AN INVESTIGATION OF THE RELATIONSHIP AMONG THE SEVENTH GRADE STUDENTS' MATHEMATICS SELF EFFICACY, MATHEMATICS ANXIETY, ATTITUDES TOWARDS MATHEMATICS AND MATHEMATICS ACHIEVEMENT REGARDING GENDER AND SCHOOL TYPE

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Approval of the Graduate School of Social Sciences

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ABSTRACT

AN INVESTIGATION OF THE RELATIONSHIP AMONG THE SEVENTH GRADE STUDENTS' MATHEMATICS SELF EFFICACY, MATHEMATICS ANXIETY, ATTITUDES TOWARDS MATHEMATICS AND MATHEMATICS ACHIEVEMENT REGARDING GENDER AND SCHOOL TYPE

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The purpose of this study was to investigate the relationship among the seventh grade students' mathematics self efficacy, mathematics anxiety, attitudes towards mathematics, and mathematics achievements regarding gender and school type. Moreover, the role of three personal constructs (self efficacy, anxiety and attitude) and two demographics (gender and school type) on predicting mathematics achievement were also investigated.

The Data was collected from 13 elementary schools in Çankaya District of Ankara in spring semester of 2010-2011 academic years. The total of 934 seventh grade students (477 female and 457 male) participated in the study. The participants were given three self reports; Mathematics Self Efficacy Scale (MSES), Mathematics Anxiety Scale (MANX) and Mathematics Attitude Scale (MAS), in order to quantify the levels of mathematics self efficacy, anxiety and attitude towards mathematics, respectively. Besides, Level Determination Exam (LDE) 2010 Mathematics Subtest

Scores of participants were used to determine the students' mathematics achievement. Causal comparative and correlation research design were used in this study. In addition, two way ANOVA and multiple regression analysis were performed to examine the data.

Two way ANOVA results yielded that there was no interaction effect of gender and school type on personal constructs and mathematics achievement. Moreover, gender had significant main effect on each variable whereas school type had only main effect on attitude. Regression analyses revealed that four of the independent variables (self efficacy, anxiety, attitude and gender) were significantly correlated with the dependent variable (achievement). In addition, it was found that all the variables other than school type were significant predictor of achievement.

Keywords: Self Efficacy, Anxiety, Attitudes, Achievement

ÖZ

İLKÖĞRETİM YEDİNCİ SINIF ÖĞRENCİLERİNİN MATEMATİK ÖZ YETERLİK ALGISI, MATEMATİK KAYGISI, MATEMATİK DERSİNE KARŞI TUTUM VE MATEMATİK BAŞARILARI ARASINDAKİ İLİŞKİNİN CİNSİYET VE OKUL TÜRÜNE GÖRE İNCELENMESİ

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Bu çalışmanın amacı, ilköğretim yedinci sınıf öğrencilerinin matematik öz yeterlik algısı, matematik kaygısı, matematik dersine karşı tutum ve matematik başarıları arasındaki ilişkiyi, cinsiyet ve okul türü değişkenlerine göre incelemektir. Çalışmanın bir diğer amacı ise, kişisel değişkenler ile cinsiyet ve okul türünün matematik başarısını yordama düzeyini incelemektir.

Çalışmanın verileri 2010-2011 akademik yılının bahar döneminde, Ankara'nın Çankaya ilçesindeki 13 ilköğretim okulundan toplanmıştır. Çalışmaya toplam 934 ilköğretim yedinci sınıf öğrencisi (477 kız ve 457 erkek) katılmıştır. Katılımcıların matematik öz yeterlik algılarını, matematik kaygılarını ve matematik dersine karşı tutumlarını belirlemek için sırasıyla Matematik Öz Yeterlik Anketi, Matematik Kaygı Anketi ve Matematik Tutum Anketi uygulanmıştır. Buna ek olarak, katılımcıların matematik başarı düzeyini tespit etmek için ise 2010 Seviye Belirleme Sınavı-SBS matematik sonuçları esas alınmıştır. Bu çalışma kapsamında,

nedensel karşılaştırma ve korelasyonel araştırma modelleri kullanılmıştır. Anket sonuçlarından elde edilen verilerin analizi için iki yönlü varyans analizi ile çoklu regresyon analizi gerçekleştirilmiştir.

İki yönlü varyans analiz sonuçları, cinsiyetin çalışmadaki her kişisel değişken üzerinde anlamlı bir etkiye sahip olduğunu ortaya konmuştur. Okul türünün ise sadece tutum değişkeni üzerinde anlamlı bir etkisinin olduğu tespit edilmiştir. Ayrıca, regresyon analiz sonuçları, öz yeterlik, kaygı, tutum ve cinsiyet değişkenleri ile başarı değişkeni arasında istatistiksel olarak anlamlı bir ilişki olduğunu dolayısıyla okul türü dışındaki her bir değişkenin başarıyı anlamlı bir şekilde yordama gücüne sahip olduğunu göstermiştir.

Anahtar Kelimeler: Öz Yeterlik, Kaygı, Tutum ve Başarı

To My Mother, Father and Sister

Who always shown their love and trust in me

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ABBREVIATIONS

ANOVA: Analysis of Variance

B: Standardized Beta Value

R: Correlation Coefficient

df: Degree of freedom

DV: Dependent Variable

f: Frequency

IV(s): Independent Variables

LDE: Level Determination Exam

MANX: Mathematics Anxiety Scale

MAS: Mathematics Attitude Scale

MSES: Mathematics Self Efficacy Scale

M: Mean

MoNE: Minister of National Education

MRA: Multiple Regression Analysis

NCTM: National Council of Teachers of Mathematics

m: Number of predictor variables

PISA: Program for International Student Assessment

N: Sample size

p: Significance level

SD: Standard deviation

TIMMS: Trend in International Mathematics and Science Study

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The important goals of mathematics education in all grade levels are becoming confident and capable mathematics learners, developing a positive attitude towards the use of mathematics and becoming autonomous mathematics learners (National Council of Teachers of Mathematics [NCTM], 2000). However, the continuing problem of mathematics education is that many students show poor performance in mathematics and leave schools with inadequate mathematics skills all over the world (NCTM, 2000).

Poor academic performance does not have to mean that students do not have the ability to do well in mathematics; however it does mean that students may avoid actively participating the class and avoid enrolling mathematics with their own choices ruled by their emotions and self beliefs rather than lack of ability (Geoghegan, 2002). Those emotions and self beliefs have particular importance for students' mathematics performance (Schunk, 1984). Despite the fact that the mathematics is viewed as cognitive and emotion-free discipline, the affective dimension should not be ignored. In particular, strong negative emotions lead little or no experiences in mathematics, whereas strong positive emotions lead more experiences (Hembree, 1990; Pajares, 1999). For instance, among the students only who feel helpless, inadequate or anxious are apt to give up in the face of difficulties and failures. If one considers that the mathematics is a domain where failure is explicit (Yates, 1999), it is much easier for students to doubt on their abilities. On the contrary, among the students who feel adequate and efficacious are prone to try hard and put much effort to succeed. That is, if one believes his/her abilities in doing

mathematics, then mathematics becomes a domain where achievement is inevitable (Yates, 1999). Hence, it is believed that the personal constructs are important factors in explaining mathematics performance. Therefore, personal constructs are the main concern for the present study.

Since the last two decades, it has been a widespread issue among social scientists to investigate the influence of personal constructs on mathematics achievement. There have been lots of studies conducted in order to understand the nature of personal constructs such as mathematics self efficacy, mathematics anxiety and attitudes towards mathematics, believed to be helpful in explaining mathematics achievements (Ma, 1989; Pajares & Hembree, 1990; Schunk, 1983; 1984; Thomas, Iventosch, & Rohwer, 1987; Williams, 1994; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Martinez-Pons, 1990).

According to the literature, among the personal constructs, self efficacy belief which is defined as a situational or problem-specific assessment of an individual's confidence in her or his ability to successfully perform or accomplish a particular task or problem (Hackett and Betz, 1989), is found to be one of the most critical variables for explaining difference in mathematics performance of students (Bandura, 1977, 1982). Research reveals that self efficacy beliefs itself explains quarter of the variance while predicting students' mathematics achievements (Pajares, 2006). Similarly, mathematics self-efficacy is a stronger predictor of mathematics achievements than both mathematics anxiety and previous mathematics experience (Pajares & Miller, 1994; Pajares & Miller, 1995) and influences students' mathematics achievements as much as their general mental ability (Pajares & Kranzler, 1995). Moreover, self efficacy beliefs have a strong influence on the choice whether to engage in a task, the amount of effort in performing it and persistence in achievement (Bandura, 1977; Bandura & Schunk, 1981; Barling & Beattie, 1984; Brown & Lent & Larkin, 1989; Hackett & Betz, 1989) as well as the standard and quality of performance (Bandura, 1986; Locke & Latham, 1990; MoNE, 1994; Wood & Locke, 1987). Although self efficacy is a crucial factor in explaining the nature of

mathematics performance of students, the studies related to self efficacy beliefs of elementary students are in scarce in Turkey. In other words, lots of studies conducted in Turkey related to self efficacy beliefs included mostly pre-service teachers rather than elementary school students (Aşkar, 1986). Therefore, mathematics self efficacy of elementary students is one of the concerns for the present study.

Students' level of anxiety is believed to be another more critical factor in order to explain the nature of mathematics performance (Hembree, 1990; Ma, 1999; McLeod, 1992; Richardson & Suinn, 1972; Spielberger, 1988; Tobias, 1978; Wigfield & Meece, 1988). Anxiety in mathematics refers to the feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (Richardson & Suinn, 1972). It was claimed that the beginning point of anxiety can be considered as early as elementary mathematics classes and experiences during elementary years (Harper & Deane, 1998). Those experiences lower confidence of students in their mathematics abilities leading to avoiding mathematics. Research studies revealed that students, who have high levels of mathematics anxiety, display lower levels of mathematics performance (Adams & Holcomb, 1986; Betz, 1978; Brush, 1978; Cooper & Robinson, 1991; Cowen, Zax, Klein, Izzo, & Trost, 1963; Dew, Galassi, & Galassi, 1984; Lunneborg, 1964; Resnick, Viehe, & Siegel, 1982; Suinn, Edie, Nicoletti, & Spinelli, 1972; Wigfield & Meece, 1988) and may be less likely to follow mathematics courses (Hembree, 1990; Richardson & Suinn, 1972). To state differently, many students who suffer from math anxiety have little confidence in their ability to do math, and tend to take the minimum number of required mathematics courses (Pajares, 2006). Hence, this leads to low self efficacy beliefs and negative attitudes towards mathematics. As can be seen from the literature, anxiety has a negative direct influence on self confidence in mathematics and attitudes of students towards mathematics. In addition, it has an indirect hindering effect on mathematics performance. Hence, it is believed that anxiety is an important variable in mathematics achievement of elementary students. However, the number of studies investigating the effect of mathematics anxiety on mathematics

achievements of elementary grades is limited (Cooper & Robinson, 1991; Ma, 1999). Therefore, anxiety is another concern for this study.

