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Relations Attitude Towards Mathematics Lessons: Anxiety and Academic Success

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Abstract

In this particular study attitude towards mathematics lessons and relation between anxiety and academic success had been explored. Though as a result of the comparative analysis of the study gender, teacher, class and the most popular and favourite lesson were determined to cause significant differences of opinion with regard to attitude towards mathematics lesson in some cases, based on structural equation modelling substantive and significant impact had been observed only for the most popular and favourite lesson. Besides, anxiety towards mathematics lesson was determined to have a mediation impact on the relation between attitude towards mathematics lesson and anxiety. The most popular and favourite lesson variable differentiated academic success in a significant manner. In the meantime, a significant relation was determined between attitude as a scaling factor and success in mathematics lesson. Anxiety had been determined to be effective is projection and prediction of success with its intermediary impact.

Keywords: Attitude towards mathematics lesson, anxiety towards mathematics lesson, success in mathematic lesson

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Relaciones de Actitud hacia las Clases de Matemáticas: la Ansiedad y el Éxito Académico

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Resumen

En este estudio en particular se exploró la actitud hacia las lecciones de matemáticas y la relación entre la ansiedad y el éxito académico. Aunque como resultado del análisis comparativo del estudio, el género, el maestro, la clase y la clase más popular se determinaron para causar diferencias de opinión significativas en relación con la actitud hacia la clase de matemáticas en algunos casos, basados en la modelación de ecuaciones estructurales, se ha observado un impacto significativo solo para la más clase más popular y la favorita. Además, se determinó que la ansiedad hacia las matemáticas tiene un impacto de mediación en la relación entre la actitud hacia la clase de matemáticas y la ansiedad. Evaluando los hallazgos obtenidos y la relación de estos con los estudios disponibles en la literatura relevante, se obtienen ciertas conclusiones significativas. En primer lugar, la clase más popular y favorita puede verse como un indicador de la actitud hacia la clase de matemáticas. La variable de clase más popular y favorita diferencia el éxito académico de manera significativa. Al mismo tiempo, se determinó que hay una relación significativa entre la actitud como factor de escala y el éxito en la clase de matemáticas. Se ha determinado que la ansiedad es efectiva en su proyección y predicción del éxito con su propio impacto como intermediario.

Palabras clave: Actitud hacia la clase de matemáticas, ansiedad hacia la clase de matemáticas, éxito en clase de matemáticas

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Mathematics is a thinking game involved with numbers for which the players are actual numbers or a systematic thought system which drives people to think (Akdeniz, 2015). Mathematics is a sort of statistics through which people are enabled to carry out their thoughts and ideas to actual life and to use in each and every realm of their lives. Besides mathematics being a fundamental science, its utilization and application for a numerous disciplines pave the way for its perception as a useful and helpful science among ordinary people. However, despite this need for mathematics, as it is seen as a difficult course and subject to learn and to apply, the desired level of success cannot be achieved. The students are likely to have a negative attitude towards mathematics due to its nature being constrained behind closed rules and formulas, overwhelmed with operations and most important of all not being able to maintain a substantive learning process. As a result of these, anxiety towards mathematics lesson being expressed as a sort of fear arises and performance of students in terms of mathematical activities drop down. Because individuals believe that they should be interested in what they can comprehend and make an effort to be successful whereas they believe that it is unnecessary to be involved with what they do not comprehend (Şahin & Abalı Öztürk, 2012).

One of the most important factors affecting the academic success of learners/students is certainly their anxious attitude. Anxiety is literally defined in the dictionary by sadness, *"concern/distress, worry"* (Turkish Language Association (TDK), 2019). According to Aydın & Tiryaki (2017), anxiety reaction is a component of mental, physical and affective behaviors. Anxiety is defined as a feeling of distress produced by the individual (Geçtan, 1987) or as a state of excitement caused by displacement of fear and hope (Morgan, 1991). In addition, Sapir & Aranson (1990) approached anxiety as a state of fear based on negative result expectation, whereas Aydın & Zengin (2008) approached anxiety as a state of weakness felt under dangerous and threatening situations.

