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The Role of Attitude toward Mathematics, Fear of Negative Evaluation and Stress Level for Academic Expectations in Predicting Mathematics Achievement

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Abstract
The aim of this study is to determine to what extent the emotional factors such as attitude, fear of negative evaluation and stress level for academic expectations predict students' mathematics achievements. In this quantitative study a prediction research design, type of correlational design, was used to anticipate results by using particular variables as predictors. The study was conducted on 352 middle school students attending a middle school in Bursa. Students' mathematics scores, *Mathematics Attitude Scale (MAS), Fear of Negative Evaluation Scale Short Form (FNES) and Academic Expectations Stress Inventory (AESI)* were used for data collection. In order to determine participants' level of attitude toward mathematics, fear of negative evaluation and stress level for academic expectations descriptive statistics were used. Secondly to compare participants' score on three measurements according to their gender, class level, and mathematics scores, multivariate analysis of variance (MANOVA) was employed. According to results gender did not make a significant difference on mathematics attitude, fear of negative evaluation and stress level separately, as well. Class level increases, students' positive attitudes towards mathematics decreases. Students with high mathematics scores had significantly more positive feelings towards mathematics than students with low mathematics scores. The results of correlation analysis indicated that mathematics success was significantly and positively associated to mathematics attitude while it was significantly and negatively associated to fear of negative evaluation and stress for academic expectations.

Keywords: Attitude toward mathematics, Fear of negative evaluation, Mathematics Achievement,

INTRODUCTION

Mathematics is one of the important tools that are used to solve problems not only stated in science, but also faced in everyday life (Gujjar, Bajwa & Shaheen, 2011). It is regarded very significant for a country's future as it sits at the heart of advances in many of today's business. Many people are involved in doing mathematics in some way (Berlinghoff & Gouvêa, 2004). Thus, more mathematics lessons are likely to be taught in schools all around the world than any other subject (Orton, Orton, D. & Frobisher, 2004). Apart from its usage in business, mathematics teaching and learning in schools enable students to improve their thinking and to broaden their horizons. It helps students' full development in todays' complex society (Ignacio, Nieto & Barona, 2006). It helps to equip students for life with skills to work with numbers, money, time, shape and measurement (Gujjar et al., 2011). Despite the value placed on mathematics, it is observed by

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many researchers that students consider it as a hated and boring lesson (Gary & Tall, 1992, Ignacio et, al., 2006). Most of the students throughout the world show poor performance in mathematics (Okigbo & Osuafor, 2008). This situation does not show a difference in Turkey. Latest national and international evaluations have revealed that Turkish students are also in trouble with mathematics (Basturk, 2011; Mullis, Martin, Foy & Arora, 2012; OECD, 2023; OSYM, 2023). For instance, 2023 university entrance exams indicated that of 2.995.638 students who attempted the first stage of the exams, 100271 students scored zero or below in mathematics part (OSYM, 2023).

Internationally looking, 2022 PISA assessment manifested those Turkish students scored 453 points in mathematics, the main theme of the exam, compared to an average of 472 points in OECD countries. This score is the 39th score among OECD countries, and 44th score among 65 participating countries (OECD, 2023). Turkish Ministry of National Education (MEB) took some precautions to reduce these national and international failures in mathematics. MNE, thus, have put mental mathematics and realistic mathematics education projects into implementation. Although extensive researches on the effectiveness of these projects are being conducted by MNE, further studies investigating the underlying factors for mathematics failure need to be carried out. Smith (2004) believes that one of the reasons for failure in mathematics is the shortage of qualified teachers.

However, it is difficult to explain the students' failure in mathematics lessons only by one factor. There may be many reasons that affect the success of students. For example; the abstract language used in mathematics, the students' gender and mathematical intelligence, the education level of students' parents, the teaching methods, the inefficient study, the learning environment, the behaviors of teachers, the lack of motivation, poverty and increasing diversity of the school population can be some of the reasons for the failure in mathematics (Alderman, 2013). It is seen that most of the reasons for mathematics failure consist of cognitive factors. Yet, mathematics depends not only on cognitive abilities but also on emotional factors (Dowker, Bennet& Smith, 2012). McLeod (1992) also states the importance of integrating affective issues into studies of mathematics education to strengthen the researches. It is thought that the emotional factors like attitudes, fear of negative evaluation and stress also have an important role in mathematics success. Therefore, in this study, the effects of these factors in mathematics achievement have been examined.

Affective Factors and Mathematics Success

Success in school usually fits two categories as cognitive and affective (Georgiou, 2008). Cognitive category which consists of cognitive factors such as prior knowledge, self-regulation, reading ability etc. has emerged from researches conducted in the western context. On the contrary, affective category including attitudes, fear, stress etc. has been examined in eastern context. In Turkish context, though the relationship between mathematics success and cognitive factors has been much examined (Arsal, 2009; Bektas, et al. 2015; Ocak &Yamaç, 2013), affective factors (excluding mathematics attitude) has not driven much interest of Turkish researchers. That's mostly because of the complexity and difficulty in assessing affective features of students (Öztürk, Akkan ve Kaplan, 2020).

