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High School Students' Attitudes towards Mathematics

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The purpose of this study is to determine the attitudes of students studying at different types of high schools towards mathematics classes, and to test whether or not there is a meaningful difference between the demographic properties of the students and their attitudes. The data used in this study were obtained from 1,801 students studying at different types of high schools. The data obtained in the study showed that the attitudes of the students towards mathematics are at medium level, and that there is a meaningful difference between the attitudes of the students towards mathematics classes and the education levels of their fathers and the students' high school types. On the other hand, it has been determined that there is no meaningful difference between the gender of the students, the gender of the mathematics teachers, attending to an extra course, receiving private lessons for mathematics, their perceived success status, educational levels of their mothers, the income level of their families, the number of siblings, the order of the student in the family as a sibling, fathers' and mothers' profession, and the attitudes of the students. According to the Multi Linear Regression Analysis which was performed with the purpose of determining the factors affecting the attitudes of the students in the study group, the Gender of the Mathematics Teacher (= -.073), the Profession of the Mother (= - .069) and the Educational Level of the Father (= .049) have effects in determining the attitudes of the students towards mathematics classes.

Keywords: high school students, mathematics class, attitudes, developing scales

INTRODUCTION

Mathematics, which is a thought, a lifestyle, and even a universal language, is accepted as an indispensable field in today's fast-developing world for individuals, society, scientific research, and technological developments (Moralı, Köroğlu, & Çelik, 2004).

Mathematics is considered by many people to be a series of rules to be memorized, or as arithmetic calculations, mysterious and algebraic equations, and geometrical proofs (Delice, Ertekin, Aydın, & Dilmaç, 2009). For this reason, probably the most feared subject in the Turkish educational system is the mathematics with no

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exception. The purpose of mathematics classes in schools is to help students gain problem-solving skills, reasoning, to be able to make interconnections, generalization, establish communications, and some other mathematical skills such as sensory and psychomotor skills, and to use these skills in order to solve problems they encounter in real life (Baykul, 1990; Olkun & Toluk Uçar, 2007; Gürefe & Kan, 2013). However, the real target in the educational system is obtaining voluntary changes in the positive direction of individuals' behaviors from the education-training process. Often, students think that mathematical issues can either not be learned, or can only be learned with great difficulty. According to Baykul (1990), many students have difficulties in mathematics classes and this creates increased anxiety levels because they think that they cannot succeed in mathematics; and therefore develop negative attitudes towards mathematics classes. In another study, Baykul (1990) states that students gradually develop negative attitudes towards mathematics classes in the process from the 5th grades of primary education until the last grade of high school.

State of the literature

- Many students have difficulties in mathematics classes and this creates increased anxiety levels because they think that they cannot succeed in mathematics; and therefore develop negative attitudes towards mathematics classes
- It is known that there are three components of the attitude; cognitive, sensory and behavioral dimensions

Contribution of this paper to the literature

- The finding that the attitudes of the high school students towards mathematics are at a medium level indicates that more detailed studies are needed in order to increase the attitudes of high school students towards mathematics
- In this study, the findings show that the attitudes of the high school students towards mathematics are at a medium level. mathematician.

Perhaps the most important factor which influences mathematics success levels of students is the students' attitude towards mathematics classes. It has been widely known for a very long time that there is a high-level relationship between mathematical success levels and attitudes towards mathematics. In the studies conducted so far, it has been suggested that students with higher positive attitudes towards mathematics also have higher levels of success (Aiken, 1970 Erktin, 1993; Peker & Mirasyedioğlu, 2003; Çanakçı & Özdemir, 2011).

It is possible to define the concept of 'attitude', which is at the very heart of the defining point of an individual's behaviors, as follows: Attitude is the cognitive, sensory and behavioral positive or negative inclinations of an individual, and are directed towards the events, people, objects, thought systems and institutions within the limits of one's perceptional realm. Fishbein and Ajzen (1975) defined the concept of 'attitude' as the learned inclination to give either a positive or negative reaction towards an individual (as cited by Çanakçı & Özdemir, 2011). According to Allport (1935), the 'attitude' is having a direct or dynamic effect on one's reactions towards a certain object or an event (as cited by Çanakçı & Özdemir, 2011).