According to Ma (1999), the anxiety expressed as one of the important factors affecting the academic achievement of the learners is also very important in teaching mathematics. Emphasis on importance and significance was made by Miller & Mitchell (1994) as well, they asserted that meaningful learning process cannot take place due to students' problem of focusing based on anxiety. In the body of literature related with anxiety towards mathematics, anxiety for this particular subject was approached

based on different affective reactions. Of these studies, Dreger & Aiken (1957) explained anxiety towards mathematics based on affective reaction syndrome, Richardson & Suinn (1972) explained anxiety towards mathematics based on feeling of frustration and anxiety, Fennema & Sherman (1976) explained anxiety towards mathematics based on feelings of anxiety and irritation/nervosity manifested along with physical symptoms, Hendel (1980) explained anxiety towards mathematics based on avoidance of mathematics, Sherard (1981) explained anxiety towards mathematics based on feeling of tension in general towards mathematics and Ashcraft (2002, p. 181) explained anxiety towards mathematics based on fear for mathematics. All these definitions show that anxiety is a very significant variable in teaching mathematics. Something is likely to go wrong in teaching without considering this variable.

In general, anxiety is perceived as a totally negative meaning, but this is not a correct determination. When anxiety is kept under control, it is very useful in the learning process and it has a feature that positively stimulates the individual. While anxiety refers to a level problem, low and high levels of anxiety is not preferred, yet anxiety in a moderate level plays a significant role in directing the individual to performance. Biber (2012) who drew attention to this problem of level stated that anxiety felt above a certain level reduces success and performance. Low performance determination highlighted in this study was reiterated by Chui & Henry (1990) and Wilson (2012) as they have highlighted that reaction ignited by fear would adversely affect cognitive performance. Mathematics being among the subjects Turkey fail in terms of exams such as PISA and TIMMS impelled researchers to question the underlying factors of this situation. As a matter of course, an important section of the researchers' problem cluster is comprised of anxiety towards mathematics.

Another variable investigated for the explanation of the above mentioned failure phenomenon was the attitude towards mathematics. Conducted research studies (Tuncer & Bahadır, 2017; Tuncer & Yılmaz, 2016) firmly determine that Turkish students do not like mathematics. Studies conducted by Eldemir (2006) and Yenilmez & Duman (2008) may be considered as related examples. One of the common findings of these two studies is that they explain the failure in the mathematics course with an attitude towards this course. According to Aksu & Bikos (2002, p. 23), negative attitude towards the course lead to anxiety at a high level and low performance. As a

matter of fact, Tremblay, Gardner, Heipel (2000) drew attention to two exterior variables which have impact on anxiety and they are namely interest and attitude towards mathematics. The definition of attitude as a learned behavior (Aiken, 1970, p. 551) should be taken into consideration by the educators. At this point, it is necessary to ensure that a negative attitude is not developed, while the second is to identify and eliminate negative attitudes with a diagnostic study.

The importance of anxiety and attitude in mathematics teaching has made them part of the teaching process. In the case of a failure, the investigation of attitudes or anxiety may be considered as well as questioning the levels before the instruction and teaching process. Classification of Turkey among inadequate countries in terms of success in mathematics provide us useful samples for research studies to be conducted for anxiety and attitude towards the subject. In this study, anxiety and attitude levels towards mathematics course/subject were determined, and these levels were evaluated in terms of certain independent variables, and finally the relation between academic success and attitude along with anxiety had been questioned and evaluated.

Method

Two data collection tools were used in this study which were applied in accordance with scanning model. The first one of the data collection tools is Avcı developed by Aşkar (1986), and the second one is 20-item attitude scale developed by Coşkuntuncel & İnandı for which exploratory factor analysis was made and the result of the reliability analysis was found .96. Five-item likert type scale is graded as *"5: I definitely agree; 4: I agree; 3: I am indifferent; 2: I do not agree; 1: I definitely disagree"*. One other data collection tool developed by Bindak (2005) is 10-item Mathematics Anxiety Scale For Elementary School Students. Five-item likert type scale is graded as *"5: Always; 4: Frequently; 3: Sometimes; 2: Rarely; 1: Never"*. Tuncer & Yılmaz (2016) conducted exploratory factor analysis and determined that total variance explained for the scale is %50.400. In addition, the academic achievement grades of the students in the research are among the data of the research.

The research was conducted on 115 students in a private school. Of the students, 62 (53.9%) took lessons from teacher A, and 53 (46.1%) of them took mathematics lessons from teacher B. A teacher is male whereas teacher

B is female. 48 (41.7%) of the students were female and 67 (58.3%) were male. 53 (46.1%) of the students mentioned mathematics as the most favorite course and 62 (53.9) as one of the other courses. 28 people are studying in fifth grade (24.3%), 24 people in sixth grade (20.9%), 34 people in seventh grade (29.6%) and 29 in eighth grade (25.2%). The Cronbach alpha coefficient of the attitude scale for the mathematics course was .945, while the Cronbach alpha coefficient of the anxiety scale for the mathematics course was .833.