As Hart (1989) claims, describing affective domain is not an easy task. The meaning of the affective terms changes according to the context in which it is used. They have different meanings in psychology than they have in mathematics. For instance one of the most confused terms, anxiety is described sometimes as fear sometimes as dislike or worry (Hart, 1989). This confusion, unfortunately, remains as a major task for current researchers in both fields. McLeod (1992), giving example of Bloom's taxonomy of the cognitive domain and Krathwohl's taxonomy for the affective domain, indicates that working on cognition seems relatively simple compared to the affective domain. He defines affective domain as a wide range of beliefs, feelings, and moods regarded as going beyond the domain of cognition. He points out that affect is more difficult to be explained and measured in comparison with cognition. However, affective factors play a central role in mathematics learning and instruction (McLeod, 1992). Accordingly, a need has been raised

for the research of mathematics success of students in terms of emotional factors on mathematics lessons. Several studies have showed that emotional factors like attitudes, stress level and fear of negative evaluation may play a significant role in mathematical performance (Ang, Huan & Braman, 2007; Dowker *et al.* 2012; Ekizoglu & Tezer, 2007; Hemmings, Grootenboer & Kay, 2011). DeBellis and Goldin (1991) points out that two levels of affective responses, local and global are important in mathematics education. Local affect refers to the momentary changes in feeling as students solve mathematics problems. Emotions like anxiety, fear, stress etc. are good examples of local affect. Global affect is more stable than local affect. It is related to beliefs and attitudes that the student usually have. The following part discusses attitude as global affect, and fear, and stress as local affect.

Attitude and Mathematics Success

Considerable amount of literature on the affective domain is related to attitudes towards mathematics. Though attitude was described as a term including beliefs in early works (Leder, 1987; Reyes, 1984), McLeod (1992) defines it as affective responses involving positive and negative feelings of moderate intensity and reasonable stability. He maintains that attitudes are more affective and less cognitive than other factors such as beliefs or values. In mathematics education, the feelings like anxiety, confidence, satisfaction and frustration used to describe the responses to mathematical tasks are discussed as attitudes in literature (McLeod, 1992). Attitudes are partly intellectual, partly spiritual, and never innate but always acquired feelings (Ekizoğlu & Tezer, 2007). Mathematics attitudes are viewed as a positive and negative response toward mathematics (Ay, 2017; Hemmings et. al., 2010). As knowledge and skills based on mathematics are required in many fields, it is important to develop a positive attitude in students towards mathematics (Ekizoğlu & Tezer, 2007). A positive attitude toward mathematics reflects a positive emotional disposition in relation to the subject (Mata, Monteiro &Peixoto, 2012).

A large body of literature has investigated the assumption that positive feelings towards mathematics lead to an increase in mathematics performance and conversely negative feelings cause poor mathematics performance. Thus, it seems that there is a reciprocal association between attitudes and mathematics performance. This relationship has drawn much attention of researchers for over 40 years (Ai, 2002; Antonnen, 1969; Demirel and Turkmen, 2023; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; Lipnevich *et al.*, 2011; Ma &Kishor, 1997; Yara, 2009; Yee, 2010). For instance, Antonnen (1969) one of the firsts to examine this relationship, reported a strong positive correlation between attitude and performance. More recently, Dowker *et al.*, (2012), Hemmings *et al.* (2010), Mata *et al.*, (2012) found that positive attitudes towards mathematics increased success in mathematics. In Turkish context, attitudes in mathematics education remain popular, as well. A number of studies have identified a positive association between attitude and success (Öztürk, Akkan ve Kaplan, 2020). Ekizoğlu and Tezer (2007) found that students who had difficulty in understanding the mathematics subjects also had negative attitudes towards mathematics.

Although the relationship between attitude and mathematics success have been mostly investigated in Turkish context, the influential connection between mathematics success and other affective factors such as fear and stress requires further exploration.

Fear of Negative Evaluation and Mathematics Success

As emotions which change rapidly are called as “local response”, fear can be characterized as one of them. Up to now, the local affects have not been major research topic in mathematics education because of the fact that stable affects are easier to measure by questionnaires (McLeod, 1992). Although local affects like fear and stress are difficult to examine, it is crucial to understand the process in mathematics education to increase the success.

The most general expression of fear of negative evaluation is social phobia. Social phobia is identified as distinct and persistent fear that appears in social surroundings or in situations which require performance in front of foreigners (APA, 2000). People with social phobia have a fear for making mistakes (Doğan, 2010). Most of the students keep away from mathematics for this fear

of making mistakes (Kurbanoğlu & Takunyacı, 2012). Individuals regard their own success level on performance as their own identity's success level. Therefore, they are afraid of losing their value in the eyes of their teachers and schoolmates (Şahin, 2004). Moreover, it is stated that individuals who have a high-level fear of mathematics generally make more mistakes while dealing with the mathematical process (Hopko *et al.,* 2003). And this situation shows that there is a link between fear of negative evaluation and mathematics success.

There have been several studies that indicate the relationship between fear of negative evaluation and mathematical success (Bloom & Broder, 1950; Buxton, 1981; Hopko *et al.*, 2003; Reglin, 1990). Students who believe they achieve insufficiently have more fear and anxiety (Reglin, 1990). Thus, they perform unsuccessfully and make more mistakes. Hart (1989) notes that anxiety is sometimes described as fear. There is a relation between anxiety and mathematics performance (Hembree, 1990). Students have poor performance in mathematics tasks when they are anxious.