It is known that there are three components of the attitude; cognitive, sensory and behavioral dimensions. Although (i) environmental factors: negative classroom environment, teacher properties that may be perceived as negative, family pressure, highly complex symbols or signs used in mathematics, (ii) cognitive properties: lack of self-conscience in the student, having not gained sufficient mathematics knowledge and its infrastructure in previous mathematics experiences, (iii) personal properties: feeling insufficient in social relationships, shyness, being introvert, insufficient self-personality are interrelated with the mathematical anxiety, it must also be accepted that these properties have the power of affecting these three components of attitude. Papanastasiou (2000) states that mathematical attitude is the positive or negative attitude developed by the individual towards mathematics.

According to many researchers in the field, the positive or negative attitudes of students affects their success levels in mathematics classes in a positive or negative

way (Minato & Yanase, 1984; Ethington & Wolfle, 1986; Baykul, 1990; Erktin, 1993; Ma, 1999; Peker & Mirasyedioğlu, 2003). In their studies, Ertem and Alkan (2004) state that the success or failure of students in mathematics classes is an important factor in developing the attitudes of the students (as cited by Boran, Aslaner, & Çakan, 2013). Terwilliger and Titus (1995) state that mathematical anxiety can also negatively affect the attitudes of students. Students' attitudes towards mathematics are thought to be linked to certain variables. These variables include student gender, grade level, school type, perceived success level of high school students, mothers' education level, fathers' education level etc. (Ekizoğlu & Tezer, 2007). Aydınlı (1997) states there is no meaningful relationship between educational levels of high school students' parents and the students' attitude levels. In another study, Taşdemir (2008) states there is no meaningful difference between the mean values of students' attitudes when the educational levels of their mothers are considered; however, when the education levels of the fathers are considered, there are differences in the attitudes points and the mean values at a meaningful level.

The Purpose of the Study

The purpose of this study is to determine whether or not there is a meaningful difference between the mean values of the mathematical attitude points of high school students and their gender, the gender of their mathematics teachers, their high school type, private course attendance, receiving private mathematics lessons, education level of their mother, education level of their father, their perceived success levels, etc. The problem sentence and the sub problems, when the aforementioned variables are considered, are as follows.

Problem Sentence

Is there a meaningful difference between the average values of students' attitudes towards mathematics classes who study at different types of high schools at 0.05 level?

Sub Problems

1. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the genders of high school students are considered?
2. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the gender of the mathematics teachers are considered?
3. Is there a meaningful difference between the mathematical attitude points at 0.05 level when their receiving private lesson status is considered?
4. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the attending a private course status of high school students who study at different school types are considered?
5. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the different school types of the students are considered?
6. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the perceived success levels of high school students who study at different school types are considered?
7. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the education levels of the mothers of the students who study at different school types are considered?
8. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the education levels of the fathers of the students who study at different school types are considered?
9. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the numbers of brothers/sisters of the students who study at different school types are considered?
10. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the order of the student in the family as a sibling is considered?

11. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the professions of the mothers of the students who study at different school types are considered?
12. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the professions of the fathers of the students who study at different school types are considered?
13. Is there a meaningful difference between the mathematical attitude points at 0.05 level when the income levels of the families of the students who study at different school types are considered?
14. Is there any difference between the importance levels of the factors (independent variables) which affect the attitudes of the high school students towards mathematics (dependent variable)?

Method

Study Group

In this study, 1,801 students who were studying at different high schools located in Denizli city center, Turkey, were included. The distribution of the study group is shown in Table 1. As can be seen in Table 1, 1,010 (56%) of the students in the study group are male, and 791 (44%) are female.

Data Collection Tool

Mathematical Attitude Scale (MAS): In order to determine the attitudes of high school students towards mathematics classes, the *Mathematical Attitude Scale* consisting of 35 items developed by Yaşar, Çermik, and Güner (2014), which was revised later and decreased to 19 items by Yaşar (2014) was used. The 19-Item short form of the *Mathematical Attitude Scale* is a 5-point Likert-type scale. The positive items in the scale are given points "5, 4, 3, 2, and 1" beginning from "I definitely agree", through to "I don't agree"; whereas the negative items in the scale are given points "1, 2, 3, 4, and 5" beginning from "I don't agree" through to "I definitely agree". The lowest point in the scale is 19 and the highest is 95 points. In order to calculate the score interval, the Range = (the highest value – the lowest value) / (number of degrees) formula is used (Sümbüloğlu & Sümbüloğlu, 1993). The assessment range of the item average values is like: (1) 1.00-1.80 "I don't agree at all", (2) 1.81-2.60 "I don't agree", (3) 2.61-3.40 "I partly agree", (4) 3.41-4.20 "I agree", and (5) 4.21-5.00 "I definitely agree". In this study, the average of the attitudes of high school students has been calculated as $\overline{X}_J$ = 2.83. This value shows that the attitudes of the students towards mathematics classes are at a medium level.