Attitude towards a domain is another critical variable drawn social scientists attention on explaining mathematics achievement due to crucial role in both teaching and learning of mathematics (Aiken, 1970; Robinson, 1975). Attitude refers to a learned disposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept or another person. Research on attitude has been particularly contradictory and confusing, due to the fact that it has given more emphasis to creating measurement instruments rather than elaborating on a theoretical framework (Kulm, 1980; McLeod, 1992; Ruffell, Mason & Allen, 1998). That is, due to lack of theoretical framework that characterizes the researches on attitude, the findings of studies related to attitudes towards mathematics have been inconsistent. In fact, when attitudes were used in order to explain achievement in mathematics, most of the researchers found statistically significant positive correlations (Aiken, 1970, 1976; Neale, 1969). It is also claimed that positive attitude toward mathematics also have an influence on student motivation toward mathematics (Haladyna, Shaughnessy & Shaughnessy, 1983) and the intention to learn mathematics (Norwich & Jaeger, 1989). On the contrary, there have been counter-researchers claimed that there was not any statistical significance between attitude toward mathematics and achievement in mathematics (Robinson, 1975; Ma & Kishor, 1997). In brief, the literature revealed that attitude was an important factor for mathematics performance of students and other personal constructs. On the other hand, it was an inconclusive issue. Therefore, attitude towards mathematics is another concern for the present study.

Despite the fact that personal constructs are such important factors in explaining mathematics achievement, the influence of self efficacy, anxiety and attitude on mathematics achievement have been investigated separately in most of the researches. In general, duo relationship such as self efficacy versus mathematics achievement has been investigated. However, the researches investigating the

influence of all these variables together on mathematics achievement are limited both in Turkey and abroad (Baloğlu, 2010; Pajares & Miller, 1994). Therefore, the role of all these variables on predicting mathematics achievement is a concern for the present study.

In this study, personal constructs such as self efficacy, anxiety and attitude, and their influence on mathematics achievement were investigated. In addition to these variables, two demographics, gender and school type, were added to the study. Indeed, there have been studies explaining the difference in affective and attitudinal factors with respect to gender and school type in the literature (Fennema, 1998). Most of those studies related to differences in personal constructs investigated the effect of gender (Fennema & Sherman, 1978; Pajares & Miller, 1994; Skaalvik & Rankin, 1994). However, the findings of those studies explaining the difference in mathematics self efficacy, mathematics anxiety and attitude towards mathematics with respect to gender were not determined as consistent as differences in achievement scores (Fennema & Sherman, 1978; Goodwin, 2009; Ma, 1989). Hence, gender is a concern for this study. On the other hand, there have been few studies related to the effect of school type on these personal constructs in United States (Lubienski, 2003). In these studies, the influence of religious, charter and private schools on mathematics achievement were investigated and it was revealed that the school type had a significant influence on achievement in the favor of private school (Lubienski, 2003). However, there are limited number of studies related the effect of school type on achievement in Turkey (Baloğlu, 2010). Therefore, the school type is another concern for the present study in order to reflect the difference in self efficacy, anxiety and attitudes in mathematics.

1.2 Purpose of the Study

As it was seen above literature, the main purpose of this study is to investigate the relationships among seventh grade students' mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics

achievements in terms of gender and school type. Another purpose is to examine the role of three personal constructs (mathematics self efficacy, mathematics anxiety and attitude towards mathematics) and two demographics (Gender and school type) on predicting mathematics performance of seventh grade students in Turkey.

1.3 Research Questions and Hypothesis

The following research questions are going to be investigated in this study and hypothesis are formulated as follows:

RQ1. Is there a significant mean difference in seventh grade students' mathematics self efficacy scores in terms of gender and school type?

Sub-Question 1: Is there a significant influence of gender-school type interaction on seventh grade students' mathematics self efficacy scores?

H_0: There is no significant influence of gender-school type interaction on seventh grade students' mathematics self efficacy scores.

Sub-Question 2: Is there a significant mean difference in male and female students' mathematics self efficacy scores?

H_0: There is no significant mean difference in male and female students' mathematics self efficacy scores.

Sub-Question 3: Is there a significant mean difference in seventh grade students' mathematics self efficacy scores who are enrolled in public and private schools?

H_0: There is no significant mean difference in seventh grade students' mathematics self efficacy scores who are enrolled in public and private schools.

RQ2. Is there a significant mean difference in seventh grade students' mathematics anxiety scores in terms of gender and school type?

Sub-Question 1: Is there a significant influence of gender-school type interaction on seventh grade students' mathematics anxiety scores?

H_0: There is no significant influence of gender-school type interaction on seventh grade students' mathematics anxiety scores.

Sub-Question 2: Is there a significant mean difference in male and female students' mathematics anxiety scores?

H_0: There is no significant mean difference in male and female students' mathematics anxiety scores.

Sub-Question 3: Is there a significant mean difference in seventh grade students' mathematics anxiety scores who are enrolled in public and private schools?

H_0: There is no significant mean difference in seventh grade students' mathematics anxiety scores who are enrolled in public and private schools.

RQ3. Is there a significant mean difference in seventh grade students' attitude towards mathematics scores in terms of gender and school type?

Sub-Question 1: Is there a significant influence of gender-school type interaction on seventh grade students' attitudes towards mathematics scores?

H_0: There is no significant influence of gender-school type interaction on seventh grade students' attitudes towards mathematics scores.

Sub-Question 2: Is there a significant mean difference in male and female students' attitude towards mathematics scores?

H_0: There is no significant mean difference in male and female students' attitude towards mathematics scores.

Sub-Question 3: Is there a significant mean difference in seventh grades students' attitudes towards mathematics scores who are enrolled in public and private schools?

H_0: There is no significant mean difference in seventh grade students' attitudes towards mathematics scores who are enrolled in public and private schools.

RQ4. Is there a significant mean difference in seventh grade students' mathematics achievement scores in terms of gender and school type?

Sub-Question 1: Is there a significant influence of gender-school type interaction on seventh grade students' mathematics achievement scores?

H_0: There is no significant influence of gender-school type interaction on seventh grade students' mathematics achievement scores.

Sub-Question 2: Is there a significant mean difference in male and female students' mathematics achievement scores?

H_0: There is no significant mean difference in male and female students' mathematics achievement scores.

Sub-Question 3: Is there a significant mean difference in seventh grade students' mathematics achievement scores who are enrolled in public and private schools?

H_0: There is no significant mean difference in seventh grade students' mathematics achievement scores who are enrolled in public and private schools.

RQ5. How well do the three measures of attitudinal constructs (self efficacy, anxiety and attitude) and two demographics (gender and school type) predict mathematics achievement of seventh grade students?

H_0: Three measures of students' beliefs of mathematics (self efficacy, anxiety and attitude) and two demographics (gender and school type) do not predict mathematics achievements of seventh grade students.

1.4 Definitions of Important Terms

The research questions and hypothesis were presented in the previous section. In order to understand those research questions and hypothesis better, constitutive and operational definitions of important terms of this study were given in this section.

Self Efficacy is defined as "the belief in one's capabilities to organize and execute the courses of action required managing prospective situations" (Bandura, 1995, p. 2).

Mathematics Self Efficacy is defined as "a situational or problem-specific assessment of an individual's confidence in her or his ability to successfully perform or accomplish a particular mathematics task or problem" (Betz & Hackett, 1989, p.262). In this study, mathematics self efficacy scores refer to the scores received from the Mathematics Self Efficacy Scale (MSES) developed by Umay (2001).

Anxiety is defined as a general term for feelings that causes nervousness, fear, apprehension and worry (Hembree, 1990, p.10).

Mathematics Anxiety is defined as "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (Richardson and Suinn, 1972, p.551). In this study, mathematics anxiety scores refer to scores received from the Mathematics Anxiety Scale (MANX) developed by Erol (1989).

Attitude is defined as "a learned disposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept or another person" (Aiken, 1970, p.551).

Attitudes towards Mathematics is defined as "a positive or negative emotional disposition toward mathematics" (McLeod, 1992, p.210). In this study, attitudes towards mathematics scores refer to the mean scores received from the Mathematics Attitudes Scale, MAS, developed by Aşkar (1987).

Mathematics Performance or Mathematics Achievement refers to the mean of mathematics scores in the Student Level Determination Exam – LDE 2010.

School type is defined as different kinds of school organizations. In this study, school type refers to public and private elementary schools in Turkey.

1.5 Significance of the Study

Learning mathematics is believed to be related to cognitive domain rather than affective domain (Hembree, 1990). However, as in other cognitive fields, in mathematics attitudinal constructs can play an important role in students' decisions about the amount of mathematics they will need in the future and the way they approach the mathematical content they will study (Reyes, 1984). To state

differently, students' mathematics career trajectories can be influenced by their emotions, feelings and self beliefs toward this domain. Hence, all these attitudinal constructs either guide students study in mathematics and in mathematics related fields or push those away from careers that require even moderate mathematics competencies (Hafner, 2008). Therefore, it is believed that the results of this study provide a valuable set of information for educators, instructors and consultants in order to understand the influence of these personal factors in career planning of elementary students and help students better understand the role of their attitudes and beliefs in mathematics in elementary years.

For the above purpose, social scientists have been interested in explaining differences in mathematics performance of students with the help of emotional parameters and self beliefs in the last decade (Hafner, 2008). State differently, there have been several studies conducted abroad to make realistic predictions of mathematical performance and to explain the nature of predictions (Ma, 1989; Pajares & Hembree, 1990; Schunk, 1983; 1984; Thomas, Iventosch, & Rohwer, 1987; Williams, 1994; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Martinez-Pons, 1990; Hembree, 1990; Ma, 1999; McLeod, 1992; Richardson & Suinn, 1972; Spielberger, 1988; Tobias, 1978; Wigfield & Meece, 1988). More specifically, the researchers investigated lots of predictor variables such as self efficacy, anxiety, attitude, gender, socioeconomic status etc and found statistically significant results (Ma, 1989; Pajares & Hembree, 1990; Schunk, 1983; 1984; Richardson & Suinn, 1972; Spielberger, 1988). However, due to cultural, economic, ethnic and socioeconomic differences, the results of those studies may not reflect the actual situation in Turkey. This study provides an alternative model for presenting differences in mathematics performance of students in Turkey by a model consisting of three attitudinal (efficacy, anxiety and attitude) and two demographic variables (gender, school type).