In the Turkish setting, though there have been several researches that examine the relation between attitude and mathematics success (Ekizoğlu & Tezer, 2007; Yücel & Koç, 2011), limited number of studies have been conducted on the impact of local affective factors like fear, anxiety and mathematics performance. For instance Şahin (2004) investigated high school students' affective responses towards mathematics, and found out that students' fear of mathematics was associated to their mathematics success. As the mathematics success raises the fear level of the students' decreases. Another study by Kurbanoglu and Takunyacı (2012) indicate that students' thoughst about mathematics' being a difficult and an unachievable subject give rise to the fear and anxiety. This affects students' attitudes to mathematics and their self-efficacy. As a result, students perform unsuccessfully.

Stress Level for Academic Expectation

Stress can also be characterized as one of the local responses to mathematics and it is considered to be an absence of inner peace (Seaward, 2008). Everyone is faced by daily stresses. It affects every aspect of life (Calaguas, 2012). In schools, students often see themselves as being evaluated in terms of their academic performance and the academic expectation is one form of academic stress (Ang&Huan, 2006). Academic stress in school surroundings generally arises by students' self-expectations and expectations of others (e.g. parents and teachers). It has been studied extensively as an important factor in college student adjustment (Gall, Evans, & Bellerose, 2000; Mallinckrodt, 1988). Since stress is identified as any factor making adaptation to environment difficult, it is considered that high level of stress for academic expectations affects students' mathematics success negatively.

There have been numerous studies that confirm the relationship between stress for academic expectation and mathematics success (Ang&Huan, 2006; Ang, *et al.*, 2007; Calaguas, 2011; Calaguas, 2012; Kurbanoğlu&Takunyacı, 2012). Calaguas (2012) points out that it could be assumed expectations whether set by one or others were indeed sources of academic stress and thereby affected the mathematics performance of students. When students feel that they cannot succeed a mathematical task, this situation leads to tension and frustration (Bloom & Broder, 1950). When taken into consideration of others' expectations, students feel stressed. Buxton (1981), also notes that the feelings like panic and anxiety disrupt students' ability to concentrate on the task and thereby affect their mathematics success. In Turkish setting the number of the studies which deal with the effect of stress on mathematics achievement is really restricted. For this reason the need for more research on this topic both in Turkey and worldwide is obvious.

As discussed above there have been several studies examining the effect of emotional factors on mathematics achievement. However, the researchers to date have tended to focus on the effect of these factors on mathematics success separately. This paper is significant as it discusses the emotional factors that affect students' mathematics success in tandem. The aim of this study is to determine to what extent the emotional factors such as attitude, fear of negative evaluation and stress level for academic expectations predict students' mathematics achievements. The research questions guided this aim are;

1. Do the students' attitudes toward mathematics, fear of negative evaluation and stress level for academic expectations change according to gender?
2. Do the students' attitudes toward mathematics, fear of negative evaluation and stress level for academic expectations differ according to their class level?
3. Do the students' attitudes toward mathematics, fear of negative evaluation and stress level for academic expectations differ according to their mathematics scores?
4. How well do attitude toward mathematics, fear of negative evaluation and stress level for academic expectations predict mathematics success?
    a. How much variance in mathematics success scores can be explained by scores on these three scales?
    b. Which is the best predictor of mathematics success: attitude toward mathematics, fear of negative evaluation and stress level for academic expectations?

METHOD

Research Design

In this quantitative study a prediction research design, type of correlational design, was used to anticipate results by using particular variables as predictors. In this form of research, the investigator identifies one or more predictor variable and a criterion (or outcome) variable (Creswell, 2012). Correlational research is ideal in providing context, in dealing with many variables, and in establishing the total pattern of relationships (Brown & Hedges, 2009).In this study first, the effect of gender, class level, and mathematics score on attitude toward mathematics, fear of negative evaluation, and stress level for academic expectations was examined, then the predictive power of attitude toward mathematics, fear of negative evaluation, and stress level for academic expectations on mathematics success was examined.

Participants

The study was conducted on 352 middle school students attending a middle school in Bursa (see Table 1). 174 of the participants were female, 178 of them were male.5th graders consisted of 98 students, 6th graders consisted of 94 students, 7th graders consisted of 93 students, and 8th graders consisted of 67 students. Participants' mathematics scores were classified into five categories as determined by MNE. Of the 352 participants 87 of them had 0-44 mathematics scores while 66 had 45-54; 67 had 55-69; 65 had 70-84 and 67 had 85-100 mathematics scores.

Table 1. Demographic distribution of participants

Groups	*f*	*%*
Gender		
Female	174	49,4
Male	178	50,6
Level		
5th grade	98	27,8
6th grade	94	26,7
7th grade	93	26,4
8th grade	67	19,0
Mathematics score		
1 (0-49)	87	24,7
2 (50-59)	66	18,8
3 (60-69)	67	19,0
4 (70-84)	65	18,5
5 (85-100)	67	19,0
Total	352	100,0

Instruments

Mathematics scores of the participants were obtained from school administration within the permissions of participants to use in the study. In Turkey, students' mathematics scores, as in other courses, were measured by taking mean scores of at least two midterms and a final exam at each semester. In these exams students are administered multiple choice achievement tests and their scores are classified into five categories as determined by MNE. According to regulation (Number 33) on measurement and evaluation in elementary schools, the grading scale has been identified for exams, project and performance homeworks as "excellent" for grades between 85-100; "good" for 70-84,99; "intermediary" for 55-69,99; "acceptable" for 45-54,99; and "unsuccessful" for 0-44,99 out of 100 (Turkish Republic Official Journal, 27.8.2003/25212).