Analysis of the Data

The data obtained in the study have been analyzed by using SPSS (Version 20). Comparisons have been made by using One-Way ANOVA analysis and ***t*** test by taking the demographic properties and the attitudes of the high school students into consideration. At the same time, Multiple Linear Regression Analysis has been used to determine the

Table 1. *Distribution of the Study Group according to Gender and School Type*

	School Type						Total	
Gender	Anatolian Teacher Training High school	Anatolian High school	Imam and Preachers High school	General High school	Industry and Vocational High school	Science High school	n	%
Female	46	83	226	305	47	84	791	44
Male	26	128	84	226	469	77	1,010	56
Total	72	211	310	531	516	161	1,801	100

relationship level between the attitudes of the students (dependent variable) towards mathematics classes and the properties influencing these properties (independent variables).

The regression model which includes more than one independent variable is expressed as Multiple Linear Regression Model. The Multi-Variable Regression Analysis is a statistical analysis type with the purpose of estimating the dependent variable based on one or more variables that are interrelated with the dependent variable. This analysis makes it possible to comment on the direction of the relationship between the dependent and the independent variables (Büyüköztürk, 2002; Altınkurt, 2008).

FINDINGS

Findings on the first sub-problem of the study

The first sub-problem of the study considers: *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the gender of high school students are considered?"* The ***t*** test has been used for the independent exemplifications to find the answer to this question.

When Table 2 is examined, it can be observed that there is no meaningful difference between the mean values of the attitude points of male and female students since the result was $p>0.05$.

Findings on the second sub-problem of the study

The second sub-problem of the study considers: *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the genders of the mathematics teachers are considered?"* The data obtained from the exemplification to answer this question have been subjected to ***t*** test. The findings are given in Table 3.

When Table 3 is examined, it can be observed that there is no meaningful difference between the mean values of the attitude points of the male and female students when the gender of the mathematics teachers are considered.

Findings on the third sub-problem of the study

The third sub-problem of the study considers, "Is there a meaningful difference between the mathematical attitude points at 0.05 level when the receiving private lesson status of the high school students are considered? The t test has been used for the independent exemplifications in the analysis of the average mathematics points obtained from the exemplification which has been formed with the purpose of answering this question.

When Table 4 is examined, it can be observed that there is no meaningful difference at 0.05 level between the averages of the mathematical attitude points of the students in terms of receiving private mathematics lessons, except at the school and at the course.

Findings on the fourth sub-problem of the study

The fourth sub-problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the attending a private course status of the high school students who study at different school types is considered?"* The findings on this question are given in Table 5.

According to Table 5, it is obvious that there is no meaningful difference at 0.05 level between the average values of the mathematical attitude points in terms of the students' attending a course or not.

Findings on the fifth sub-problem of the study

The fifth sub-problem of the study considers "*Is there a meaningful difference between the mathematics attitude points at 0.05 level when the different school types of the students are considered?"* The findings on the fifth sub-problem are given in Table 6 and in Table 7.

In order to test whether or not there is a meaningful difference between the mathematics attitude point mean values of the students who study at different types of schools, One-Way ANOVA Analysis was performed. When Table 6 is examined, it is obvious that [$F_{(5:1797)} = 21.747$; $p<0.05$]. Therefore, it is suggested that there is a meaningful difference between the high school types of the students and their mathematical attitude point mean values.