In addition, school type is a crucial variable to be considered in scientific researches (Lubienski, 2003). It is also a source of concern for mathematics

educators (Coleman; 1981). It is widely accepted that private schools and public schools have some differences. For instance, public schools are required to admit all students with different backgrounds (socioeconomic status, parents' education level) and hence the classes are more heterogeneous and crowded. On the contrary, in private schools, admission and selection process of students are based on some standards such as achievements, discipline and adaptability to school culture. Besides, the class sizes are smaller and homogeneous which increase the interaction among students and teacher in class. In addition, private schools have several facilities (transportation) and provide services and goods (pool, sports and arts centers, computer, science and math labs) which was not presented in public schools (Friedman, 1962). Hence, it is not surprising that the private school students outperform the public school students in many fields such as sports, science, mathematics, fine arts and music (Lubienski, 2001, 2003). Despite these differences, there also exist some similarities. To illustrate, all schools follow basic national educational guidelines. That is, both types of schools implement the same topics of educational program content and school curriculums. Moreover, textbooks are provided to all schools by MoNE so that equity in opportunities and excellence in education is promoted in Turkish Education System. It is believed that these differences and similarities between public and private schools might have some influence on personal constructs and performance. However, there is not sufficient number of studies investigating the effect of school type to explain differences in seventh grade students' personal factors related to mathematics and mathematics achievements. Therefore, school type was chosen as a concern to be investigated in this study.

Moreover, related to the issue, there exist some studies conducted in Turkey (Askar & Işıksal, 2003; Baloğlu, 1998; Erol, 1989; Umay, 1988). Most of the researchers studying on predicting mathematics performance in Turkey are limited due to the duo relationship they investigated such as mathematics self efficacy versus mathematics achievement or mathematics anxiety versus mathematics achievement. However, the present study consists of mathematics self efficacy, mathematics

anxiety, attitudes towards mathematics constructs, gender, school type and mathematics achievement together. That is, the unique and interaction effect of more sources for poor and high scores in personal constructs and the achievement will be revealed in the present study. It is believed that this study will be beneficial for teachers, educators, and consultants to understand the sources of poor mathematics performance of elementary students with respect to affective factors.

1.6 Assumptions and Limitations of the Study

For the current study, it was assumed that the students who participated in this study were volunteers and gave careful attention on the items of the questionnaires. That is, they reflected their actual beliefs, real concerns and honest responses about mathematics. Moreover, it was assumed that the sample selected for this study represented the population to a certain degree. Furthermore, regardless of outcomes, variables other than self efficacy, anxiety and attitude did not contribute to the data results and it was also assumed that the difference scores were independent of each other.

Data were collected from thirteen different elementary schools in Çankaya / Ankara, half of which is private elementary school. These schools were not selected randomly. Due to convenient sampling, the generalization of the results of the study would be limited. Besides, the sample of the study included only the seventh grade students so this leads the researcher to generalize results only to 7^{th} graders' in similar settings and conditions rather than all elementary students.

CHAPTER 2

LITERATURE REVIEW

The following literature review addressed the differences in mathematics self efficacy, mathematics anxiety, attitudes towards mathematics, and mathematics achievements with respect to two demographics (gender and school type). Moreover, the role of three attitudinal constructs of interest in predicting mathematics achievements was also presented. In accordance with the purposes, this chapter is classified into four main sections. The sections are devoted to the information about the present literature related to relationship between mathematics self efficacy beliefs, mathematics anxiety, attitudes towards mathematics, and mathematics achievement in terms of gender or school type.

2.1 Self Efficacy

In this section, the definitions of self efficacy beliefs in the literature will be presented. Secondly, the importance of mathematics self efficacy on mathematics achievement will be summarized and finally, the research studies conducted related to differences in mathematics self efficacy with respect to gender and school type in Turkey and abroad will be presented.

2.1.1 Definition of Self Efficacy

Self Efficacy is defined as "the belief in one's capabilities to organize and execute the courses of action required managing prospective situations" (Bandura, 1995, p. 2).The concept of self-efficacy composes the fundamental idea of Bandura's Social Cognitive Theory. Bandura (1986) emphasized the role of observational learning, social experience, and reciprocal determinism in the development of personality.

According to Bandura, development of personality was influenced by individuals' attitudes, abilities, and cognitive skills, which made up the self-system of individuals. This system plays a major role in how we perceive situations and how we behave in response to different situations. Self-efficacy is one of the essential parts of this self-system (Bandura, 1977). In order to better understand the nature of self efficacy, it is believed that it will be useful to explain how they are acquired, how they influence motivational and self constructs and how they are different from other self constructs.

According to Bandura (1992), self efficacy beliefs evolve during early childhood as the children encounter different experiences, obstacles, new tasks or difficult situations. Nevertheless, the development of self efficacy beliefs do not stop during youth or adulthood, as well as keeps evolving throughout whole life as people acquire new skills, encounter new experiences. Bandura (1994) believed that the self efficacy beliefs are nurtured from four main sources, namely; mastery experiences, social modeling (vicarious experience), social persuasion and psychological responses. Firstly, mastery experiences reflect the most effective way of developing sense of self efficacy (Bandura, 1994). In particular, to complete a task successfully makes the sense of self efficacy strengthen whereas to fail from a task undermine or weaken the sense self efficacy. Secondly, Bandura (1994) defined social modeling as "seeing people similar to oneself succeed by sustained effort raises observers' beliefs that they too possess the capabilities master comparable activities to succeed" (p.132). That is, when people witness other people performing a task successfully or fail from the task, then the observer feels s/he can also do it or cannot do it either. Thirdly, Bandura (1994) believed that people are convinced that they have the adequate skill or abilities to succeed or perform a task. That is, when the peers told something positive and encouraged to help you perform successfully, you overcome your doubts and do your best. Lastly, psychological responses indicated that "it is not the sheer intensity of emotional and physical reactions that is important but rather how they are perceived and interpreted" (Bandura, 1994, p.135). By learning how to

minimize stress and elevate mood when facing difficult or challenging tasks, people can improve their sense of self-efficacy.

Bandura (1986) defined the self efficacy as "peoples' judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p.391). In other words, self efficacy is peoples' own beliefs on their abilities to complete a particular task. It is peoples' "I can" or "I cannot" beliefs. Bandura (1986) described these beliefs as determinants of how people think, behave and feel. That is, self efficacy has an influence on behaviors of people in terms of the activities they select, time and energy they spend, the goals they set and the level of persistence in the face of difficulties (Bandura, 1989). For those who doubt their abilities it is hard to perform a challenging task. They are tend to quit or give up quickly and attribute the failure to lack of ability instead of the effort they put forth. However, those who have strong self efficacy view difficulties as challenges to be mastered. As the task becomes harder, they extend more effort and attribute failure to lack of effort (van Eekelen, 1998). Similarly, a person's self efficacy beliefs play a major role in approaching the goals, tasks, and challenges they want to achieve. For instance, people with a strong sense of self efficacy view challenging problems as tasks to be mastered, develop deeper interest in the activities they participated, form a stronger sense of commitment to their strengths and weaknesses and recover quickly from setbacks and failures (Pajares, 2006). However, people with a weak sense of self efficacy avoid challenging tasks, believe that difficult tasks and situations are beyond their capabilities, focus on personal failings and negative outcomes and quickly lose confidence to personal abilities (Pajares & Miller, 1995).

Self efficacy term mostly confused with the other self-constructs such as self concept and self perceptions of competence. Sometimes, those concepts are used interchangeably. Self efficacy is different from self concept in that self concept covers self worth beliefs related to ones' perceptions of competence and self concept is more global (e.g., math competence) which is not measured at the level of

specificity (Pintrich & Schunk, 2002). However, self efficacy is more situation specific than other self constructs. Smith and Fouad (1999) stated that self efficacy are specific to subject areas and show little generalization across areas. That is, efficacy term is preferred for very specific academic problems such as two digit subtraction problems with regrouping whereas self concept is used for mathematics competence (Schunk, 1989). To illustrate, let's consider the difference between a student whose claim is that *I am good at math* versus a student who claims *I am confident that I can accurately perform two-digit subtraction*. Former is related self concept due to its broadness whereas later is account for efficacy due to it is specificity (Harter, 1985).

2.1.2 Studies related to Mathematics Self Efficacy and Mathematics Achievement

Betz and Hackett has defined mathematics self efficacy as "a person's beliefs (confidence) related to his/her abilities concerning mathematical problems, daily math tasks and math related course works" (1983, p.330). To state differently, mathematics self-efficacy is, "a situational or problem-specific assessment of an individual's confidence in her or his ability to successfully perform or accomplish a particular mathematics task or problem" (Hackett & Betz, 1989, p.262).

Studies related to mathematics self efficacy in academic settings have focused mostly on two main areas (Pajares & Miller, 1995). The first area, attempted to understand the link between self efficacy and college major and career choices in the area of mathematics and science (Brown, Lent & Larkin, 1989; Lent & Hackett, 1987) and second area investigated both the relationship of self efficacy and achievement and the self efficacy beliefs level of prediction in achievement. In first area, the studies reported that mathematics self efficacy beliefs have some influences on how students view their capabilities in mathematics, how hard they try and for how long (Pajares & Miller, 1995). This certainly influences students' emotions and attitudes toward mathematical tasks, affects the behaviors displayed in mathematics

class (Schunk, 1985; Multon, 1991). Moreover, future plans related mathematics is also influenced in a way that students mainly using past mathematics experiences to question their capabilities for next mathematics courses and mathematics related college majors whether join or do not join according to their experiences (Lopez & Lent, 1992). For instance, Pajares and Miller (1994, 1995) reported that mathematics self efficacy of undergraduates is better predictor for their mathematics interest and choice of mathematics related courses and majors than their previous mathematics achievements. To state differently, these self beliefs on mathematics shape ideas of children towards their careers matching perceptions of their mathematics abilities or push students stay away from careers that require different types of mathematics competencies (Hafner, 2008).

Studies in the second area have focused on two main issues. The first issue has been the relationships between self efficacy beliefs, other motivational constructs and mathematics achievement (Pajares, 1996). Researchers have found that self efficacy beliefs are directly or indirectly correlated with other motivational and self constructs as well as academic achievement (Bandura, 1991; Bouffard-Bouchard, 1989; Pajares & Miller, 1994). For instance, Pajares and Miller (1994) found that mathematics self efficacy had a stronger direct effect on mathematical problem solving (B= .545 where B indicates strengths of variable in total variance) than did prior experiences. This supported the fact that regardless of ability level and gender, students with high self efficacy performed more problems correctly and resolved most of the problems they missed (Collins, 1982). Similarly, Schunk (1984) reported that mathematics performance was influenced by self efficacy both directly (B=.46) and indirectly (B=.30) through persistence required to show high academic achievement.

Based on the second issue, the researchers have attempted to understand the accuracy of prediction when self efficacy and mathematics performance are correlated (Pajares, 1996). It was found that mathematics self-efficacy is a stronger predictor of mathematics performance regardless of the factors of performance

(Bandura, 1986; Pajares, 1996) and regardless of any other variables (Bandura & Locke, 2003; Pajares & Graham, 1999). Moreover, it was determined that mathematics self-efficacy is a better predictor of mathematics performance than mathematics anxiety, conceptions for the usefulness of mathematics (Pajares & Miller, 1994), prior involvement in mathematics (Pajares & Miller, 1995), mathematics self-concept and previous mathematics performance (Klassen, 2004). It is important to note that self-efficacy beliefs were even found to be a stronger predictor of performance than general mental ability (Pajares & Kranzler, 1995).