Mathematics Attitude Scale (MAS)

MAS was developed by MNE (2009) to determine students' attitude toward mathematics. The psychometric properties of the scale were examined by Yücel and Koç (2011). The confirmatory factor analysis revealed that the scale had acceptable construct validity. Cronbach alpha coefficient for testing internal consistency was found .87 indicating that the scale was reliable. In this study, it was 0,82. The scale consists of 12 five point Likert type items. Categories of scale change between strongly disagree and strongly agree. Half of the items reflect positive attitude toward mathematicsand half of themconsider negative feeling toward mathematics. The maximum score for the scale is 60; the minimum score is 12. Higher score in MAS means positive attitudes towards mathematics.

Fear of Negative Evaluation Scale Short Form (FNES)

The scale was developed by Leary (1983) in order to evaluate the students' fear of negative evaluation. This self-report style scale is used commonly abroad in researches about social phobia. FNES was adapted to Turkish context by Çetin, Doğan and Sapmaz(2010). The Turkish version of the scale consists of 11 five pointLikert type items reflecting fear and anxiety. The maximum score for the scale is 55 point, and the minimum score is 11. The Cronbach alpha coefficiency of the scale was found by Çetin, Doğan and Sapmaz (2010) as 0.84. In the current study, it was 0.77. The higher scores for FNES mean higher fear of negative evaluation in the study.

Academic Expectations Stress Inventory (AESI)

AESI was developed by Ang and Huan (2006) and adapted to Turkish context by Kellecioğlu and Filiz (2009) to determine the stress level for academic expectations. The scale was designed as five point Likert type and consisted of nine items. It has two subscales: family/teachers expectations and self-expectations. The Cronbach alpha coefficiency of the scale was measured by Kellecioğlu and Filiz (2009) as 0.81. In this study, it was 0.84. The maximum score for AESI is 45 and the minimum score is 9. The higher score means the higher stress.

Data Analysis

In the study, the normality test indicated that the data collected had a normal distribution (Kolmogorov Smirnov, $p>0.05$). Therefore, parametric tests were used in the study. In order to determine participants' level of attitude toward mathematics, fear of negative evaluation and stress level for academic expectations descriptive statistics (means, standard deviations etc.) were used. Secondly to compare participants' score on three measurements according to their gender, class level, and mathematics scores,

Multivariate analysis of variance (MANOVA) was employed. MANOVA is a statistical test used to compare multivariate means of several groups. As a multivariate procedure, it is used when there are two or more dependent variables, and is typically followed by significance tests involving individual dependent variables separately. It helps to answer; whether changes in the independent variables have significant effects on the dependent variables; the relationships between the dependent variables, and the relationships between the independent variables. MANOVA was applied in the study since there were correlations between dependent variables,

mathematics attitude, fear of negative evaluation and stress in academic expectations (see Table 6) (Pallant, 2011). Finally, multiple regression analysis was performed to explore interrelationship between dependent (GPA) and independent variables/predictors (Mathematics attitude, fear of negative evaluation, and stress in academic expectations). For the statistical analysis and interpretation of the research data, the significance level was set to $p< .05$. In MANOVA analysis, because of three dependent variables, this alpha level was divided into three as .17 (Bonferroni adjustment).

FINDINGS

The first concern of the study was to determine the students' attitude toward mathematics, fear of negative evaluation and stress level for academic expectations. The results were shown in Table 2.

Table 2. Students' mean scores for MAS, FNES and AESI

Scales	*N*	*M*	*SD*
Attitude	352	44,71	8,07
Fear	352	33,61	7,79
Stress	352	32,48	7,61

The findings indicated that means of students' attitude toward mathematics is moderately high (*M*=44.71; *SD*=8.07). This value shows that students demonstrated positive feelings about mathematics. The mean scores of students in FNES indicated that students' fear of being evaluated negatively is at medium level (*M*=33.61; *SD*=7.79). This highlights that students neither afraid of being evaluated negatively nor positively. The findings revealed that students' scores in AESI were high (*M*=32.48; *SD*=7.61). When considering the maximum score for AESI (45), the revealed mean indicated that the students showed greater stress regarding their academic developments.

The second concern of the study was the comparison of students' scores in MAS, FNES and AESI according to their gender, class level and mathematics score. The first sub-question guided this aim was, *Do the attitudes, fear of negative evaluation and stress levels for academic expectations change according to gender*? The findings regarding this question were shown in Table 3.