While the dependent variables were compared according to the independent variables, the eta-squared values were calculated in cases with significant difference of opinion. Cohen's (1988) influence quantity reference values (≥ 0.5: strong, ≥ 0.3: middle level and ≥ .01 weak) were taken into consideration for interpretation of influence quantities (Cit. Gliner, Morgan & Leech, 2015, p. 308). Furthermore, the coefficient of relative variability was calculated for the distribution of opinions for each dimension. The relative coefficient of variation is calculated by the formula (SD / Mean) *100). If the value found is below 19, the distribution is homogeneous, between 20 and 25, the distribution is deemed as normal and 30 or above is interpreted as heterogeneous. The relative coefficient of variation is a way of better interpretation of the calculated mean and standard deviation values. This coefficient not only avoids interpretation errors due to the mean, but also gives information about the variability of responses to relevant items.

For the structural equation modelling of the study, some adjustment index values were calculated and interpreted. Stapleton (1997) states that some of the fit index values such as X_2, X_2 /sd GFI, NFI, CFI, RMSEA X_2, X_2 /df, GFI, NFI, CFI, RMSEA should be taken into account for structural equation models. For these indices values X_2 /df to be below 2 or 3 indicates perfect fit (Schreiber et al., 2006) whereas being below 5 indicates middle level of competitiveness (Sümer, p. 200). Again Schreiber et al. (2006) states that GFI to be above .95 indicates perfect fit, Sümer (2000) states that this value to be above .85 indicates it is efficient and competitive in terms of modelling-data. The CFI tests the model with respect to the relationship between implicit variables, and if this value is .90 and above it is deemed acceptable, in case it is .95 and above, if it is considered as a perfect fit (Sümer, 2000). RMSEA and SRMR values less than .05 indicate that the model-data fit is excellent, and less than .08 is considered as acceptable (Şimşek, 2007; Hooper & Mullen, 2008; Schumacker & Lomax, 2010, Cit. Çapık, 2014).

Within the scope of the research, some structural equation models have been tried. Therefore, the appropriateness of the data in terms of skewness and kurtosis were evaluated. It has been determined that anxiety scores towards mathematics is (Kurtosis:1.791; Skewness:1.541), attitude scores towards mathematics is (Kurtosis:1.991; Skewness: -1.444) and academic success for mathematics is (Kurtosis:1.506; Skewness: -1.459). Since in relevant literature (Tabachnick & Fidell, 2013; McKillup, 2012; Wilcox, 2012; Howitt & Cramer, 2011; Lind, et al. 2006) computed skew and kurtosis indices ranged within ±2 limits near to 0, it has been ascertained that a normal distribution existed (Cit. Demir, Saatçioğlu & İmrol, 2016). According to these views in literature, scale sub dimensions demonstrated a normal distribution here too.

Findings

The averages of the dependent variables observed for the study in terms of independent variables are as in Table 1. Relative variability coefficients were calculated in order to better interpret the distribution of opinions about dependent variables.

As can be seen in Table 1, the mean for the teacher A is higher in terms of attitude. Female students 'anxiety averages and male students' attitude and academic achievement scores were higher. Students who choose mathematics as their favorite subject are less anxious about mathematics, their attitudes are more positive and their academic achievement is higher. In general, the distribution of the views on mathematics anxiety are heterogeneous in terms of teachers A and B, gender, and mathematics being the most favorite subject. It was observed that views on attitude were mostly distributed normally. Academic achievement scores are distributed homogeneously in terms of all three independent variables. This means that there is no serious fluctuation in academic achievement points, the scores are close to each other (the range of points is smaller).

Table 1.
Mean, standard deviation values and distribution characteristics of independent variables in terms of dependent variables.