In his research, Multon studied the 68 published and unpublished research papers, texted from the year-1977 to 1988, which were related to relationship between self efficacy and academic performance and persistence. Meta analysis was conducted to investigate the correlation among self efficacy, performance and persistence with 39 of those studies and 4998 subjects ranging from elementary school to college. It was found that self efficacy beliefs are responsible from the significant variance among subjects. The study revealed that there exist 0.38 correlations between self efficacy beliefs and performance and self efficacy beliefs responsible from the 14% of the variance in students' academic performance. That is, 14% of students' academic performance can be explained by their self efficacy (Multon, Brown & Lent, 1991). Similarly, the path findings of another study revealed that students' self-efficacy beliefs about their mathematics made 12% independent contribution to the prediction of their mathematics problem solving performance when other motivational variables were controlled (Phan & Walker, 2000).

However, there have been few studies reporting lack of relationship or weak relationship between self efficacy and mathematics performance (Benson, 1989; Cooper & Robinson, 1991). For instance, Benson (1989) found that a path from mathematics self efficacy to mathematics exam grades in statistics course was not statistically significant. Similarly, Cooper and Robinson (1991) compared the self

efficacy scores from MSES and performance scores in a placement test in Missouri and reported a significant but very weak correlation.

2.1.3 Difference in Mathematics Self Efficacy with respect to Gender and School Type

The importance of gender in learning mathematics is emphasized by many researchers as it is crucial variable to be considered in social studies and differences between males and females has been a major issue in the literature (Dweck, 1986; Lloyd, Walsh & Yailagh, 2005). Several studies have investigated the effect of gender on achievement but fewer studies conducted on the differences of self efficacy beliefs with respect to gender (Fennema & Sherman, 1977). In addition, Pajares and Miller (1997) stated that the relationship between gender and mathematics self efficacy beliefs has not been explored as consistent as that of between gender and mathematics achievement. Therefore, the major concern for the present study is the effect on gender on mathematics self efficacy beliefs.

The studies related to the issue divided into two main areas; the influence of gender on self efficacy and the effect of self efficacy on males' and females' further choices. The first area of research mostly interested in the differences between self efficacy beliefs of males and females. Most of the studies yielded that there was a significant effect of gender on mathematics self efficacy beliefs in the favor of males (Hackett & Betz, 1981; Hyde, Fennema & Lamon, 1990; Pajares & Miller, 1994). For instance, in a study carried out with 262 undergraduates, Hackett and Betz (1981) reported that mathematics self efficacy expectations of male undergraduates were stronger than those of females. Similarly, Hyde and colleagues found that males in high school were superior over females in mathematics self efficacy scores (Hyde, Fennema & Lamon, 1990).

The second area of research deals with the indirect influence of self efficacy beliefs on boys' and girls' further choices. That is, the studies revealed that self

efficacy had an influence on males' and females' mathematics related course selection, college majors and career choice in the favor of males (Pajares & Kranzler, 1994). For example, Lent, Brown and Hackett (1994) proposed that women's low sense of self efficacy for mathematics related courses has been found to influence their choice of career out of science and engineering. Similarly, Zimmermann and Martinez-Pons (1990) reported that in predicting interest to seeking a career in mathematics and science, gender and self efficacy had direct effects in the favor of males.

Although there were some studies reporting significant differences on self efficacy beliefs of males and females, some researchers reported no significant difference between self efficacy beliefs of males and females (Cooper & Robinson, 1991; Schunk & Lilly, 1984). Cooper and Robinson (1991) reported no gender differences on mathematics self-efficacy, mathematics anxiety, and mathematics performance among undergraduates at a public mid-western university who selected mathematics oriented college majors. In another study, carried out by Schunk and Lilly (1984) the influence of gender on self-efficacy and attribution was investigated. Male and female students judged their self-efficacy beliefs for learning a mathematical task. Students were then provided with instruction and practice and received feedback. Although the females initially judged their self-efficacy as lower than the males, no gender difference was obtained at the end of the training.

The effect of school type on sense of self efficacy is another interest for the present study since studies related to the effect of school type on personal constructs were very limited. One of the study conducted by Lubienski (2003) showed that there was a significant effect of school type on mathematics self efficacy. In particular, Lubienski (2003) found that students in private schools were higher in both achievement and self efficacy scores than that of non charter schools without equating students' background differences. However, when background differences were equated, the effect of school type on achievement and self efficacy beliefs were not significant any more.

2.1.4 Studies related to Mathematics Self Efficacy in Turkey

Similar to the studies related to mathematics self efficacy in other countries, researchers in Turkey have mostly been interested in two main issue; the relationship between mathematics achievement and self efficacy (Alcı, 2005; Işıksal & Aşkar, 2005; Üredi & Üredi, 2006) and the difference in mathematics self efficacy beliefs of males and females (Çakiroğlu & Işıksal, 2009; Işıksal, 2005; Şahin-Taşkın, 2010). However, there exist very few studies investigating the effect of school type on self efficacy in Turkey.

Studies related to the relationship between mathematics achievement and mathematics self efficacy were reported that mathematics self efficacy and achievement were positively correlated (Alcı, 2005; Işıksal & Aşkar, 2005). These results were consistent with the findings of Bandura (1986) and Pajares and Miller (1994, 1995). For instance, Alcı (2005) investigated the relationship among mathematics achievement, problem solving skills and self efficacy beliefs of undergraduates. Mathematics achievements of the students were represented by their university entrance exam results and self efficacy scores are obtained from the results of the Scale of Motivating Strategies in Learning. The findings of the research showed that there was a statistically significant moderate positive correlation between mathematics self efficacy and achievement (r= .530). Besides, it was reported that self efficacy was a significant factor on predicting students' university entrance exam scores as well as problem solving skills. Similarly, in another study with seventh grades students, Işıksal and Aşkar (2005) found a significant positive relationship between mathematics self efficacy beliefs and mathematics achievement post-test scores (r=.507). Likewise, Üredi and Üredi (2006) investigated the predictive power of motivational efficacy beliefs on mathematics grades in reports of 8^{th} grade students. The findings of the study revealed that the students with high self efficacy had better grades in mathematics. In addition, boys were more efficious in mathematics than girls, which was supporting the studies of De Groot (1990) and Schunk (2001). However, there exists few studies found no significant relation

between mathematics self efficacy and mathematics performance. For example, Taşkın-Şahin (2010) reported non-significant relation between self efficacy and performance of elementary pre-service teachers.

The studies in Turkey which were interested in the difference between self efficacy scores of males and females were not consistent (Bursal, 2008). To illustrate, in a study of exploring the effect of gender and grade level on pre-service teachers' self efficacy beliefs, Işıksal and Çakiroğlu (2009) found a significant effect of gender as males scored significantly higher than females in their mathematics self efficacy scores. However, Işıksal (2005) detected non-significant difference between male and female pre-service teachers' mathematics self efficacy scores. Similarly, Şahin-Taşkın (2010) did not find any significant difference among elementary pre-service teachers self efficacy toward teaching regarding gender in a mixed type study.

As mentioned before, the concern of the present study was the school type and there were very few studies related to the difference between private and public elementary school students' beliefs in Turkey. The studies were mostly concerned with comparing the level of achievement in public and private schools. On the one hand, there was no consensus among researchers in Turkey regarding the effect of gender on mathematics self efficacy beliefs. On the other hand, mathematics self efficacy and difference in self efficacy with respect to gender and school type are the major concern for the present study.

2.2 Anxiety

In this section, the definitions of anxiety in the literature will be presented. Secondly, the studies related to mathematics anxiety and mathematics achievement will be summarized and finally, the research studies conducted related to differences in mathematics anxiety with respect to gender and school type in our country and abroad will be presented.

2.2.1 Definition of Anxiety

As mentioned before, there has been an increasing attention towards the research studies analysing the critical role of personal constructs within the fields of education and psychology (McLeod, 1994; Pintrich, 2000). Educational psychologists have been concerned with understanding the nature of relationship between personal factors and academic performance (Lent, Brown, & Gore, 1997). One of the personal factors that have probably received more attention than the other factors in affective domain is anxiety (Hembree, 1990; Ma, 1999; McLeod, 1992). In order to better understand the nature of anxiety, it is believed that it will be useful to explain the definition in detail, types of anxiety, sources of anxiety and difference from stress.

Anxiety is "a general term for feelings that causes nervousness, fear, apprehension and worry" (Hembree, 1990, p.10). Similarly, Seligman and Walker defined anxiety as "a psychological and physiological state characterized by somatic, emotional, cognitive and behavioral aspects that influence how people feel or behave" (2000, p.35). Early theorists and educational psychologists such as Freud and Kierkegaard preferred the term *angst* for anxiety, which is a word that has no English equivalent (May, 1958). One translation of Kierkegaard uses the word *dread* in order to translate *anxiety*. It appears to be a more powerful word with the root meaning of; "to vex or trouble in either the absence or presence of psychological stress (Bouras, 2007, p.42). Today, psychologists use the term anxiety for feelings leading nervousness, apprehension, fear and worry which influence the way they feel, think and behave (Hembree, 1990).

Anxiety is a complex personal construct that can be conceptualized in different types (Spielberger, 1970). It is believed that there exist three different types of anxiety namely; process, trait anxiety and state anxiety. Firstly, Spielberger's model of anxiety as a *process* is a result of a chain reaction that consisted of a stressor, a perception of a threat, a state reaction, cognitive reappraisal and coping.

Secondly, trait anxiety model reflects a stable tendency to respond with state anxiety in the anticipation of threatening situations (Spielberger, 1972). It is closely related to the personality trait. Such anxiety may be conscious or unconscious as well as it does not depend on time or a situation. Lastly, model of state anxiety is the unpleasant emotional state or condition which is characterized by activation or arousal of the autonomic nervous system (Spielberger, 1972). State anxiety is dependent on time and a situation, and is aroused when a person perceives a situation as dangerous. The focus of the current study; mathematics anxiety, is a type of state anxiety since it is aroused only in situations involving mathematical tasks.

The sources of anxiety are classified as situational, dispositional and environmental antecedents in Cemen's anxiety-reaction model (1987). Baloğlu and Koçak (2006) stated that the situational factors, such as classroom factors and instructional approach, are external whereas dispositional factors, negative attitudes and lack of confidence, are internal and related to personality. On the other hand, environmental factors are defined as individuals' attitudes, prior perceptions and experiences such as negative mathematics experiences and lack of parental encouragement (Baloğlu & Koçak, 2006).

Stress and anxiety are two terms that are often used interchangeably, but are in fact very different from one another. Stress is a normal physical reaction that a person possesses in the face of different or demanding stimuli. In other words, stress is the body's response system to help protection. Stress can come from any situation or thought that makes you feel frustrated, angry, nervous, worried, or even anxious. What is stressful to one person may not be stressful to another (McLeod, 1992). However, anxiety is sometimes caused by stress, it is a different type of condition altogether. Anxiety is a feeling of apprehension or fear. When you feel anxiety about something, you engage in a physical response to stimuli that makes you feel afraid or as though you can't face something. Some individuals don't know why they feel anxiety, or suffer from anxiety disorders that greatly disrupt their lives (Hembree, 1990).