Table 2. Statistics of the Mathematical Attitudes Points of High school Students and the t Test Results

	Student Gender	N	$\overline{X}$	S_X	Mean Standard Error	t	p
Mathematical Attitude Score	Female	791	52.586	16.539	.588	-.645	.519
	Male	1,010	53.081	15.843	.498		

Table 3. Statistics and results of the t test of students' attitudes towards mathematics according to the gender of the mathematics teacher

Gender of the Mathematics Teacher		N	$\overline{X}$	S_X	Mean Std. Error	t	p
Mathematical Attitude Score	Female	762	53.34	15.99	.579	.878	.380
	Male	1,005	52.66	16.35	.515		

Table 4. Statistics and the results of the t test of high school students' attitudes towards mathematics according to receiving private mathematics lessons

Receiving Private Mathematics Lessons		N	$\overline{X}$	S_X	Mean Standard Error	t	p
Mathematical Attitude Score	Yes	94	51.24	14.78	1.52	-1.01	.314
	No	1,702	52.96	16.22	.393		

Table 5. Statistics and the results of the t test of the attitudes of the high school students towards mathematics according to attending private courses or not

Attending Private Course		N	$\overline{X}$	S_X	Mean Standard Error	t	p
Mathematical Attitude Score	Yes	414	53.316	16.352	.803	.657	.511
	No	1,371	52.721	16.094	.434		

In order to determine between which school types there are differences, the Tukey LSD (Post-Hoc) Multi Comparison was performed. When Table 7 is examined, it is observed that there is a meaningful difference between the mean values of the mathematical attitude points of the high school students from the Anatolian Teacher Training High school, Anatolian High school, and Science High school. This difference is in favor of the Anatolian Teacher Training High school students. On the other hand, there is no meaningful difference between the mean values of the mathematical attitude points of the high school students from Anatolian Teacher Training High school and other students from different school types.

There is no meaningful difference between the mean values of the mathematical attitude points of the high school students from Anatolian High school and Science High school. On the other hand, there is a meaningful difference between the mean values of the mathematical attitude points of other high school students. This difference is against Anatolian High school students.

Findings on the sixth sub-problem of the study

The sixth sub-problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the perceived success levels of high school students who study at different school types are considered?*"

In determining the perceived success levels of the students studying at different high school types, the One-Way Variance (ANOVA) Analysis was performed to see whether or not there is a meaningful difference between the mean values of the mathematical attitude points of the high school students. The findings are given in Table 8.

When Table 8 is examined, it is observed that there is no meaningful difference between the mean values of the mathematical attitude points of the high school students in terms of success levels perceived by them.

Table 6. *One-Way Variance Analysis (ANOVA) of the attitudes points of the high school students from different school types.*

Variance Resource	Sum of Square	df	Mean Square	F	p
Between Groups	26,795.442	5	5,359.088		
Within Groups	442,823.877	1,797	246.424	21.747	.000
Total	469,619.319	1,802			

*p< .05

Table 7. *Findings on LSD Multi Comparison (Post-Hoc) of the mathematical attitudes points according to the School Types of the High school Students*

High school Types		Differences between the averages				
		1	2	3	4	5
1	Anatolian Teacher Training High school					
2	Anatolian High school	10.50*				
3	Imam and Preachers Vocational High school	-.016	-10.52*			
4	General High school	1.73	-8.76*	1.75		
5	Industry Vocational High school	.77	-9.73*	.78	-.96	
6	Science High school	10.07*	-.42	10.09*	8.33	-9.30*

*p< .05

Table 8. *One-Way Variance Analysis (ANOVA) results of the Mathematical Attitudes Points according to the perceived success levels of high school students*.

Variance Resource	Sum of Square	df	Mean Square	F	p
Between Groups	1,148.745	4	287.186	1.102	.354
Within Groups	468,470.574	1,798	260.551		
Total	469,619.319	1,802			

Table 9. *One-Way Variance Analysis (ANOVA) results of the attitudes points towards mathematics classes according to the educational status of the mothers of the high school students*

Variance Resource	Sum of Square	df	Mean Square	F	p
Between Groups	1,441.686	7	205.955	.791	.595
Within Groups	461,902.677	1,774	260.374		
Total	463,344.364	1,781			

Table 10. *One-Way Variance Analysis (ANOVA) results of the attitudes points towards mathematics classes according to the education status of the fathers of the high school students*

Variance Source	Sum of Squares	Sd	Mean Squares	F	p
Between Group	5,619.399	7	802.771	3.106	.003
Within Group	459,981.601	1,780	258.417		
Total	465,600.999	1,787			

Findings on the seventh sub-problem of the study

The seventh sub-problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the education levels of the mothers of the students who study at different school types are considered?*" The One-Way Variance Analysis (ANOVA) results was performed in order to respond to the sub-problem, and the results are given in Table 9.

When Table 9 is considered, it is observed that there is no meaningful difference [F(7:1774) = .791; p>.05] between the educational levels of the mothers of high school students and their attitudes towards mathematics.