In depended variables	Depended Variables	Teacher	N	Mean	Std. Deviation	((SD/Mean)*100)Distribution
Teacher	Anxiety	A	62	1.79	.68	37.99 (Heterogeneous)
		B	53	1.84	.67	36.41 (Heterogeneous)
	Attitude	A	62	4.27	.68	15.93 (Homogeneous)
		B	53	3.91	.97	24.81 (Normal)
	Positive Attitude	A	62	4.12	.69	16.75 (Homogeneous)
		B	53	3.67	1.14	31.06 (Heterogeneous)
	Negative Attitude	A	62	4.42	.80	18.10 (Homogeneous)
		B	53	4.15	.91	21.93(Normal)
	Academic Achievement	A	62	90.30	11.79	13.06 (Homogeneous)
		B	53	92.94	10.52	11.32 (Homogeneous)
Gender	Anxiety	Female	48	2.09	.75	35.89 (Heterogeneous)
		Male	67	1.62	.54	33.33 (Heterogeneous)
	Attitude	Female	48	3.97	.83	20.91 (Normal)
		Male	67	4.21	.85	20.19 (Normal)
	Positive Attitude	Female	48	3.83	.90	23.50 (Normal)
		Male	67	3.97	.98	24.69 (Normal)
	Negative Attitude	Female	48	4.10	.91	22.20 (Normal)
		Male	67	4.44	.79	17.79 (Homogeneous)
	Academic Achievement	Female	48	90.64	10.80	11.92 (Homogeneous)
		Male	67	92.14	11.60	12.59 (Homogeneous)
Fav. Lesson	Anxiety	Math	53	1.61	.52	32.30 (Heterogeneous)
		Others	62	1.99	.75	37.69 (Heterogeneous)
	Attitude	Math	53	4.58	.39	8.52 (Homogeneous)
		Others	62	3.70	.92	24.86 (Normal)
	Positive Attitude	Math	53	4.44	.45	10.14 (Homogeneous)
		Others	62	3.46	1.03	29.77 (Heterogeneous)
	Negative Attitude	Math	53	4.71	.46	9.77 (Homogeneous)
		Others	62	3.95	.96	24.30 (Normal)
	Academic Achievement	Math	53	94.92	9.46	9.97 (Homogeneous)
		Others	62	88.61	11.90	13.43 (Homogeneous)

The t-test based on independent groups was used to compare the opinions about anxiety, attitude and sub-dimensions of the research, and academic achievement points according to teacher, gender and the most popular course focused on independent variables. However, as it was determined that the

distribution was not homogeneous in some dimensions, t tests were taken into consideration. The results for these analyzes are given in Table 2.

Table 2.
t-test based on independent groups to compare dependent variables in terms of independent variables.

Indep. Var.	Dep. Var.		F	Sig.	t	df	Sig.	Eta-Squared
Teacher	Anxiety	Equal variances assumed	.001	.979	-.368	113	.714	-
	Attitude	Equal variances not assumed	9.097	.003*	2.263	91.023	.026*	.046
	Pos_Att	Equal variances not assumed	15.094	.000*	2.518	82.997	.014*	.057
	Neg_Att	Equal variances assumed	1.676	.198	1.696	113	.093	-
	Acad_Ach	Equal variances assumed	3.409	.067	-1.255	113	.212	-
Gender	Anxiety	Equal variances not assumed	9.747	.002*	3.746	81.169	.000*	
	Attitude	Equal variances assumed	.002	.966	-1.501	113	.136	-
	Pos_Att	Equal variances assumed	.665	.416	-.768	113	.444	-
	Neg_Att	Equal variances assumed	2.191	.142	-2.125	113	.036*	.038
	Acad_Ach	Equal variances assumed	.213	.645	-.705	113	.482	-
Fav. Lesson	Anxiety	Equal variances not assumed	9.949	.002	-3.124	108.685	.002*	.076
	Attitude	Equal variances not assumed	23.257	.000	6.760	85.205	.000*	.266
	Pos_Att	Equal variances not assumed	22.644	.000	6.778	87.192	.000*	.268
	Neg_Att	Equal variances not assumed	24.299	.000	5.545	91.391	.000*	.198
	Acad_Ach	Equal variances not assumed	8.047	.005	3.165	112.444	.002*	.079

In the comparison of the opinions about the dependent variables in the table according to the teacher independent variable, it was determined that there was a significant difference in opinion in favor of teacher (male teacher)

in the attitude scale and positive attitude sub-dimension (p <.05). According to gender variable for anxiety dimension the women were in favor of men (t (81.169) =3.746, p=.000<.05), and for sub-dimension of negative attitude the men were in favor of women (t (113) =-2.125, p=.036<.05), thus a significant opinion difference was determined. Based on mathematics or one other subject to be the most popular and favorite, it was determined that there was a significant difference in opinion in all dimensions (p <.05). According to Eta-squared values, mathematics being the most popular course has a strong effect on all dependent variables. Gender variable has only a moderate effect on the negative attitude sub dimension. The teacher has a strong influence on the attitude scale and on the sub-dimension of positive attitude.