Table 3. Comparison of students' scores in MAS, FNES and AESI according to gender

					Wilks' Lambda=.99; η^2=.002		
Source	Dependent Variable	SS	df	MS	F	*p*	η^2
Multivariate Test							
Gender	MAS* FNES* AESI	-	3	-	,277	,842	,002
Between Subject Effects							
Gender	MAS	5,538	1	5,538	,085	,771	,000
	FNES	16,662	1	16,662	,274	,601	,001
	AESI	21,059	1	21,059	,363	,547	,001
Error	MAS	22848,482	350	65,281			
	FNES	21305,448	350	60,873			
	AESI	20316,760	350	58,048			
Total	MAS	726593,000	352				
	FNES	418837,000	352				
	AESI	391618,000	352				

A one-way between-groups multivariate analysis of variance was performed to examine sex differences in mathematics attitude, fear of negative evaluation, and stress for academic expectations. The independent variable was gender. Preliminary assumption testing was conducted to check for normality, linearity, univarite and multivariate outliers, homogeneity of variance covariance matrices, and multicollinearity, with no serious violations noted.

Multivariate analysis of variance test indicated that there was a nonsignificant difference between males and females on the combined dependent variables, $F_{(3, 348)}$ =.28, p = .84; Wilks' Lambda = .98; partial eta squared = .00. Test of between subject-effects was administered to examine

whether males and females differ on all of three dependent measures or just some. The results for the dependent variables when considered separately indicated nonsignificant difference in terms of gender. These findings highlighted that gender had no effect on mathematics attitude, fear of negative evaluation, and stress for academic expectations

The second sub- question guided this study was, *Do the students' attitude toward mathematics , fear of negative evaluation and stress level for academic expectations differ according to their class level?* Since the data violates the assumption of homogeneity of variance-covariance matrices, Pillai's Trace statistics was used instead of Wilks' Lambda. The results were indicated in Table 4.

Table 4. Comparison of students' scores in MAS, FNES and AESI according to class level

					Pillai's Trace =.08; η^2=.027		
Source	Dependent Variable	SS	df	MS	F	*p*	η^2
Multivariate Test							
C.Level	MAS* FNES* AESI	-	9	-	3,167	,001*	,027
Between Subject Effects							
C.Level	MAS	786,718	3	262,239	4,135	,007*	,034
	FNES	1005,375	3	335,125	5,740	,001*	,047
	AESI	317,977	3	105,992	1,842	,139	,016
Error	MAS	22067,302	348	63,412			
	FNES	20316,736	348	58,381			
	AESI	20019,841	348	57,528			
Total	MAS	726593,000	352				
	FNES	418837,000	352				
	AESI	391618,000	352				

*p<0.05

MANOVA analysis showed that there was a statistically significant difference between 5th, 6th, 7th and 8th grade students in terms of their mathematics attitude, fear of negative evaluation, and stress for academic expectations $F_{(9,348)}$=3,167; p=.001, Pillai's Trace =.08; η^2=.027. When the results for the dependent variables were considered separately, using Bonferroni adjusted alpha level of .017 the differences to reach statistical significance were mathematics attitude $F_{(3,348)}$= 4.135, p=.007, partial eta squared = .03 and fear of negative evaluation $F_{(3,348)}$= 5.740, p=.001, partial eta squared = .05. There was no significant difference in terms of stress for academic expectations $F_{(3,348)}$=1.842, p=.14, partial eta squared = .02.

Further analyses using the Tukey HSD test indicated that the mean score in MAS for 5th grade students (M= 46.35, SD = 7.13) was significantly different from 8th grade students (M= 41, 93 SD= 7.87). 6th grade students (M= 44.80, SD= 8.99) did not differ significantly from 5th grade students, 7th grade students or 8th grade students. These findings indicated that 5th grade students who newly started middle school, showed significantly more positive feelings toward mathematics than did the other groups. As students' class level increases, students' attitude toward mathematics decreases.

Tukey HSD test for FNES showed that mean scores for 6th grade students (M=34.48, SD=7.03), 7th grade students (M=35.13, SD=6.94) and 8th grade students (M=34.16, SD=8.76) were significantly different from 5th grade students (M=30.94, SD=8.01). These findings indicated that 5th grade students have less fear of negative evaluation than the other groups. The higher scores for FNES mean higher fear of negative evaluation in the study.

Students' stress for academic expectations did not change significantly according to their class levels. On the other hand, 8th grade students (M=33.82, SD=7.80) showed higher academic expectation stress in AESI than did the other groups. Mean scores for AESI indicated that as class level increases, students stress level increase. This is probably because of national examinations on entrance to high schools.

The third sub-question guided this study was, *Do attitude toward mathematics, fear of negative evaluation and stress level for academic expectations differ according to their mathematics scores?* The results were indicated in Table 5.

Table 5. Students' scores in MAS, FNES and AESI according to their mathematics scores

					Pillai's Trace =.72; η^2=.24		
Source	Dependent Variable	SS	df	MS	F	*p*	η^2
Multivariate Test							
M.Score	MAS* FNES* AESI	-	12	-	27.188	,001*	,239
Between Subject Effects							
M.Score	MAS	6115,981	4	1528,995	31,698	,001*	,268
	FNES	10253,455	4	2563,364	80,361	,001*	,481
	AESI	8651,538	4	2162,884	64,222	,001*	,425
Error	MAS	16738,039	347	48,236			
	FNES	11068,656	347	31,898			
	AESI	11686,280	347	33,678			
Total	MAS	726593,000	352				
	FNES	418837,000	352				
	AESI	391618,000	352				

*p<0.05

A one-way between-groups multivariate analysis of variance was performed to examine mathematics scores in affective variables. Students were divided into five groups according to their mathematics scores (Group 1: 0-44; Group 2: 45-54; Group 3: 55-69; Group 4: 70-84; Group 5: 85-100).Preliminary assumption testing was conducted to check for normality, linearity, univarite and multivariate outliers, and multicollinearity, with no serious violations noted. However, since the data violate the assumption of homogeneity of variance-covariance matrices, Pillai's Trace statist ics was used instead of Wilks' Lambda.