2.2.2 Studies related to Mathematics Anxiety and Achievement

Mathematics anxiety refers to "the general lack of comfort that someone might experience when required to perform mathematically" (Wood, 1988, p.8) or "the feelings of tension, helplessness, and mental disorganization one has when required to manipulate numbers and shapes" (Tobias, 1978, p.15). Similarly, Richardson and Suinn (1972) defined mathematics anxiety by means of its debilitating influence on mathematical achievement. It is stated that mathematics anxiety involves apprehension and arousal concerning the manipulation and solution of mathematical problems in academic, private, and social environments (Richardson & Suinn, 1972). In order to better understand the nature of mathematics anxiety, it is believed that it will be useful to explain dimensions of mathematics anxiety, foundations of mathematics anxiety, the influence on performance and studies related to performance.

Richardson and Suinn (1972) originally assumed that the construct of mathematics anxiety was one-dimensional, however, one can easily conclude from the definitions and the results of factor analysis that mathematics anxiety is a multidimensional construct consisting of an affective emotionality and a cognitive worry dimensions (Hart, 1989; Wigfield & Meece, 1988). Affective mathematics anxiety addresses to the emotional component of mathematics anxiety, feelings of nervousness, tension, dread, fear and other unpleasant physiological reactions to mathematical situations (Spielberger, 1972). On the other hand, cognitive mathematics anxiety refers to the worry dimension of mathematics anxiety, mostly exhibited as negative expectations, preoccupation with and self deprecatory thoughts about an anxiety leading events (Wigfield & Meece, 1988).

There have been two influential theoretical models in the foundations of mathematics anxiety theories, Interference and Deficits Models. In the interference model of mathematics anxiety, researchers defined the anxiety of mathematics as a disturbance of the recall of prior mathematics learning, knowledge, and experience

(Liebert & Morris, 1967). According to this model, students' mathematics anxiety is attributed to not remembering past experience and knowledge in mathematics. On the other hand, the deficit model of Tobias (1972), mathematics anxiety is regarded as the recall of poor performance in the previous mathematical tasks and it is believed that poor previous performance leads higher level of mathematics anxiety. According to this model, students' poor performances are attributed to poor study habits and test taking skills which results in a higher level of mathematics anxiety (Hembree, 1990; Tobias, 1982).

The construct of mathematics anxiety might have *a debilitative* and *a facilitative* influence on students' mathematics performance (Alpert & Haber, 1960). Facilitative anxiety helps a learner to be more alert to a mathematical task and this is considered as positive factor in order to accomplish the mathematical task. On the contrary, debilitative anxiety is negative, where a learner becomes too anxious and may not perform the mathematical task to the optimum level (Tobias, 1982). That is, according to the individual and the task, optimal/moderate level of mathematics anxiety might foster the students' mathematics performance to a certain point. However, beyond the optimal levels of mathematics anxiety, higher level of mental activities and conceptual processes might be hindered and debilitated (Skemp, 1986).

Similarly, traditional arousal theorists attempted to explain the relationship between mathematics anxiety and performance in a way that that there is an optimal level of arousal around the middle of the arousal dimension- optimal both in terms of performance and in the sense of being pleasant (Hebb, 1955). The idea can be displayed graphically as an inverted-U shape depicting a curvilinear relationship between anxiety and performance which indicates that some anxiety is beneficial to performance but after a certain point it undermines the performance (Ma, 1999). However, most of the researchers recently have explained characteristic of this relationship within linear notion that anxiety seriously impairs mathematics

performance (Lazarus, 1974). In particular, the anchor idea is that higher level of anxiety is associated with a lower level of performance (Ma, 1999).

There exists substantial literature providing a significant moderate and negative linear correlation between mathematics anxiety and mathematics performance (Adams & Holcomb, 1986; Betz, 1978; Brush, 1978; Cooper & Robinson, 1991; Dew, Galassi, & Galassi, 1984; Suinn, Edie, Nicoletti, & Spinelli, 1972; Wigfield & Meece, 1988). For instance, Wigfield and Meece (1988) conducted a study including elementary and high school students. The results of the study revealed that emotional reactions to mathematics (e.g. nervousness, fear, dread and general lack of comfort in experiencing mathematics) negatively correlated with students' perceptions of their mathematics capabilities, perceptions of their performances, expectancies and actual mathematics performances as measured by their grades. That is, the more anxious, stressful and nervous the student is about mathematics, the more likely s/he displays a lower mathematics performance.

In a meta-analysis, results of 151 studies were integrated by Hembree to examine the construct of mathematics anxiety. Results of the study showed that mathematics anxiety depresses mathematics performance on mathematics achievement tests. Moreover, it relates inversely to positive attitudes towards mathematics and is bound directly to avoidance of the domain. In other words mathematics anxiety appears more strongly linked with poor performance and avoidance of mathematics in precollege students, even special work to enhance students' competence failed to reduce their anxiety levels and drop outs of the mathematics courses (Hembree, 1990).

However, there have been few studies reporting lack of relationship or weak relationship between anxiety and mathematics performance (Betz, 1978; Hunsley, 1987; Hadfield & Maddux, 1988). For instance, the investigations of Hunsley (1987), using multiple regression analysis, and those of Hadfield and Maddux (1988), using analysis of variance, did not provide a significant correlation between mathematics

anxiety and mathematics performance. Moreover, it is also claimed that when the influence of previous mathematics performances, attitude towards mathematics and mathematics self-concepts are controlled, the effects of mathematics anxiety becomes either non-significant or merely minimized (Betz, 1978; Brush, 1980, Fennema & Sherman, 1977; Rounds & Hendel, 1980; Siegel, Gallassi, & Ware, 1985).

2.2.3 Difference in Mathematics Anxiety with respect to Gender and School Type

As stated before, the importance of gender in learning mathematics is emphasized by many researchers as it is crucial variable to be considered in social studies and differences between males and females has been a major issue in the literature (Dweck, 1986; Lloyd, Walsh & Yailagh, 2005). Most of the studies have investigated the effect of gender on achievement but fewer studies conducted on the differences between the level of mathematics anxiety of males and females in elementary schools (Hembree, 1990). In addition, Pajares and Miller (1997) stated that the relationship between gender and personal constructs (efficacy, anxiety and attitude) has not been explored as thoroughly as that of between gender and mathematics achievement in elementary years. Therefore, the major concern for the present study is the effect on gender on mathematics anxiety.

There were some studies related to the influence of gender on the correlation between students' mathematics anxiety and their performances (Meece, Wigfield, & Eccles, 1990; Pajares & Miller, 1994; Pintrich & De Groot, 1990; Wigfield & Meece, 1988). The studies revealed that significant gender differences in mathematics anxiety do not appear until the late elementary grades, while this gender effect on mathematics anxiety became stronger in high school and college students in the favor of boys (Ma, 1999). For instance, Hembree (1990), in a meta-analysis of 151 studies, investigated the influence of gender on mathematics anxiety and mathematics performance. Female students reported higher amount of mathematics

anxiety than did male peers in high school and college. He also claimed that the higher level of anxiety refers to depressed performance or more mathematics avoidance for female students, since it is not believed that females cope with anxiety better (Hembree, 1990). Similarly, in a study of math anxiety in sixth through twelfth grade students (Wigfield & Meece, 1988), females displayed stronger negative emotional reactions to mathematics than did boys in high school but the difference was weak in elementary level.

Although there were some studies reporting significant effect of gender on level of mathematics anxiety, some researchers reported no difference or minimal differences between mathematics anxiety levels of males and females (Kazelskis, 2000; Ma, 1999; Perez, 2005). For instance, in a later meta-analysis of the relationship between anxiety and achievement in mathematics Ma (1999) found no significant gender differences in this relationship. Ma also criticized the Hembree's study, claiming that his meta-analysis did not focus on the relationship between math anxiety and math achievement, and that his conclusion appears to apply more to college students than to precollege students. Similarly, Perez (2005) attempted to determine if gender had any effects on mathematics anxiety and performance with Hispanic/Latino college students. The results revealed that males and females reported the same level of mathematics anxiety. Besides, Kazelskis (2000) also reported minimal gender differences among math anxiety scores.

Another interest for the present study is the effect of school type on mathematics anxiety levels of elementary students. A study conducted by Lubienski (2003) showed that there was a significant effect of school type on personal constructs and achievement. In particular, Lubienski (2003) found that students in private schools were higher in both achievement and anxiety scores than that of non charter schools. However, when background differences were controlled, the effect of school type on achievement and anxiety were not significant any more.

As can be seen from the literature, the studies related to effect of gender and school type on mathematics anxiety levels of elementary students are very limited. Therefore, the differences between anxiety levels of males and females in private and public elementary schools are the main concern for the present study.

2.2.4 Studies related to Mathematics Anxiety in Turkey

The studies related to mathematics anxiety in Turkey have mainly focused on two major issues; the correlation between anxiety and performance and the influence of demographics (gender, socioeconomic status, age and grade level) on level of mathematics anxiety. For the first area of interest, the researchers in Turkey have mostly reached a consensus that there was a significant correlation between anxiety and achievement (Baloğlu, 2010; Birgin, Coştu, Çatlıoğlu & Gürbüz, 2009; Özbey & Yenilmez, 2006). The results of the studies consistently revealed that mathematics anxiety and mathematics achievement were negatively correlated (Birgin, Coştu, Çatlıoğlu & Gürbüz, 2009). For instance, Baloğlu (2010) investigated anxiety levels of 220 elementary students comparing with their mathematics achievements. The results yielded that high level of anxiety leads poor performance among Turkish elementary school students, which totally supports the Deficit Theory of Tobias (1986). Similarly, Özbey and Yenilmez (2006) studied to determine the level of mathematics anxiety of secondary school and private school students and relations between the level of mathematics anxiety and students' characteristics like type of school, gender, mathematics achievement and parental education level. It was reported that mathematics anxiety hinders the students' mathematics performances regardless of other factors supporting the debilitative influence of anxiety.

However, there were few studies reporting non-significant correlation between anxiety and performance. For example, Ilgar (2005) conducted a research in order to investigate the high school students' level of mathematics anxiety with respect to some characteristics, like mathematics performance, gender, type of high school, parental attitudes, parents' education level. Results of the study supports the

findings of Robinson (1991) and Ma (1999) as, there is no hindering influence of mathematics anxiety observed on mathematics achievements of high school students.

For the second area of research, the influence of gender on mathematics anxiety, the researchers have not reached a consensus in Turkey. There were some studies reporting significant difference between mathematics anxiety of males and females (Baloğlu, 2004). For example, Baloğlu (2004) investigated 760 college students' mathematics anxiety with respect to gender and performance. The results of the study showed that women scored significantly higher than men on Revised Mathematics Anxiety Scale-RMARS indicating that females were more anxious than males. Similarly, Pamuk and Karakaş (2011) reported that mathematics anxiety levels of college students were differentiated with respect to gender in the favor of boys. To state differently, males were less anxious than females.. However, there were some studies found no significant influence of gender on level of mathematics anxiety (Ilgar, 2005; Özbey & Yenilmez, 2006). In a study of 21 high school students, Ilgar (2005) investigated the influence of gender, type of school, parental attitudes, and parents' education level on mathematics achievement and personal constructs. The findings of the study showed that there was not any statistically significant difference between the anxiety levels of females and males. Similarly, Özbey and Yenilmez (2006) reported no significant main effect of gender on college students' mathematics anxiety.