The last independent variable of the study is the class that has been studied. The opinions about dependent variables in terms of the class of education were compared with one-way analysis of variance. Distribution, mean scores and standard deviation values are calculated and given in Table 3 before these comparisons are given.

Table 3.

Mean, standard deviation values and homogeneity test of independent variables according to class variable.

					Levene Test	
	Class	N	Mean	Std. Deviation	F	Sig.
Academic Achievement	5	28	86,67	13,20	5.245	.002*
	6	24	95,87	5,78		
	7	34	93,29	9,70		
	8	29	90,51	12,84		
	Total	115	91,52	11,25		
Anxiety	5	28	1,82	,81	2.293	.082
	6	24	1,67	,48		
	7	34	1,77	,56		
	8	29	1,98	,78		
	Total	115	1,82	,67		
Attitude	5	28	4,42	,53	4.617	.004*
	6	24	4,16	,73		
	7	34	4,15	,77		
	8	29	3,70	1,11		
	Total	115	4,11	,84		
Positive Attitude	5	28	4,40	,48	8.042	.000*
	6	24	3,93	,98		

Table 3.
Mean, standard deviation values and homogeneity test of independent variables according to class variable (…/…)

					Levene Test	
	Class	N	Mean	Std. Deviation	F	Sig.
	7	34	3,90	,76		
	8	29	3,45	1,23		
	Total	115	3,91	,95		
	5	28	4,44	,70		
	6	24	4,39	,60		
Negative Attitude	7	34	4,41	,880	3.436	.019*
	8	29	3,96	1,07		
	Total	115	4,30	,86		

As can be seen in Table 3, the distribution of academic success, attitude and sub-dimensions is not homogenous. For this reason, comparisons were made according to Kruskall Wallis H test instead of one-way analysis of variance in these dimensions. Anova and KWH analyzes are given in Table 4.

Table 4.
Comparison of the opinions about dependent variables in terms of the class of study.

		ANOVA / Kruskall Wallis H					
		Sum of Squares	df	Mean Square	F (Chi-Square-X_2)	Sig. (Asymp. Sig)	Differences
Acad_Ach	B. Groups	1247,663	3	415,888			
	W. Groups	13197,032	111	118,892	X_2=7.004	Asymp. Sig.=.072	-
	Total	14444,696	114				
Anxiety	B. Groups	1,434	3	,478			
	W. Groups	51,190	111	,461	F=1.036	Sig.=.379	-
	Total	52,624	114				

Table 4.
Comparison of the opinions about dependent variables in terms of the class of study (…/…)

		ANOVA / Kruskall Wallis H					
		Sum of Squares	df	Mean Square	F (Chi-Square- X_2)	Sig. (Asymp. Sig)	Differences
Attitude	B. Groups	7,540	3	2,513			
	W. Groups	74,647	111	,672	X_2=6.885	Asymp. Sig.=.076	-
	Total	82,187	114				
Pos_Att	B. Groups	12,734	3	4,245			5>8
	W. Groups	90,678	111	,817	X_2=12.151	Asymp. Sig.=.007*	Eta-Squared: .12
	Total	103,412	114				
Neg_Att	B. Groups	4,531	3	1,510			
	W. Groups	79,938	111	,720	X_2=4.813	Asymp. Sig.=.186	-
	Total	84,469	114				

As a result of the analysis, only a significant difference was found in the positive attitude sub-dimension of the attitude scale towards mathematics lesson ($p < .05$). The determined and specified difference of opinion is in favor of fifth grade students in between fifth and eighth grade students. According to the influence quantity calculated for this dimension (μ_2=.12), the effect of the class of study on the positive attitude sub-dimension is strong. Among the opinions about other dependent variables, no significant difference in opinion was found between the groups in terms of the class level ($p > .05$).

The relationship between the dependent variables of the study in which direction and at which level is another condition studied and analyzed for this research. Pearson correlation coefficients between attitude, anxiety and academic achievement were calculated and given in Table 5.