Multivariate test results manifested that there was a statistically significant difference between mathematics scores on the combined dependent variables, $F_{(12,\ 347)}$ = 27.188, *p*= .001; Pillai's Trace=.72;partial eta squared = .24. the results of Between Subject-Effects test for the dependent variables, when considered separately, indicated a statistically significant difference in MAS scores for the five groups: $F_{(4,\ 347)}$ =31.7, *p*=.001, partial eta squared = .27. The effect size was found large. This represents 27 per cent of the variance in mathematics attitude explained by mathematics score. Further analyses using the Tukey HSD test indicated that the mean score for Group 5 (*M*= 52.30;*SD*= 5.20) was significantly different from Group 1, Group 2, Group 3 and Group 4. These findings clearly indicated that as mathematics scores of students increase their attitude toward mathematics increases, as well.

Test of Between Subject-Effects also revealed that students' mathematics scores had effect on their fear of negative evaluation $F_{(4,\ 347)}$ =80.361, *p*=.001, partial eta squared = .48.The mean scores for the groups showed that students with low mathematics score demonstrated significantly higher fear than the other students with high mathematics score (Low mathematics score=High FNE). Further analyses using the Tukey HSD test indicated that the mean score for Group 1 (M = 40.05, SD = 4.58) was significantly different from all groups. This shows that students with low achievement afraid of being negatively evaluated.

The test also manifested that there was a significant difference between students' stress for academic expectations according to their mathematics scores, $F_{(4,\ 347)}$=64.222, p=.001, partial eta squared = .43. The results showed that students with low mathematics scores (Group 1, M=37.73, SD=4.36 and Group 2, M=36.10, SD=6.32) demonstrated significantly higher stress in academic expectations than did the other students. These findings highlighted that mathematics scores have large effect on students' stress in academic expectations. The results also indicated that as students' mathematics scores increase, their stress levels decrease.

Factors Associated to Students' Grade Point Average

The relationship among students' mathematics scores and mathematics attitude, fear of negative evaluation, and stress for academic expectations were investigated using simple correlation and multiple regression analysis. Firstly correlations between all factors were determined to indicate which factors shared the most common variances (Table 6). The test results manifested significant correlations between three variables. Students' mathematics scores were significantly and positively associated with their mathematics attitude (*r*=.49), but they were significantly and negatively related to fear of negative evaluation (*r*=-,63) and stress for academic expectations (*r*=-,61). These findings suggest that students' mathematics attitude, fear of negative evaluation and stress for academic expectations may predict their mathematics score.

Table 6. Simple correlation and multiple regression results

Dependent Variable	*Multiple Correlation (R=0.76)* R^2*=0.57,5;* $F_{(3,351)}$*=157.157** Predicting Variable	*r*	*B*	*SE*	*Beta*	*t*	*p*	*Tol.*
Maths scores	(Constant)		5,624			11,251	,001	
	Mathematics attitude	,49*	,042	,007	,234*	6,095	,001	,826
	Fear of Negative Evaluation	-,63*	-,073	,007	-,393*	-9,879	,001	,770
	Stress for Academic Expectations	-,61*	-,067	,008	-,348*	-8,587	,001	,741

*p< 0.01

Table 6 indicated that the regression was pretty good (R^2=.57,5) and the overall relationship was significant [$F_{(3,351)}$ =157.16, *p*=.001] for students' mathematics score. This indicates that, when all predictors taken together, they are significantly associated with mathematics scores. The model (which includes the variables of mathematics attitude, fear of negative evaluation and stress for academic expectations) explained 57.5 percent of the variance in mathematics score. The regression analysis also indicated which of the variables included in the model contributed to the prediction of mathematics success. The results showed that fear of negative evaluation made the strongest and statistically significant unique contribution to explaining the mathematics success (beta=-39), when the variance explained by all other variables in the model is controlled for. The beta value for stress for academic expectations was slightly lower (beta= -35), indicating that it made less of a unique contribution. Finally mathematics attitude made the least and significant unique contribution (beta=23) to explaining mathematics success. The results in Table 6 affirm that holding everything else constant one unit increase in mathematics attitude will increase mathematics success by ,042 points; and one unit decrease in Fear of Negative Evaluation and Stress for Academic Expectations will reduce mathematics achievement by ,073 and ,067, respectively. Thus explicit regression equation for estimating the mathematics success can be written as:

*Mat. Ach.= 5,624+,042*Mathematics attitude -,072* Fear of Negative Evaluation -,067* Stress for Academic Expectations*

The findings indicated that there is no collinearity problem among these multiple relationships, as well (ranging from0.83 to 0.74).