Findings on the eighth sub-problem of the study

The eighth sub problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the education levels of the fathers of the students who study at different school types are considered?*" One-way variance analysis (ANOVA) was performed in order to respond to the sub-problem, and the results are given in Table 10.

When Table 10 is examined it is observed that there is a meaningful difference [$F_{(7:1780)}$ = 3.106; p<.05] between the mean values of the mathematical attitude points of the high school students in terms of their fathers' educational levels. In order to determine between whom this difference is, the Multi-Comparison LSD (Post-Hoc) has been used. The results of this comparison have been given in Table 11.

When the educational levels of the high school students are considered, it is observed that there is a meaningful difference between the mean values of the mathematical attitude points of the high school students whose fathers are *Illiterate* [$\overline{X}$ = 63.30], and the students whose fathers are Primary School graduates [$\overline{X}$ = 52.71], and the students whose fathers are *Secondary School Graduates* [$\overline{X}$ = 51.00], and those students whose fathers are *High school Graduates* [$\overline{X}$ = 52.97], and those students whose fathers are *Undergraduates* [$\overline{X}$ = 53.875]. This difference is in favor of the students whose fathers are illiterate.

Again, it has been observed that there is a meaningful difference between the mean values of the mathematical attitude points of the high school students whose fathers are at *Literate* level [$\overline{X}$ = 60.875] and those whose fathers are at *Primary School* level [$\overline{X}$ = 52.71] and *Secondary School* level [$\overline{X}$ = 51.00]. This difference is in favor of the students whose fathers are at "*Literate*" level.

There is a meaningful difference between the mean values of the mathematical attitude score of the high school students whose fathers are *Primary School Graduates* [$\overline{X}$ = 52.71], and those whose fathers' education levels are at *Post Graduate Study* level [$\overline{X}$ = 59.84]. This difference is in favor of the students whose fathers' education levels are at *Post Graduate Study* level.

Similarly, it is obvious that there is a meaningful difference between the mean values of the mathematical attitude points of the high school students whose fathers are *Secondary School Graduates* [$\overline{X}$ = 51.00] and the students whose fathers are at *Undergraduate* level [$\overline{X}$ = 53.875] and those at *Post Graduate* degree [$\overline{X}$ = 59.84]. This difference is against the high school students whose fathers are *Secondary School Graduates*.

It has also been observed that there is a meaningful difference between the mean values of the mathematical attitude points of the high school students whose fathers are *High school Graduates* [$\overline{X}$ = 52.969], and the students whose fathers' education levels are *Post Graduate Degree* [$\overline{X}$ = 59.84]. The difference is in favor of the high school students whose fathers are at *Post Graduate Degree*. It has also been observed that there is no meaningful difference between the mean values of the mathematical attitude points of the high school students whose fathers are at *Doctorate* level [$\overline{X}$ = 59.00] and the students whose fathers are at *other* category.

Findings on the ninth sub-problem of the study

The ninth sub problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the numbers of brothers/sisters of the students who study at different school types are considered?*" The findings obtained to find an answer for this question are given in Table 12.

When Table 12 is examined, it becomes clear that the difference between the income levels of the families of the high school students and the mean values of the mathematical attitude points [$F_{(4:1792)}$ = .558; p>.05] of them are not meaningful.

Table 11. *The Results of the Tukey LSD (Post-Hoc) Multi-Comparison according to One-Way Variance (ANOVA) Analysis Results of the Mathematical Attitude Points in terms of the educational levels of the fathers of the high school students*

Literacy Level of the Father		Differences Between the Averages						
		1	2	3	4	5	6	7
1	Illiterate							
2	Literate	-3.425						
3	Primary School Graduate	11.588*	8.163*					
4	Secondary School Graduate	13.300*	9.875*	-1.711				
5	High school Graduate	11.330*	7.905	-.258	-1.969			
6	Undergraduate Graduate	10.425*	7.000	-1.163	-2.875*	-.905		
7	Master's Degree	4.451	1.026	-7.137*	-8.848*	-6.879*	5.973*	
8	Doctorate	5.300	1.875	-6.288	-8.000*	-6.030	-.848	-5.125

Table 12. *One-Way Variance Analysis (ANOVA) results of the attitudes points towards mathematics classes according to the number of the siblings of high school students*