As mentioned before, another concern of the present study was school type but there were very few studies related to difference between private and public elementary school students' beliefs in Turkey. Therefore, the difference in anxiety scores with respect to school type was investigated in the present study. Similarly, there was limited number of studies with elementary students' mathematics anxiety with respect to school type and gender in Turkey. Moreover, there was no consensus among researchers in Turkey regarding the effect of gender on mathematics anxiety. Therefore, mathematics anxiety and difference in level of anxiety with respect to gender and school type are the major concern for the present study.

2.3 Attitude

In this section, how attitudinal beliefs are defined in the literature will be presented. Moreover, the relation between the attitudes towards mathematics and mathematics achievement will be summarized and then, the research studies conducted related to differences in attitudes towards mathematics with respect to gender and school type in our country and abroad will be presented.

2.3.1 Definition of Attitude

As stated before, there has been an increasing attention towards the research studies analyzing the critical role of affective factors within the fields of education and psychology (McLeod, 1994; Pintrich, 2000). Educational psychologists have been concerned with understanding the nature of relationship between personal constructs and academic performance (Lent, Brown, & Gore, 1997). One of the personal constructs that have probably received more attention than the other factors in affective domain is attitude (Aiken, 1970; Neale, 1969). In order to better understand the nature of attitude, it is believed that it will be useful to explain the definition and dimensions, sources of attitude and lastly characteristic of attitudinal beliefs.

There exists lack of theoretical background that characterizes research on attitude toward mathematics and hence most of the studies conducted on attitude either do not provide a clear definition of the construct itself or it is defined implicitly (Leder, 1992; Daskalogianni & Simpson, 2000). Kulm (1980) claims that "it is probably impossible to provide a definition of attitude toward mathematics that is suitable for all situations, and even if one were agreed on, it would probably be too general to be useful" (p. 358).

In the field of education and psychology, descriptors such as *like, dislike, boring, frustrating* and *interesting* are mostly preferred in order to reflect students' feelings and emotion towards an academic assignment (Riley, 1997). In literature,

these emotions and feelings are often reflected in one broader term as attitude. In this context, Neale (1969) defined attitude as "an aggregated measure of liking or disliking of a subject, object or concept, tendency to engage in or avoid, a belief that one is good or bad at, and a belief that it is useful or useless" (p.632). According to Aiken (1970), attitude is "a learned disposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept or another person" (p.551), whereas these positive and negative feelings or emotions have a moderate intensity and reasonable stability (McLeod, 1992).

According to Di Martino and Zan (2003) believed that the construct of attitude toward mathematics consists of three dimensions, namely, emotions, beliefs, and behavioral dimension. First dimension, emotional dimension of attitude refers to *perceived pleasure* (Di Martino & Zan, 2003). That is, pleasure in doing mathematics is viewed as positive attitude toward subject, whereas confronting a problem in doing mathematics means negative one. Therefore, in most of the questionnaire emotional aspects of attitude range from the items *I like mathematics* to *I do not like mathematics*. Second dimension, belief dimension of attitude refers to common view shared by experts (Di Martino & Zan, 2003). In other words, belief dimension deals with the dilemma whether mathematics is useful or not. To illustrate, if students believe that mathematics is for their use, then they develop positive attitude toward it, however, if they do not believe, then they cannot. The last dimension of attitude is related to the behavioral component. Behavioral dimension is related to experiencing success versus failure (Di Martino & Zan, 2003). That is, in the school context, doing homework in mathematics fosters positive attitude whereas failing to complete homework develop negative attitude towards mathematics.

Hannula (2002) claimed that there were several ways in which people acquire attitudes; one of their earliest agents of attitude formation is parents, later followed by peers and the media, especially their experience itself. Hannula (2002) studied the attitude with respect to cognitive-emotional perspectives. In his research, he states "While a student is engaged in a mathematical activity, there is a continuous

unconscious evaluation of the situation with respect to personal goals" (Hannula, 2002, p.30). When students are evaluated, there are four areas to examine upon acquiring attitude towards a subject. The first is simply situational and no prior experience of the entity being evaluated (Hannula, 2002). The second depends entirely on previous experience and is the kind that is typically seen on questionnaires. The third evaluation is when the situation is to a familiar to a degree, but the individual has no personal experience. The fourth is when an individual looks at ones whole life and the value of different goals in it. Hannula stated that these four evaluations are the main sources of attitude (Hannula, 2002).

Crucial characteristic of attitude is considered to be stable as soon as formed or acquired. However, students' attitudes may change as their experiences change in a relatively short time (Hannula, 1998). Likewise, McLeod (1992) believed that attitude toward mathematics is related to the performance in the classroom as well as students performance depends on their attitude. That is, attitude toward mathematics is directly proportional to the recent mathematical performance in a mathematics task. In other words, a good mathematics performance in class can bend the attitude to the positive side whereas; a bad performance can swing the attitude toward negative side. However, Hannula (2002) stated that "once established an attitude fairly stable and only minor changes may occur based on successes and failures" (p.32).

2.3.2 Studies related to Attitudes towards Mathematics and Mathematics Achievement

As stated before, there is a lack of theoretical background that characterizes research on attitude toward mathematics, which leads inconsistent findings in the studies related to relationship between attitude towards mathematics and mathematics achievement. In the process of reviewing literature on the relationship between attitude toward mathematics and achievement in mathematics, it was found that there were two different groups of researchers. One group claimed that there was

a significant but moderate relationship between attitude towards mathematics and achievement in mathematics (Aiken, 1970; Kloosterman, 1991; Minato & Yanese, 1984; Neale, 1969; Randhawa & Beamer, 1992), whereas the other group of researchers argued that there was not any statistical significance or low correlation between attitude toward mathematics and achievement in mathematics (Dutton, 1962; Lindgren, 1964; Robinson, 1975; Ma & Kishor, 1997).

The researchers in the first group believed that attitudes had a crucial role in both teaching and learning of mathematics. When attitudes are used in order to predict achievement in mathematics, these researchers found statistically significant positive but moderate correlations (Aiken, 1970, 1976; Neale, 1969). For instance, in a study of Fennema and Sherman (1977) with secondary school students, it was found that those who viewed mathematics as more useful generally received higher grades in mathematics tests. Similarly, it was stated that students who held positive feelings towards mathematics were better problem solvers (Cramers, 1989). Proponents of the issue also claimed that positive attitude toward mathematics also have an influence on student motivation toward mathematics (Haladyna, Shaughnessy & Shaughnessy, 1983) and the intention to learn mathematics (Norwich & Jaeger, 1989) and persistence with it (Leder, 1992). For instance, Schofield (1981) reported that pupils who enjoy mathematics were more tend to spend more time and energy in learning and doing mathematics.

On the other hand, counter-researchers claimed that the correlation between attitude toward mathematics and achievement in mathematics was either very weak indicating little practical significance in education or even not significant (Dutton, 1962; Lindgren, 1964; Robinson, 1975; Ma & Kishor, 1997). For instance, in a study of Lindgren (1964), the relationship between mathematical problem solving attitude and achievement in mathematics were examined in Brazilian elementary school students. Analysis of 108 Brazilian elementary students revealed that small but significant positive correlation ($r = 0.24$) between problem solving attitude and achievement in arithmetic and a positive but not significant correlation between

attitudes and grades in arithmetic. Similarly, in a survey by Dutton (1962), some evidences for the relationship between attitude and achievement scores were found yet results revealed very low positive correlation between attitudes toward arithmetic of college students and their reported arithmetic grades in elementary school. Moreover, Ma and Kishor (1997) conducted a meta-analysis of 113 studies to examine the relationship between attitude toward mathematics and mathematics achievement of different grades. The study produced no significant result which was an indication that mathematical beliefs and attitudes were not correlated with achievement in mathematics.

As can be seen from the related literature, the researchers have not reached an agreement on the relationship between mathematics achievement and attitudes towards mathematics. Therefore, attitude towards mathematics is one of the concerns in the present study.

2.3.3 Differences in Attitude towards Mathematics with respect to Gender and School Type

The gender issue in the area of mathematics has been studied by many researchers as it is crucial variable to be considered in social studies (Dweck, 1986; Lloyd, Walsh & Yailagh, 2005). Several studies have investigated the effect of gender on attitude but still there is no consensus on the differences of attitudes towards mathematics and achievement in mathematics with respect to gender due to lack of theoretical framework (Fennema & Sherman, 1977). In addition, Pajares and Miller (1997) stated that the relationship between gender and personal constructs (self efficacy, attitude and anxiety) has not been explored as consistent as that of between gender and mathematics achievement. Therefore, the major concern for the present study is the effect on gender on attitudes towards mathematics.

Historically, the achievement of girls in mathematics, across a range of different contexts, was lower than that of the boys, and this was attributed to a

variety of reasons including personal factors (Leder, 1992). In a meta-analysis of studies on "gender comparisons of mathematics attitudes and affect", Hyde, Fennema, Ryan, Frost, and Hopp (1990) found that, in general, female students held more negative attitudes to mathematics than male students, and these differences increased with age. They suggested that this was problematic because, "if females have more negative affect and attitudes about themselves and mathematics, they will learn less mathematics than males do which leads staying away from mathematics courses, college majors and career related to mathematics in the future" (p. 301). Similarly, Young-Loveridge (1992) explored the attitudes towards mathematics of nine-year-old children in New Zealand and found that boys generally liked mathematics more than girls. More specifically, the boys held more positive views about mathematics than the girls and a significantly higher proportion of the boys perceived themselves as being good at mathematics than the girls did. Campbell and Beaudry (1998) investigated the factors contributed to students' achievement in mathematics. Fifty hundred tenth grade students were analyzed who achieved at or above 70% in the Longitudinal Study of American Youth. The results of the study indicated that there was a 10.8 % gender gap in the favor of boys. The effect sizes show that girls had lower scores than boys on both achievement test and attitude scale, whereas boys had better mathematics self concept, better peer attitudes on or about mathematics.

The sources of gender differences in attitudes towards mathematics were found to be more complex and complicated (Chamdimba, 2003). Researchers have identified parental and societal attitudes (Papanastatsiou, 2000; Wong, 1992), and students' classroom experiences (Fisher & Rickards, 1998; Leder, 1992), as being influential in making girls internalize the feeling that they are inferior to boys in mathematics. Studies that have studied classroom environments consider also teachers' classroom behaviors to be a factor associated with students' attitudes.