Relationships between the dependent variables of the research as seen in Table 5 were determined to be significant between all dependent variables. The relationship between anxiety and attitude towards mathematics lesson (r = -.676) was found to be negative, meaningful and the high, whereas a significant and lowest relation between mathematics lesson achievement and attitude towards mathematics lesson (r = .362) had been observed.

Table 5.
Relationships between independent variables of research.

Correlation	N	Pearson (r)	Sig.
Math Achievement*Math Anxiety		-.510	.000**
Math Achievement*Math Attitude	115	.362	.000**
Math Anxiety*Math Attitude		-.676	.000**

The effect of independent variables on attitudes towards mathematics course was also discussed and analyzed. The model established for this purpose is given in Figure 1 with the results of the analysis. A similar model was tested with the concern for the mathematics lesson, but it was not confirmed and verified.

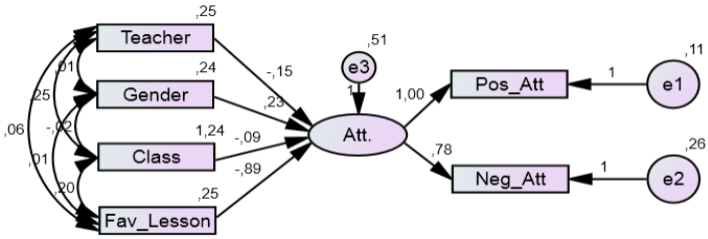

Figure 1. The effect of independent variables on attitude towards mathematics lesson.

All the independent variables of the study can be added as predictive internal variables to this model. Some fit indices and regression coefficients for the model are given in Table 6.

Table 6.
The relation of attitude towards mathematics course with some independent variables.

Path	Reg. Coefficient	Effect Size	Fit Indexes	Value
Attitude←Teacher	-.08 (p >.05)	-	CMIN/DF	8.843/3=2.948
Attitude←Gender	.13 (p >.05)	-	CFI	.966
Attitude←Class	-.11 (p >.05)	-	GFI	.976
Attitude← Favour Lesson	-.50 (p <.01)	Large Effect	SRMR	.0323

The CMIN / DF, CFI, GFI and SRMR indicators in the table are in perfect alignment. The regression coefficients in the table were found to be quite low and only the most popular lesson had a strong effect (-.50) on the attitude towards mathematics lesson (p <.01).

In the study, it was investigated whether any mediating effect between the attitude towards mathematics course and the academic achievement of mathematics lesson is available. The developed model is given in Figure 2.

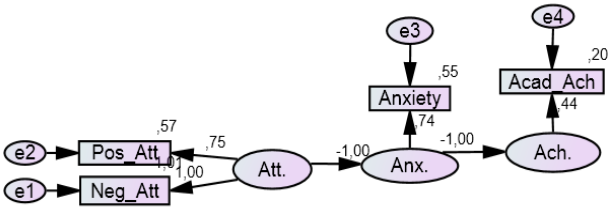

Figure 2. A model for the mediation effect of anxiety between attitude and academic achievement.

Some of the fit indices regression coefficients of the model in Figure 2 are given in Table 7.

Table 7.
The regression coefficients and the model fit values for the mediation effect of the anxiety towards mathematics course and the attitude towards academic achievement are acceptable.

Path	Estimate	S.E.	C.R.	P	CMIN	13.542	GFI	.944
Anx.<-Att.	-.586	.062	-9.389	.000*	DF	3	CFI	.948
Ach.<-Anx.	-9.840	2.047	-4.807	.000*	CMIN/DF	4.514	SRMR	.0644

*p<.05

Therefore, the established model was confirmed and it was determined that the anxiety towards mathematics course has mediating effect between attitude towards academic lesson and academic achievement. Attitudes towards mathematics lesson and anxiety about mathematics lesson, anxiety about mathematics lesson and ways of academic success of mathematics lesson are significant.

Conclusion, Discussion and Suggestions

As a result of the comparative analysis of the study, it was determined that gender, teacher, class of education, and the most popular course could cause significant difference of opinion in terms of attitudes towards mathematics lesson in some cases yet for structural equation modelling significant and strong effect was observed in relation with the most popular course. In addition, it was determined that anxiety towards mathematics lesson has mediating effect between attitude towards academic lesson and academic achievement.