Variance Source	Sum of Squares	Sd	Mean Squares	F	p
Between Group	582.263	4	145.566	.558	.693
Within Group	467,724.062	1,792	261.007		
Total	468,306.325	1,796			

Table 13. *One-Way Variance Analysis (ANOVA) results of the attitudes of the high school students towards mathematics according to the order of the student in the family as a sibling*

Variance Source	Sum of Squares	Sd	Mean Squares	F	p
Between Group	926.194	4	231.549	.888	.470
Within Group	467,413.132	1,792	260.833		
Total	468,339.327	1,796			

Table 14. *Statistics of the One-Way Variance (ANOVA) Analysis of the mathematical attitude Score in term of the professions of the mothers of the high school students*

Variance Source	Sum of Squares	Sd	Mean of Squares	F	p
Between Group	3,567.535	5	713.507	2.750	.018
Within Group	464,759.293	1,791	259.497		
Total	468,326.828	1,796			

Findings on the tenth sub-problem of the study

The tenth sub-problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the order of the student in the family as a sibling is considered?*" To answer this question, the data was subjected to One-Way Variance (ANOVA) Analysis. The obtained analysis results are given in Table 13.

Table 13 shows that there is no meaningful difference [$F_{(4:1792)}$=.888;p>.05] between the mean values of the mathematical attitude points of the high school students in terms of the order of the high school students within their family as a sibling.

Findings on the eleventh sub-problem of the study

The eleventh sub problem of the study considers *"Is there a meaningful difference between the mathematics attitude points at 0.05 level when the professions of the mothers of the students who study at different school types are considered?"* In order to find the answer for this question, the mathematical attitude points of the high school students classified according to the professions of their mothers and the One-Way Variance Analysis results are given in Table 14. When Table 14 is examined, it is observed that the difference [$F_{(5:1791)}$ = 2.750; p<0.05] between mean values of the mathematical attitude points of the high school students is meaningful when the income levels of the families are considered.

According to the One-Way Variance Analysis results, the Multi-Comparison (Post-Hoc) has been performed in order to determine between which group the meaningful difference in the mean values of the mathematical attitude points is detected in terms of the professions of the mothers. The Multi-Comparison results are given in Table 15.

When Table 15 is examined, it is observed that there is a meaningful difference between the mathematical attitude points of the high school students whose mothers are in the "***Retired***" category and the high school students whose mothers are in ***other*** groups. This difference is against the high school students whose mothers are in the "***Retired***" category.

Table 15. *Results of the Tukey LSD (Post-Hoc) Multi-Comparison according to One-Way Variance (ANOVA) Analysis Result of the mathematical attitude points in terms of the professions of the mothers of the high school students*

Mother's Profession		Differences between the Averages				
		1	2	3	4	5
1	Housewife					
2	Worker	1.83674				
3	Officer	.05587	-1.78087			
4	Trader	2.68961	.85287	2.63373		
5	Farmer	2.44199	.60525	2.38612	-.24762	
6	Retired	6.97294*	5.13620*	6.91707*	4.28333	-4.53095

*p<0.05

Table 16. *Results of the One-Way Variance (ANOVA) Analysis of the mathematical attitude Score in terms of the professions of the Fathers of the High school Students*

Variance Source	Sum of Squares	Sd	Mean of Squares	F	p
Between Group	268.392	5	53.678	.206	.960
Within Group	462641.036	1,773	260.937		
Total	462909.428	1,778			

Table 17. *Results of One-Way Variance (ANOVA) Analysis of the mathematical attitude points of the high school students in terms of their family income status*

Variance Source	Sum of Squares	Sd	Mean of Squares	F	p
Between Group	2,036.310	5	407.262	1.557	.169
Within Group	459,974.979	1,759	261.498		
Total	462,011.288	1,764			

Table 18 .*The model summary table (Model Summary b) belonging to the multi linear regression that affect the attitudes of the high school students towards mathematics classes.*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.103[a]	.011	.009	16.124	.002	5.115	1	2146	.024	1.703

Findings on the twelfth sub-problem of the study

The twelfth sub problem of the study considers "*Is there a meaningful difference between the mathematical attitude points at 0.05 level when the professions of the fathers of the students who study at different school types are considered?"* The findings regarding the answer to this question are given in Table 16. When Table 16 is examined, it becomes clear that the difference between the mean values of the mathematical attitude points of the students is not meaningful in terms of the income levels of the families [$F_{(5:1773)}$ = .206; p>0.05].