Despite the fact that males outperform females with respect to attitude towards mathematics, there were some studies reporting non-significant or weak

influence of gender on attitude towards mathematics (Ma & Kishor, 1997; Robinson, 1975). For instance, in their meta-analysis of 113 studies, Ma & Kishor (1997) reflected that gender was not a statistically significant effect on the relationship between attitudes toward mathematics and achievement in mathematics. Similarly, Robinson (1975) stated that elementary girls and boys did not differentiate according to their attitude and performance level in the domain of mathematics. That is, gender stereotype did not account for the relationship between attitude and performance on mathematics.

Another interest for the present study is the effect of school type on mathematics attitudes of elementary students towards mathematics. There are limited number studies related to the issue but the results were inconsistent yet. A study conducted by Farooq and Shah (2008) showed that there was a significant effect of school type on personal constructs and achievement. In particular, it was found that students in private schools were higher in both achievement and attitude scores than that of government schools. However, Lubienski (2003) reported that when background differences were controlled, the effect of school type on achievement and attitude were not significant any more.

As can be seen from the literature, the studies related to effect of gender and school type on attitudes of elementary students towards mathematics are very limited and the findings of the studies were not as consistent as the other personal constructs. Therefore, the differences between anxiety levels of males and females in private and public elementary schools are the main concern for the present study.

2.3.4 Studies related to the Attitude towards Mathematics in Turkey

The studies related to attitude towards mathematics in Turkey have mainly focused on either relationship with mathematics achievements or the influence of gender, grade level, parental involvement, and socioeconomic status etc. on attitude (Peker & Mirasyedioğlu, 2003; Savaş & Duru, 2005; Taşdemir, 2009; Ünlü, 2007;

Yıldız & Turanlı, 2010). Most of the studies dealing with the relationship revealed that students' attitude towards mathematics was positively correlated with mathematics achievements. For instance, in a study of Peker and Mirasyedioğlu (2003), the relationship between attitudes towards mathematics and mathematics achievements of five hundred second grade students in public high school were investigated. Similar to present study, students' attitudes towards mathematics were evaluated by scale of attitude which was developed by Aşkar (1986). Students' mathematics achievement was determined by achievement test which was developed by author. The results of the study showed that more than half of the students had positive attitudes towards mathematics and the students who held positive towards mathematics displayed better performance in mathematics achievement test. Similarly, Yıldız and Turanlı (2010) investigated 700 private high school seniors' and graduates' attitudes towards mathematics. The results of the study yielded that the general attitude of students towards mathematics was not negative. In addition, students with positive attitudes towards mathematics were fairly successful and more likely to prefer professions related to mathematics.

On the other hand, the other area of interest related to attitudes towards mathematics was the influence of gender. The studies revealed that gender had an influence on males' and females' attitudes towards mathematics in the favor of males (Taşdemir, 2009; Ünlü, 2007). For instance, Taşdemir (2009) investigated the attitudes of 400 elementary students against mathematics courses. The elementary students' attitudes were determined with respect to attitude scale of Baykul (1990). The results revealed that males had more positive attitudes than that of females. Moreover, Taşdemir (2009) reported that students' attitude declined as the class level increased. Similarly, Ünlü (2007) carried out a study in order to determine the interest and manners of 1684 third, fourth and fifth graders to the course of mathematics with respect to gender and parental involvement. The results revealed that as expected, males' interest in mathematics was more than that of females with respect to attitude towards mathematics.

However, there exist few studies reporting females' superiority in attitudes towards mathematics (Savaş & Duru, 2005). For instance, in a study of Savaş and Duru (2005), the differences in mathematics achievement and attitudes toward mathematics of students in the first grade high school in Van center was explored. A group of 123 students were randomly chosen such that 61 males and 62 females in three different high schools. Their mathematics achievement and attitudes toward mathematics results according to males and females were compared. Analysis showed weak significant difference between the mean scores of boys and girls in mathematics test. Particularly, it was reported that females' attitudes towards mathematics were higher than that of males and girls also had a significantly more positive career interests related to mathematics than boys.

As mentioned before, another concern of the present study was school type and there were very few studies related to difference between private and public elementary school students' beliefs in Turkey. The studies mostly concerned with comparing the level of achievement in public and private schools. Therefore, the difference in attitude scores with respect to school type was investigated in the present study. Similarly, there was limited number of studies with elementary students' attitudes with respect to school type and gender in Turkey. Moreover, there was no consensus among researchers in Turkey regarding the effect of gender on attitudes and the relation between attitude and achievement. Therefore, the attitudes towards mathematics and the difference in attitudes with respect to gender and school types are the major concern for the present study.

2.4 The difference in Mathematics Achievement with respect to Gender and School Type

The importance of gender in learning mathematics is emphasized by many researchers as it is crucial variable to be considered in social studies and differences between males and females has been a major issue in the literature (Fennema, 1974; Hyde, 2005; Işıksal & Çakiroğlu, 2008; Leder, 1992; Paret, 2008; Savaş & Duru,

2005). Many empirical studies have revealed that males are more likely to outperform females in the area of measurement, proportionality, geometry, spatial geometry, analytic geometry, trigonometry, and applications of mathematics (Battista, 1990; Fennema & Carpenter, 1981; Wood, 1976). On the other hand, females have displayed better performance than boys in the area of computation, set operations, and symbolic relations (Beaton, 1999; Brandon, Newton, & Hammond, 1987; Fennema, 1974). For instance, in as study of Walden and Walkerdine (1982), it was reported that males perceived themselves better when spatial ability is necessary, while females had a higher rate of achievement in algebra.

The social scientists claimed that gender difference in mathematics achievement exists mostly in high school and college but difference was either weak or none in elementary school (Fennema, 1974; Muller, Leahey & Guo, 2001). For instance Muller, Leahey and Guo (2001) investigated mathematics performance of elementary and high school students with respect to gender. The results showed that there were no gender differences in mathematics among elementary students. However, some differences began to emerge as students progressed high school. Similarly, Fennema (1974) stated that there was no statistically significant difference in elementary grades males' and females' mathematics performance but in another study Taşdemir (2009) reported a significant but weak influence of gender on mathematics performance. However, there were some studies reporting significant difference even in kinder garden and primary school (Penner & Paret, 2008). For instance, in a longitudinal study of Penner and Paret (2008), the gender difference in mathematics performance in early grades was investigated. The data obtained from Early Childhood Longitudinal Study, Kindergarten class of 1998-1999 in order to report the difference of kindergartners as they progressed to fifth grades. The results yielded that gender difference in mathematics emerged even in first grade.

The reasons for these gender differences in mathematics are attributed to many factors by researchers. Some of these reasons are; genetic explanations (Allivatos & Petrides, 1997; Harris, 1981; Kimura & Hampson, 1994; Linn &

Petersen, 1985), educational experiences (Richardson, 1994), parental encouragements towards gender-typed activities (Lytton & Romney, 1991), social experiences (Baenninger & Newcombe, 1989), and gender role identification (Signorella & Jamison, 1986).

On the other hand, there were some researchers believed that the gender gap in mathematics decreased even in high school and college day by day (Hyde, Fennema & Lamon, 1990; Ma, 1999). Moreover, it was reported weak or no gender difference in all grades (Alkhateeb, 2001; Ma, 1995). For example, Alkhateeb (2001) investigated differences in mathematics achievements of last grades in a high school of United Arab Emirates with respect to gender. The data was obtained from the Ministry of Education records and achievement results were compared and no significant difference was detected between males and females mathematics performance. Similarly, Ma (1995) compared four different education systems with respect to mathematics achievement and gender. The results revealed that there was no gender difference in algebraic courses. Likewise, Arigbabu and Mji (2004) compared the male and female pre-service teachers' mathematics performances in Nigeria. 374 pre-service teachers graduated from college between 1999 and 2001 participated to study. Arigbabu and Mji reported that the influence of gender on mathematics achievement among the sample data could be disappearing.

As can be seen for the literature, there were lots of studies conducted in order to investigate the influence of gender on mathematics performance. However, the studies related elementary grades is limited and the findings in early grades are inconsistent. Therefore, the influence of gender is a concern for this study.

The effect of school type on mathematics achievement is another interest for the present study since studies related to the effect of school type on mathematics performance were very limited. One of the study conducted by Lubienski (2003) showed that there was a significant effect of school type on mathematics performance. In particular, Lubienski (2003) found that students in private schools

were higher in mathematics achievement than that of non charter schools without controlling students' background differences. The source of difference was attributed to the goods and services provided by private schools which were limited in public schools. In particular, only the computer, mathematics and science labs might be enough to explain difference in mathematics performance. However, when background differences were controlled, the effects of school type on achievement were not significant any more. As it was observed from the limited literature, the results were not consistent and it was believed that more studies required to reach some accurate and exact conclusions. Therefore, school type is another concern for the present study.

2.4.1 Studies related to Mathematics Achievement with respect to Gender and School Type

A few researches have conducted related to the gender difference in mathematics achievement and beliefs about mathematics in Turkey (Işıksal, 2005; Işıksal & Aşkar, 2005; Işıksal & Çakiroğlu, 2008; Savaş & Duru, 2005; Ubuz, 1999). In general, these studies revealed that the gender gap with respect to mathematics achievement has declined (Ma, 1999). To state differently, in Turkey, females have begun to do mathematics and feel confident in mathematics as well as males (Savaş & Duru, 2005). For instance, Işıksal and Aşkar (2005) investigated the influence of dynamic geometry environment (spreadsheet) on mathematics achievement of seventh grade students in Turkey. Işıksal and Aşkar found no significant gender differences between boys and girls with respect to mathematics achievement. Similarly, in a study of Savaş and Duru (2005) with first grade high school students in Van city center, the role of gender on mathematics achievements and attitude towards mathematics was investigated. The results revealed that males performed better than females in mathematics but this difference is not statistically significant. In addition, results presented in Trends in International Mathematics and Science Survey –TIMMS revealed that the performance of eight grade Turkish male and

female students on mathematics test were approximately equal (Mullis, Martin, Fierros, Goldberg & Stemler, 2000).

There exist a few studies reporting significant gender difference between boys' and girls' mathematics performances in Turkey (Işıksal & Çakiroğlu, 2008; Ubuz, 1999). For instance, Işıksal and Çakiroğlu (2008) investigated the differences between boys and girls mathematics achievements by using nation-wide high school entrance examination's mathematics test in Turkey. The cities in Turkey were separated into five groups with respect to social and economic indexes and 2647 eight grade students participated to the study from these five groups of cities. The findings of the study showed that there was a significant difference in mathematics achievements of boys and girls in the favor of boys with high socioeconomic status but very small effect size for the comparison. Similarly, Ubuz (1999) explored the influence of gender on mathematics performance with tenth and eleventh grade classes of a private school in Ankara. She reported that male students gave more correct responses to all of the questions than females.

As can be seen from the literature in Turkey, the studies related to the issue in elementary grades are in scarce. In addition, the findings of the studies are not as consistent as in United States and Europe. Therefore, gender is a concern for this study. As mentioned before, another concern of the present study was school type and there were very few studies related to difference between private and public elementary school students' beliefs in Turkey. The studies mostly concerned with comparing the level of achievement in public high schools (Anatolian high, Vocational high and General high). Therefore, the difference in achievement scores with respect to school type was investigated in the present study.

