

Table 6: Mean ranks for math anxiety, by grade/age

Grade	**N**	**Mean Rank**
3,00	155	484,78
4,00	120	534,79
5,00	123	***372,67***
6,00	105	501,84
7,00	82	752,91
8,00	103	626,14
9,00	149	760,98
10,00	138	***818,83***
11,00	129	657,43
12,00	143	719,28
Total	1247	

Table 7: Kruskal-Wallis Test Statistics

	Value
Chi-Square	186,455
df	9
p	,000

The results in Table 7 show that there is significant difference between some grades. The results of the Dunnett's C post hoc test showed that significant differences did not appear between *3rd grade* and 4th, 5th and 6th grades; between *4th grade* and 3rd, 5th, 6th and 8th grades; between *5th grade* and 3rd, 4th and 6th grades; between *6th grade* and all grades except for 7th and 9th grades; between *7th grade* and 10th, 11th and 12th grades; between 8th grade and 4th, 10th, 11th and 12th grades; between *9th grade* and 10th, 11th and 12th grades; between *10th grade* and 4th, 6th, 7th and 8th grades; between *11th grade* and 6th, 7th, 8th and 10th grades; between *12th grade* and 6th, 7th and 8th grades.

Table 8: Multiple comparisons, by Grade/Age

(I) Grade	(J) Grade	Mean Difference (I-J)	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
3,00	7,00	-,59867*	,10200	-,9294	-,2679
	8,00	-,37852*	,10725	-,7249	-,0322
	9,00	-,66799*	,09126	-,9611	-,3749
	10,00	-,80240*	,09135	-1,0961	-,5087
	11,00	-,38781*	,08878	-,6734	-,1022
	12,00	-,53089*	,08797	-,8136	-,2482
4,00	7,00	-,52634*	,10225	-,8582	-,1945
	9,00	-,59567*	,09154	-,8901	-,3012
	10,00	-,73007*	,09163	-1,0250	-,4351
	11,00	-,31548*	,08906	-,6024	-,0285
	12,00	-,45857*	,08825	-,7426	-,1745
5,00	7,00	-,79313*	,11050	-1,1514	-,4349
	8,00	-,57299*	,11537	-,9457	-,2003
	9,00	-,86246*	,10067	-1,1864	-,5386
	10,00	-,99686*	,10075	-1,3212	-,6725
	11,00	-,58228*	,09842	-,8994	-,2652
	12,00	-,72536*	,09769	-1,0398	-,4109
6,00	7,00	-,52498*	,12001	-,9143	-,1356
	9,00	-,59430*	,11103	-,9522	-,2364
7,00	3,00	,59867*	,10200	,2679	,9294
	4,00	,52634*	,10225	,1945	,8582
	5,00	,79313*	,11050	,4349	1,1514
	6,00	,52498*	,12001	,1356	,9143
	8,00	,22015*	,12825	-,1958	,6361
	9,00	-,06933*	,11522	-,4422	,3035
8,00	3,00	,37852*	,10725	,0322	,7249
	5,00	,57299*	,11537	,2003	,9457
	6,00	,30483*	,12450	-,0978	,7075
	7,00	-,22015*	,12825	-,6361	,1958
	9,00	-,28947*	,11989	-,6763	,0973

9,00	3,00	,66799*	,09126	,3749	,9611
	4,00	,59567*	,09154	,3012	,8901
	5,00	,86246*	,10067	,5386	1,1864
	6,00	,59430*	,11103	,2364	,9522
	7,00	,06933*	,11522	-,3035	,4422
	8,00	,28947*	,11989	-,0973	,6763
10,00	3,00	,80240*	,09135	,5087	1,0961
	5,00	,99686*	,10075	,6725	1,3212
	9,00	,13440*	,10590	-,2060	,4748
	11,00	,41459*	,10376	,0806	,7485
	12,00	,27150*	,10307	-,0599	,6029
11,00	3,00	,38781*	,08878	,1022	,6734
	4,00	,31548*	,08906	,0285	,6024
	5,00	,58228*	,09842	,2652	,8994
	9,00	-,28019*	,10369	-,6137	,0533
	12,00	-,14309*	,10080	-,4674	,1812
12,00	3,00	,53089*	,08797	,2482	,8136
	4,00	,45857*	,08825	,1745	,7426
	5,00	,72536*	,09769	,4109	1,0398
	9,00	-,13710*	,10300	-,4681	,1939
	10,00	-,27150*	,10307	-,6029	,0599
	11,00	,14309*	,10080	-,1812	,4674

* The mean difference is significant at the 0.05 level.

4. Discussion

The present study aims to reveal how math anxiety changes by gender and grade/age. As results of the analysis, three main conclusions have been reached. First, it was found out that math anxiety significantly changed by gender. When this result was detailed, math anxiety was found to be significantly higher in female students compared to male students. This finding is consistent with the results of studies by Baloğlu & Koçak (2006), Bander & Betz (1981), Baya'a (1990), Betz (1978), Devine et al. (2012), Hembree (1990), Mutodi & Ngirande (2014), Primi et al. (2014), Yüksel-Şahin (2008), and Wigfield & Meece (1988). However, the current finding contradicts the results of Arıkan (2004), Birgin et al. (2010), Goetz et al. (2013), Ma & Xu (2004), Newstead (1998), Tapia & Marsh (2004), which determined that there is no relationship between math anxiety and gender.