When this summary finding obtained is compared with the literature, it is determined that attitude towards mathematics do not significantly differ according to gender (Yücel & Koç, 2011; Avcı, Coşkuntuncel & İnandı,

2011; Işık & Çağdaşer, 2009; Akdemir, 2007; Kaplan & Kaplan, 2006; Yenilmez & Özabacı, 2003), according to Pehlivan (2010) differentiation is in favor of male students and according to (Kurbanoğlu & Takunyacı, 2012) differentiation is in favor of female students. Yaşar (2016) noted and emphasized that gender of neither the student nor the teacher significantly differentiates attitude towards mathematics. In our study, it is seen that the findings with significant differences are similar only in the negative attitude sub-dimension of our study. The attitude towards mathematics course is positively related to mathematics achievement. Chen et al. (2018) claimed that attitude towards mathematics was the most important variable in mathematics teaching by determining that many cognitive-emotional factors predicted mathematics success even after taking into account the success of mathematics.

In the research, it was determined that the most popular lesson makes a significant difference in terms of all dependent variables. On the other hand, only the most popular lesson on the attitude towards mathematics lesson was found meaningful. Recber, Isiksal & Koç (2018) reported that gender being among the independent variables of this study is an important predictor of attitudes, anxiety and success towards mathematics. Devine, Fawcet, Szucs & Dowker (2012) found that gender did not significantly differentiate mathematics performance, whereas women's math anxiety was higher than men. The students who show their favorite lesson as a course other than mathematics are higher in their anxiety level. Tuncer and Yılmaz (2016) found a significant difference in favor of students who liked mathematics and other subjects in favor of students who liked mathematics in terms of attitude scores and in terms of anxiety scores in favor of students who liked other subjects. Tuncer & Yılmaz (2016) and Dursun & Bindak (2011) concluded that the anxiety towards mathematics in terms of grade level significantly differentiated in terms of this research.

Another finding of the study is that the academic achievement has a meaningful difference in terms of only the most popular subjects and other independent variables did not significantly differentiate the mathematics achievement. In addition to this, it was determined that academic acihievement and success in mathematics is in a positive directed relation with attitude towards mathematics and in a negative directed relation with anxiety towards mathematics. Desai & Richards (1998) reported that there is a relationship between math anxiety and performance in their research and

emphasized that anxiety should be taken into consideration as a variable during performance enhancement process of the students and learners.

There was a negative and significant relationship between anxiety and attitude towards mathematics. This finding was also obtained by Srivastava, Imam & Singh (2016). Accordingly, one of the motivation or anxiety increases while the other decreases. Accordingly, one of the motivation or anxiety increases while the other decreases. When these findings are compared with the findings in the structural equation model 2 (Figure 2), the motivation can be positively determined to decrease the anxiety. Considering the negative relationship between anxiety and mathematics achievement, the decreasing anxiety stated in the previous sentence may lead to increased success.

A significant difference was found between the fifth and eighth grade students in the positive attitude sub-dimension of the attitude scale towards mathematics lesson. Yaşar (2016) reported that the attitudes of the students towards mathematics class differed significantly in terms of this particular study. The class variable did not cause a significant difference in terms of anxiety and success. Mkhize & Maistry (2017) found that the level of anxiety was very low in the first and second grades in their research conducted with university students. A lower level of anxiety in lower age groups may be considered as an expected condition. However, it is possible to develop a higher anxiety over time due to the problems experienced in the use of acquired information. According to the anxiety scores obtained in this study, a decrease is observed after the fifth grade and then it reaches the highest level in the eighth grade. It is thought that this increase in anxiety scores may be related to the central exam, since a central examination including the mathematics course is carried out in the eighth grade in the Turkish education system.

When the findings of the study and the relationship between these findings and the studies in the literature are evaluated, some important results and conclusions are reached. First of all, it can be seen as an indicator of the attitude of the most popular course variable which is among the independent variables of the research. The most popular course variable has significantly differentiated academic achievement towards mathematics course. There was also a significant relationship between attitude scale and mathematics achievement. Again the process initiated with positive manner in terms of its intermediary effect was found to be effective in terms of prediction is in

compliance with Chen et al.'s (2018) determination of projecting success in mathematics in relation to attitude and Aksu and Bikos' point of view (2002, p. 23) stating that *"The negative attitude towards the course leads to high level of anxiety and low performance".* As a result of this research, we suggest that educators take absolute consideration of the attitude in terms of mathematics achievement. In addition, we can claim that they will have a positive mathematics achievement when they involve the learner's anxiety with the activities that will give a positive attitude in the teaching processes.

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