Findings on the thirteenth sub-problem of the study

The thirteenth sub problem of the study considers *"Is there a meaningful difference between the mathematical attitude points at 0.05 level when the income levels of the families of the students who study at different school* types *are considered?"* The findings to answer this question are given in Table 17. When Table 17 is examined, it becomes clear that the difference [$F_{(5:1759)}$ = 1.557; p>0.05] between the mean values of the mathematical attitudes points and the income levels of the families of the high school students is not meaningful.

Findings on the fourteenth sub-problem of the study

The fourteenth sub problem of the study considers "*Is there any difference between the importance levels of the factors (independent variables) which affect the attitudes of the high school students towards mathematics (dependent variable)?"* In order to find an answer to this question, a *Multi Linear Regression Analysis* has been performed by taking the mathematical attitude points of the high school students as the dependent variable, and the demographic properties as the independent variable, as bases. The statistical values on the regression model are given in Table 18.

Table 18 is a regression model summary table. It gives the rate of explanation of the independent variables in the R^2 model explaining the dependent variables. According to this, the independent variables in this model are explaining the .011' attitudes of high school students towards mathematics. Variance analysis (ANOVA) has been performed in order to

Table 19. *One-Way Variance Analysis (ANOVA[a]) Table*

Model	Sum of Squares	df	Mean Squares	F	Sig.
Regression	2,723.480	1	2,723.480	10.378	.001[b]
Residual	442,710.596	1,687	262.425		
Total	445,434.076	1,688			

a Dependent Variable: Mathematics Attitude; b. Estimators: (Constant), gender of the mathematics teacher, mother's profession, father's educational status

Table 20. *Regression Coefficients Table* [a]

	Unstandardized Coefficient		Standardized Coefficients			95% Confidence Interval for B	
Model	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
Constant	55.517	1.553		35.74	.00	.000	52.47
Gender of math teacher	-2.379	.703	-.073	-3.38	.00	.001	-3.75
Mother's profession	-1.011	.318	-.069	-3.17	.00	.002	-1.63
Father's educational status	.586	.259	.049	2.262	.02	.024	.07

a. Dependent Variable: Mathematics Attitude

determine whether or not the model is meaningful when it is considered as a whole. The ANOVA results are given in Table 19.

When Table 19 is considered, it becomes clear that since the [F(1:1687) = 10.378; p<0.05], the model carries meaning as a whole. In order to explain the meaningfulness (importance) of each estimator factor (the independent factor), the regression coefficients given in Table 20 must be considered.

The importance of the relationship level between the attitudes of the high school students towards mathematics classes (the dependent variable) and the estimative variables (the independent variables) can be decided on assessing the beta (partial correlation) values. There is a positive relationship between the attitudes of the high school students towards mathematics classes and the "Educational Level of the Fathers"; whereas, there is a negative relationship with the two other variables "The Gender of the Mathematics Teacher" and the "Mother's Profession". The most important variables in explaining the dependent variable are "The Gender of the Mathematics Teacher", "Mother's Profession" and "Educational Level of the Fathers", respectively. It is observed that there is no relationship at a meaningful level between the other variables, other than these and the dependent variable. The mathematical model that is designed to affect the attitudes of the high school students towards mathematics is provided below.Mathematics Attitude = 55.517+ (-2.379) the gender of the mathematics teacher + (-1.011) mother's profession + .586 Father's educational level.

DISCUSSION AND CONCLUSION

The finding that the attitudes of the high school students towards mathematics are at a medium level indicates that more detailed studies are needed in order to increase the attitudes of high school students towards mathematics. This is in line with other studies (Minato & Kamada, 1996) that have revealed that the mathematical success of students and their positive attitudes towards mathematics are directly proportional. In other words, as the mathematical attitude of the student increases, so does their success level in class.

In this study, the findings show that the attitudes of the high school students towards mathematics are at a medium level. This finding is supported by the findings of other studies conducted in the same field (Avcı, Coşkuntuncel, & İnandı, 2011; Yenilmez, 2007). However, it has been observed that there is no meaningful difference in terms of mathematical attitudes of high school students when the following conditions are considered; attending a course, receiving private mathematics lessons, genders of mathematics teachers, perceived success levels of students, educational status of the mothers of the students, number of siblings, the order of the student within the family as a sibling, fathers' professions and educational status, income level of the family, and the genders of the high school students.