DISCUSSION AND CONCLUSION

Success in mathematics has been a great concern of researchers for many years. Numerous studies have attempted to explain the relationship especially between cognitive factors and mathematics success (Cascallar&Musso, 2008; Dursun&Dede, 2004; Hemmings, 2010; Yates, 2000). However, mathematics success depends not only on cognitive abilities but also on emotional factors (Dowker et al., 2012). Affective variables are associated to mathematics learning in several ways. Students who feel positive about mathematics will succeed at a higher level than students who have negative attitudes towards it. Students who are more successful will also enjoy mathematics more than students who do poorly in it. Thus, studying affective factors in mathematics education is crucial to find ways to help students learn more about mathematics (Reyes, 1984). This study is thought to be significant in that it adds to the literature by putting emphasis on affective factors

such as attitudes, fear of negative evaluation and stress for academic expectation. Moreover, although there are several studies which indicate the effect of attitudes, fear of negative evaluation and stress for academic expectation on mathematic performance one by one, there is no study which handle these variables as a whole. This study also adds to the mathematics literature by examining the predictivity power of these variables on mathematic success.

The first concern of the study was to examine the impact of gender on students' mathematics attitude, fear of negative evaluation and stress level. MANOVA analysis indicated that students' gender made no significant difference on the combined dependent variables (MA, FNES and SL). This highlights that being a girl or boy does not influence students' emotional well-being towards mathematics. Further analysis showed that gender did not make a significant difference on mathematics attitude, fear of negative evaluation and stress level separately, as well. The findings of the current study indicated that there is not a statistically significant difference between male and female students' mathematics attitudes. This supports results from previous studies (Akdemir, 2006; Dowker*et al.,* 2012; Georgiou *et al.*, 2007; Ma &Kisher, 1997) which found that male and female students showed almost same feelings towards mathematics. However some other studies indicated more clear gender differences in mathematics attitudes (Cvencek*et al.,* 2011; Frost *et al.,* 1994; Leder, 1995; Tocci& Engelhard, 1991). Gender is a significant indicator of mathematics attitude (Frost *et al.,* 1994; Leder, 1995). Else-Quest, Hyde and Linn (2010) reported that boys have more positive attitudes and affect than girls. Affect and mathematics attitude are not the only influences on the development of gender differences in mathematics performance. However, attitudes are important, and both male and female attitudes should be taken into consideration in conjunction with other social and political influences (Hyde *et al.*, 2006).

The findings of the current study regarding fear of negative evaluation and stress level for academic expectation indicated that students' gender did not make a significant difference in these two variables, as well. The findings of Birgin*et al.*, (2010), and Hummer (1998) support this finding. However, these findings of the current study do not support the previous researches which manifested that gender was associated with mathematics anxiety (Baloğlu&Koçak, 2006; Devine *et al.*, 2012; Frost *et al.*, 1994; Hembree, 1990; Miller &Bichsel, 2004; Stipek, &Gralinski, 1991; Zahner, *et al.*, 2010). A number of studies have supported that female students experience more mathematics anxiety than male students (Abed &Alkhateeb, 2001; Benson, 1989; Cook, 1998; D'Ailly&Bergering, 1992; Flessati& Jamieson, 1991; Hyde*et al.*, 1990; Lussier, 1996; Tobias, 1991). According to findings of these studies fear of negative evaluation and mathematics anxiety were significantly higher in girls. Female students have lower self confidence in mathematics and thereby have more mathematics anxiety (Frost *et al.*, 1994). The study of Devine *et al.*, (2012) also indicated that girls have higher levels of mathematics anxiety than boys. However, they did not show gender difference on their mathematics performance. Eman*et al.,* (2012) note in their study that female students are more prone to test anxiety and examination stress than males.

The second concern that guided the study was to examine the effect of students' class level on their emotional well-being about mathematics (MA, FNES & SL). The analysis showed that students' overall emotions towards mathematics changed according to their class levels. Results indicated that as class level increases, students' positive attitudes towards mathematics decreases. It is encouraging to compare this with the finding of Nicolaidou and Philippou (2003) who claimed that when students first go to school, they usually have positive feelings towards mathematics as they progress their attitudes become less positive. Köğce*et al.* (2009) also indicated that 8th grade students had lower attitudes than 6th grade students had. The pressure of students' families and teachers to perform well or over demanding mathematics took can be a possible explanation for this result. Although the results are consistent with the mentioned studies, they differ from some published studies (Dowker*et al.*, 2012; Gierl&Bisanz, 1995). A recent study by Dowker*et al.* (2012) showed that year group made significant differences in favor of high-grade students. Gierl and Bisanz (1995) manifested that older students tended to show more positive attitudes toward mathematics than did the younger students.

This study also highlighted that younger students showed less fear of negative evaluation than did the older students. Students who fail to reach a solution frequently report feelings of frustration or even panic (McLeod, 1993). Numerous studies indicated that grade level or age made significant differences in students' mathematics anxiety (Birgin*et al.*, 2010; Baloğlu&Koçak, 2006; Dew *et al.*, 1983; Hembree, 1990;Lent *et al.*, 1984; Mutodi&Ngirande, 2014; Rambow, 2008). Hembree (1990) in his mata-analysis including 151 studies found that mathematics anxiety levels of 9th, 10th grade students were higher than 6th grade students. Zahner, et. al., 2010, Birgin*et al.*, (2010), and Baloğlu&Koçak (2006) found that as grades increase, mathematics anxiety levels increase. Rambow (2008) noted that older women experienced a significantly high level of mathematics anxiety. This result of the current study may be explained by the fact that as age or class level increases, students feel themselves under pressure to perform good in mathematics school examinations which is the dominant and determinant course in Turkey. In contrast to earlier findings, some studies revealed that age and class level did not have statistically significant effect on mathematics anxiety (Betz, 1978; Calvert, 1981; Hopko, 2003; Ma, 1999; McCarty, 1986).