Various reasons can be suggested concerning the fact that math anxiety appeared to be significantly higher in female students. As a reason for this, the socialized hypothesis that *mathematics is traditionally a male domain* is offered, therefore, females avoid mathematics and mathematical activities, and this socialized domain leads them

to think themselves as mathematically incompetent (Bander & Betz, 1981). Another possible reason is asserted that because they do not avoid expressing their feelings, females' feelings of anxiety are viewed as more acceptable than males (Flessati & Jamieson, 1991). This idea is supported by some other in-depth research showing that females express their anxieties, thoughts/feelings more than males (Biaggio & Nielsen, 1976; Meece, Parsons, Kaczala, & Goff, 1982; Nolen-Hoeksema, 1987). Devine at al. (2012) also agree the finding of Flessati & Jamieson (1991) such that *females being more self-critical* may be effective in emergence of gender difference in math anxiety.

It is argued that less math anxiety in males could be derived from mathematics confidence/self-concept and self-efficacy. For instance, researches (Jain & Dowson, 2009; Pajares, 2005; Pintrich & De Groot, 1990; Sherman & Fennema, 1977; Sherman, 1980; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991) demonstrated that males have more self-confidence in mathematics than females. In another view by Rubinsten, Bialik, & Solar (2012), math anxiety in females is associated with the result of biological and developmental factors that interfere with intact development of basic numerical abilities such as quantity manipulation (in difficulties with solving simple arithmetic involving subtraction, addition, and division). In parallel, Beilock, Gunderson, Ramirez, & Levine (2010) found a strong link between teachers with math anxiety and the math anxiety of their female students. Specifically, the more anxious teachers were about math, the more likely girls (but not boys) were to endorse the commonly held stereotype that "boys are good at math, and girls are good at reading." Primi et al. (2014) have also reported that females show higher levels of mathematics anxiety than males as a result of that women are less likely to seek mathematical problem-solving opportunities and tend to avoid activities related to math.

In the second main conclusion, it was determined that math anxiety is in 5^{th} grade at the least and in 10^{th} grade at the most. Math anxiety was classified in ascending order for the 5th, 3rd, 6th, 4th, 8th, 11th, 12th, 7th, 9th, 10th graders, respectively. It cannot be said anything clearly about the fact that math anxiety increases or decreases as the grade/age increases. This finding is consistent with the findings of study by Wigfield and Meece's (1988) who determined that the means did not show a consistent ascending or descending pattern; rather, math worry was highest in 9th-grade students (M = 5.46), intermediate (and at similar levels) in 7th, 8th, 10th, 11th, and 12th-grade students (M= 5.00), and lowest in 6^{th}-grade students (M=4.63). Similar conclusions were reported in Yüksel Şahin's (2008) study of 4th and 5^{th}-graders, and in the study by Ramirez et al. (2013) with first and second-grade elementary students. However, some research's findings contradict this conclusion. For example, Randolph (1997) found that eighth-grade students were more anxious than seventh-grade students. Such increasing trend by grades is supported by the finding of Arıkan (2004) who found that math

anxiety levels of eighth-grade students as the highest in comparison with those in lower grades. In parallel, Baloğlu and Koçak (2006) and Birgin et al. (2010) showed that math anxiety levels increased as grades increased. The study of Mutodi and Ngirande (2014) conducted with first-year students at a tertiary institution also demonstrated that older students (21 years and above) experienced higher levels of math anxiety than younger students (16-20 years).

It can be said that the fact that math anxiety appeared in 5th grade at the least was due to the fact that students at this level have newly started middle school level according to the new education system (4+4+4) recently implemented in Turkey. In this education system, the classroom or primary teacher teaches all courses (including math) of students in the first 4 years. It can be said that students begin to love math course when branch teachers begin to teach courses in 5th grade. This inference supports researches pointing out that some classroom teachers consider themselves insufficient in teaching branch courses (Abell & Roth, 1992; Gustafson & Rowell, 1995; Gürbüz, Erdem & Gülburnu, 2013). The fact that 5th-grade (57 acquisitions) math density is less than 4th-grade (84 acquisitions) in the Middle School Mathematics Course Curriculum (MNE, 2013) can be shown as another reason for this. It can be said that fewer math subjects in 5th grade after an intensive math course in 4th grade are effective in the decrease of math anxiety.

Several reasons can be suggested for the fact that math anxiety is the highest in 10th grade. For instance, in 4-year high school education (secondary education), students choose one of the branches of Numeric, Verbal, Equally-Weighted and Foreign Language as from 10th grade and then continue their education in the branches they have chosen for 3 years. It can be said that the fact that the 10th grade is the first year after branching and includes subjects such as Probability, Functions, and Polynomial that can be considered as difficult epistemologically cause an increase in math anxiety at this grade level. It is possible to say that complex symbols and formulas contained in these subjects pave the way for the increase in anxiety. Baloğlu (2001) reported that the fact that mathematics science includes complex formulas and terms by its nature is one of the factors that increase math anxiety. The fact that students get accustomed to their branches and high school education/environment is said to be effective in the lower level of anxiety in 11th and 12th grades.

A point that is not included among the problems to be investigated in this study but that should be discussed is the fact that participants' math anxiety averages are less as compared to the results of previous studies conducted with students at similar and close grade levels (Arıkan, 2004; Baloğlu & Koçak, 2006; Baya'a, 1990; Birgin et al., 2010; Wigfield & Meece, 1988). Indeed, it was revealed in this study that all participants' math anxiety average was M= 2.16. This important result shows that math anxiety is

decreasing in time as a result of the constructivist education. Along with the constructive approach in recent years, it is possible to say that training teacher candidates during university education based on this approach has brought an effective, different and amusing perspective to mathematics teaching. It can be said that anxieties related to math in students have been replaced by more positive attitudes with the application of this approach.

The reasons for the emergence of math anxiety at different levels by gender can be investigated in future studies. Furthermore, in-depth qualitative studies can be carried out on things to do to decrease math anxiety. On the other hand, math anxiety levels of students can be compared from the past to present by bringing together studies conducted on anxiety with an up to date meta-analysis research.

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