However, Boran et al. (2013) stated that there is a meaningful difference between the attitude point mean values when the "*gender*" variable is considered. This difference is in favor of the female students (Yenilmez & Özabacı, 2003).

When the school types of the students are considered, a meaningful difference was not observed between the mean values of their attitudes towards mathematics. On the other hand, Aysen, Tanrıöğen, and Tanrıöğen (1996), in a study by teachers of their students, are reported to have the power to influence their success. However, according to the gender of the teacher, the students did not reveal the influence of the research on their attitudes towards mathematics.

When the school types of the students are considered, a meaningful difference has been observed between the mean values of their attitudes towards mathematics. Tukey LSD (Post-Hoc) Multi-Comparison test was applied in order to determine the school types which showed differences. When Table 6 is examined, it becomes clear that there is a meaningful difference between the mean values of the attitudes of the Anatolian Teacher Training High school students towards mathematics, and the mean values of the attitudes of the Anatolian High school and Science High school students. This difference is in favor of the Anatolian Teacher Training High school students. On the other hand, it has been determined that there is no meaningful difference between the mean values of the mathematical attitude points of the Anatolian Teacher Training High school students and other students. It has also been determined that there is no meaningful difference between the mean values of the

mathematical attitude points of the Anatolian High school students and the Science High school students, whereas there is a meaningful difference between the mean values of the mathematical attitude points of the students of other school types. This difference is against the Anatolian High school students. The result is supported by earlier research (Avcı et al., 2011; Çelik & Ceylan, 2009).

It has been observed that there is a meaningful difference between the mean values of the attitudes of the high school students towards mathematics classes and the education status of their fathers. When the educational status of the fathers of the high school students is considered, there is a meaningful difference between the attitudes points of the high school students [$\overline{X}$ = 63.30] towards mathematics classes whose fathers are *illiterate*, *Primary School Graduates* [$\overline{X}$ = 52.71], *Secondary School Graduates* [$\overline{X}$ = 51.00], *High school Graduates* [$\overline{X}$ = 52.97], or *Undergraduates* [$\overline{X}$ = 53.875]. This difference is in favor of the high school students whose fathers are *illiterate*.

There is a meaningful difference between the average values of the mathematical attitudes points of the high school students [$\overline{X}$ = 51.00] whose fathers are *Barely Literate* [$\overline{X}$ = 60.875] and the students whose fathers are *Primary School* and *Secondary School Graduates* [$\overline{X}$ = 52.71]. This difference is in favor of the students whose fathers have a *Post Graduate Degree*. This difference is in favor of the high school students whose fathers are *Barely Literate*. There is a meaningful difference between the average values of the mathematical attitudes points of the students whose fathers are *Primary School Graduates* [$\overline{X}$ = 59.84] and the students whose fathers have a *Post Graduate Degree* [$\overline{X}$ = 52.71]. This difference is in favor of the students whose fathers have a *Post Graduate Degree*. Similarly, there is a meaningful difference between the average values of the mathematical attitudes points of the high school students [$\overline{X}$ = 59.84] whose fathers are *Secondary School Graduates* [$\overline{X}$ = 51.00] and the students whose fathers are *Undergraduates* [$\overline{X}$ =53.875]. This difference is against the high school students whose fathers' are *Secondary School Graduates*. There is a meaningful difference between the average values of the mathematical attitudes points of the students whose fathers are *High school Graduates* [$\overline{X}$ = 52.969] and the students whose fathers are *Undergraduates* [$\overline{X}$ = 59.84]. The difference is in favor of the students whose fathers are *Undergraduates*. It has been observed that there is no meaningful difference between the average values of the mathematical attitude points of the high school students [$\overline{X}$ = 59.00] whose fathers' education levels are at *Doctorate* level and the students whose fathers' education levels are in other categories.

There is a meaningful difference between the mathematical attitudes points of the students whose mothers are in the "*Retired*" category and the points of the students whose mothers are in other categories. This difference is against the students whose mothers are in the "*Retired*" category.

According to the Multi Linear Analysis, which was performed in order to determine the factors that had the power to influence the attitudes of the high school students towards mathematics, the most powerful variable that affects the attitudes of the students towards mathematics is the *mathematics variable,* which is among the research design followed by the *Gender of the mathematics teacher, mother's profession*, and then the *father's educational status*.

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