Another concern of the study was to find out the effect of combined affective factors on students' mathematics grades. Multivariate analysis of variance indicated that the main effect was significant. Students' affective conditions differed according to their scores in mathematics. When the variables analyzed separately, significant differences were calculated for mathematics attitude, fear of negative evaluation and academic expectation stress level. Students with high mathematics scores had significantly more positive feelings towards mathematics than students with low mathematics scores. As discussed in literature part, attitudes towards mathematics have drawn much attention among affective factors for 40 years. Both initial (Antonnen, 1969; Aiken, 1974; Coxford, 1971; Higgings, 1970; Fennema& Sherman, 1976) and recent studies (Mata*et al.*, 2012; Phelps, 2010) highlighted that attitude towards mathematics and mathematics success had a reciprocal relationship. As positive attitude towards mathematics increases, mathematics success increases as well and vice versa.

The current study also manifested that fear of negative evaluation and stress had significant effect on mathematics success. Students with low mathematics success showed higher fear than students with high mathematics success. Hembree (1990) found out in 151 studies that poor performance in mathematics is related to mathematics fear or anxiety. Ma (1999) in his meta-analysis study showed a significant correlation for the relationship between mathematics anxiety and performance. Hopko*et al.*, 2003, andReglin (1990) claimed that students with a high level of mathematics fear or anxiety tend to make more mistakes while dealing with mathematics problems. Attitudes of mathematics teachers, inadequate course books, and parental attitudes may be accepted as the preliminary factors of fear of mathematics (Baloğlu&Koçak, 2006). The current study also indicated that students' stress level for academic expectation had a large and significant effect on students' mathematics success. Students' stress levels changed significantly according to students' mathematics success. Results showed that students with higher stress for academic expectation had low mathematics scores, as well. This finding is in good agreement with the findings of Ang and Huan, (2006), and Zan*et al.* (2006).

The last concern of the study was to examine the predictive power of affective variables (attitudes towards mathematics, fear of negative evaluation, and stress for academic expectations) on mathematics success. Initially, the results of correlation analysis indicated that mathematics success was significantly and positively associated to mathematics attitude while it was significantly and negatively associated to fear of negative evaluation and stress for academic expectations. These results highlighted that as students' fear of negative evaluation and stress for academic expectations increase their mathematics success decreases. However, their achievement increases with the increase in mathematics attitude. The regression analysis manifested that all three variables together explained more than half of the variance in mathematics success. Among these variables fear of negative evaluation made the strongest contribution to explaining the mathematics success when the variance of other variables was controlled for. Vukovic*et al.*, (2013), examining the predictive power of mathematics anxiety,

revealed that mathematics anxiety contributed unique variance to both calculation skills and mathematics applications concurrently.

In Turkish setting, Erden and Akgül (2010) found out that mathematics anxiety was one of the significant predictor of mathematics achievement. As well as fear of negative evaluation, stress for academic expectations also made a significant contribution to explaining mathematics success. It is striking that these two affective factors explain important portion in mathematics success. Thus, it can be suggested that teachers should avoid the factors causing fear of making mistakes, negative evaluation, and stress in mathematics. According to Jackson and Leffingwell (1999) teachers' behaviors like negative speech, insufficient feedback, ignoring students or disappointing them may cause mathematics anxiety and stress in a period starting from kindergarten to college. Finally, attitude towards mathematics made a significant contribution to explaining mathematics success when the variance of other variables was controlled for.

Despite the study providing valuable information about the predictors of mathematics success, and the factors affecting mathematics attitude, fear of negative evaluation, and stress for academic expectations there are nevertheless some certain limitations. Firstly, the sample is relatively small. Only one middle school was involved in the study. It is important for future studies to extend both the number and the range of the sample. This is a self-report study. The opinions of students were taken only by applying three instruments. However, for future studies, it would be desirable to include other measures like observation of the students and behavioral measures (Students' responses when given a choice between activities with and without mathematical content). Another limitation of the study is the fact that only quantitative data was collected and analyzed. Although this bias was reduced by applying the appropriate statistical analyses, it could be supported with qualitative data and longitudinal studies to provide more concrete findings and a deeper understanding of the role of affective factors on mathematics achievement. Despite such potential limitations, the study provides valuable information about the role of affective factors such as attitude, fear of negative evaluation and stress level for academic expectations in predicting mats achievement. The results of the current study help us to enhance understanding of the affective factors' role on mathematics success and add to a growing body of literature on this subject. Teachers should receive training to make math interesting and accessible, employing effective pedagogical strategies. Regular and constructive feedback should be given to students to encourage them when they succeed in math, boosting their motivation. Examples and applications relating math to real-life scenarios can positively influence students' attitudes towards math. Creating a supportive environment that emphasizes students' achievements in math can increase their academic expectations. Teaching students coping strategies for dealing with math-related stress can be beneficial, helping them manage anxiety during exams. Teachers can differentiate math lessons to accommodate students' various learning styles and needs, ensuring each student learns effectively.

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