2.5 Summary of Literature Review

In summary, as it was stated before, mathematics is mostly viewed as a cognitive domain rather than affective whereas, mathematics is not a totally emotion

free discipline (Geoghegan, 2002). That is, students own feelings, beliefs and emotions are as significant as their mathematics skills and abilities. The studies revealed that personal factors had a relationship with performance in mathematics (Pajares & Miller, 1995). For instance, positive emotions fostered the performance and lead more experience in mathematics while negative emotions hindered mathematics achievement with little or no experience (Hembree, 1990; Pajares & Miller, 1995). Hence, in the present study the researcher focused on mathematics performance and personal constructs such as, self efficacy, anxiety and attitude.

In the literature related to mathematics self efficacy, many researchers reported that self efficacy had a relationship with mathematics performance (Bandura & Schunk, 1981; Brown & Lent & Larkin, 1989). In particular, mathematics self efficacy beliefs had a strong influence on decision of engaging a mathematical task, the amount of time and energy spent on the task and persistence on it (Bandura, 1986; Brown, Lent & Larkin, 1989; Pajares & Miller, 1994). Therefore, it was widely believed that students with high self efficacy performed better in mathematics. However, there exist some studies reporting no significant relation between these two variables (Cooper & Robinson, 1991). Moreover, social scientists investigated the differences in self efficacy beliefs of males and females. The findings revealed that males and female students' self efficacy beliefs were differentiated as they progressed high school (Hyde, Fennema & Lamon, 1990). Males were becoming superior against females after late elementary years in mathematics self efficacy. However, some researchers still argue that gender gap in mathematics self efficacy has been disappeared; particularly they found little or no differences in self efficacy scores of males and females (Cooper & Robinson, 1991). On the other hand, the studies related to the influence of school type on mathematics self efficacy is very limited both in Turkey and abroad (Lubienski, 2003).

Literature review also showed that anxiety had both debilitative and facilitative influences on performance of students in mathematics (Hebb, 1955; Ma, 1999; Skemp, 1986). That is, the studies revealed that some anxiety at a certain point

enhance students performance on mathematics while exceeding optimal level of anxiety undermines the mathematics performance (Tobias, 1982). Moreover, social scientists believed that there were no differences in anxiety levels of boys and girls until late elementary years (Meece, Wigfield, & Eccles, 1990). However, in high school and college, female students reported higher amount of mathematics anxiety than did male peers. Besides, there exists limited literature related to the influence of school type on mathematics anxiety both in Turkey and abroad (Lubienski, 2003).

As can be seen from literature, the findings of the studies related to the attitude towards mathematics have been inconsistent due to lack of clarity in theoretical framework (Leder, 1992; Daskalogianni & Simpson, 2000). Some researchers believed that students who had positive feelings towards mathematics were tend to learn mathematics and spent more time and energy in doing mathematics (Aiken, 1970, 1976; Neale, 1969). However, some researchers claimed that the relation between attitude and mathematics was too weak and hence it was little practical significance in mathematics education (Ma & Kishor, 1997). Moreover, most of the studies revealed that boys held more positive views about mathematics than the girls and higher proportion of the boys perceived themselves as being good at mathematics than the girls did (Young-Loveridge, 1992). On the contrary, some researchers claimed no significant relationship between these two variables and even some social scientists favored girls in attitudes towards mathematics (Ma & Kishor, 1997; Robinson, 1975). Besides, the studies related to the influence of school type on attitudes towards mathematics are very limited both in Turkey and abroad (Lubienski, 2003).

The literature on mathematics achievement historically favored men over women. In recent years, the gender difference in mathematics performance has declined but it is still in the favor of boys (Pajares & Miller, 1994). The studies yielded that difference between males and females mathematics performance emerged mostly in high school and college not until late elementary years (Muller, Leahey & Guo, 2001). On the other hand, the literature on school type is very limited

but the studies showed that students in private high schools outperform their peers in public schools (Lubienski, 2003).

To sum up, the literature review shows that most of the researchers studying on the personal factors investigated the duo relationship such as self efficacy versus mathematics achievement. However, the present study consists of self-efficacy, anxiety, attitude, gender and school type variables together. Moreover, the studies concerning elementary students with respect to these variables are limited and inconclusive. Therefore, in the present study, the relationships among seventh grade students' mathematics self efficacy, mathematics anxiety, the attitude towards mathematics and mathematics achievements were investigated in terms of gender and school type. Another purpose is to examine the role of three personal constructs (mathematics self efficacy, mathematics anxiety and attitude towards mathematics) and two demographics (gender and school type) on predicting mathematics performance of seventh grade students in Turkey.

CHAPTER 3

METHODOLOGY

This chapter is devoted to the information about the research design, population and sample, measuring instruments, data collection procedure, data analysis and finally to the internal and external validity issues.

3.1 Design of the Study

The main purpose of this research was to investigate the relationship among the seventh grade students' mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics achievement in terms of gender or school type in Turkey. The other purpose was to investigate the predicting role of mathematics self efficacy, mathematics anxiety, attitude towards mathematics, gender and school type on mathematics performance of seventh grade students. In order to investigate the research questions and test the hypothesis, quantitative research methods were preferred instead of qualitative ones. In particular, two associational research types, causal-comparative and correlational research design were used. In this study, causal comparative design was preferred in order to investigate the differences in self efficacy, anxiety, attitude and achievement scores with respect to gender and school type. To look up main and joint effect of gender and school type on personal constructs, data were examined through two-way ANOVA. In addition, the correlational research design was chosen in order to investigate the strength and direction of the relationships among a set of predictor variables. To look up how well the set of personal constructs predict mathematics achievement and to investigate relative contributions of each variable to provided model, Standard Multiple Regression Analysis was performed. Table 3.1 displays the overall research design of the study in detail.

Table 3.1 Design of the Study

1. Research Design	Quantitative Study- Causal Comparative and Correlation Research Design
2. Sampling	Convenient sampling
3. Instrument	Mathematics Self Efficacy Scale (MSES) Mathematics Anxiety Rating Scale (MANX) Mathematics Attitudes Scale (MAS) Students Level Determination Exam (SLDE)
4. Data Collection Procedure	Survey
5. Data Analysis Procedure	Two-way ANOVA and Multiple Regression

3.2 Population and Sample of Study

The target population of this study was identified as all seventh grade students in Ankara. There were 335 public and 44 private elementary schools in Ankara (Minister of National Education-MoNE, 2010). Since the target population was too large, it was hard to reach all seventh grade students at 379 elementary schools in Ankara, also it required more time and more financial resources. Therefore, the accessible population, where the results of the study will be generalized, was determined as all the seventh grade students at 132 public and 29 private elementary schools in Çankaya district of Ankara (MoNE, 2010).

The participants of the study were selected based on the convenience of accessibility and proximity to the researcher for both public and private elementary schools. In other words, a convenient sampling of the elementary schools in the district of Çankaya was preferred due to the fact that it was accessible, inexpensive, and easy. However, the convenient sampling may lead sampling bias and limitation in generalization of the results, since it may not represent the entire population.

The sample of the study consisted of 934 seventh grade students from 13 elementary schools, seven public and six private elementary schools, in Çankaya neighborhood. Table 3.2 shows the descriptive statistics of the students participated in study with respect to their school type and gender. In terms of school type, 481 (51.5 %) participants were from 7 public elementary school and 453 (48.5 %) were from 6 private elementary schools. That is, the number of students participated in this study from public and priv ate elementary schools were approximately equal. Moreover, females participants of the study were a few more than male participants of the study. For instance, 477 (51.1 %) female and 457 (48.9 %) male students were participated in this study.

Table 3.2 Distributions of Participants

	Female	Male	Total
Public School	242	239	481(51.5%)
Private School	235	218	453(48.5%)
Total	477(51.1%)	457(48.9%)	934(100%)

3.3 Measuring Instruments

As it was mentioned before, the main purpose of this research was to investigate the relationships among seventh grade students' mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics achievement in terms of gender and school type in Turkey. The other purpose was to investigate the predicting role of mathematics self efficacy, mathematics anxiety, attitude towards mathematics, gender and school type on mathematics performance of seventh grade students. Therefore, mathematics self efficacy, mathematics anxiety, attitudes towards mathematics and mathematics achievement were investigated. The data related to these variables were collected with Mathematics Self Efficacy Scale (MSES), Mathematics Anxiety Scale (MANX), Mathematics

Attitude Scale (MAS) and Students Level Determination Exam 2010 (SLDE 2010). This section of the chapter was adhered to the detailed information about these instruments used in the study.

3.3.1 Mathematics Self Efficacy Scale (MSES)

Mathematics Self Efficacy Scale (MSES), used to measure seventh grade students' self efficacy beliefs towards mathematics in this study was developed by Umay (2001). In the scale, the participants were asked to reflect their opinions with the 14 items related to their self efficacy beliefs towards mathematics. Umay (2001) categorized these MSES items into three groups according to their types as follows; the perception of mathematics self-esteem, the awareness of behaviors in mathematics and adapting mathematics skills to daily life.

Firstly, the perception of mathematics self-esteem reflects a person's overall evaluation or appraisal of his or her own worth on mathematics. Items in MSES which were numbered as 3, 10, 11, 12 and 13 were related to perception of mathematics self-esteem. Secondly, awareness of behaviors in mathematics reflects person's state of consciousness about his/her behaviors while dealing with mathematics (solving a mathematics problem). The MSES contained six items of awareness in mathematical behaviors. The items were numbered as 4, 5, 6, 7, 8 and 9. Finally, adapting mathematics skills to daily life reflects person's level of ability integrating mathematics to his/her daily life. The items of MSES numbered as 1, 2 and 14, were the items related to adapting mathematics skills to daily life component. A sample item for each sub-dimension of MSES was presented in Table 3.3.

A 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to determine the participants level of agreement with the items. Five was valued as the highest score and one as the lowest score for each item in the scale. Scores were added across items to form a possible total score ranging from 14 (low self efficacy) to 70 (high self efficacy) for each participants.

Umay (2001) reported consistent estimates of reliability across samples with Cronbach Alpha coefficient .88 where .70 was accepted as a reliable coefficient in educational researches (Pallant, 2007). Moreover, median of items' validity coefficients were calculated as .64 and it was considered to be acceptable validity value for all the items in the scale (Umay, 2001). All the items in the scale were given in Appendix A.

Table 3.3 Sample Items of MSES for each Sub-dimension

Sub-Dimension	Sample Item
Perception of mathematics self-esteem	I consider that mathematics is not an appropriate profession for me. (Matematiğin benim için uygun bir uğraş olmadığını düşünüyorum)
Awareness of behaviours in mathematics	I know how to behave when I meet a new situation in mathematics. (Matematikte yeni bir durumla karşılaştığımda nasıl davranmam gerektiğini bilirim)
Adapting mathematics skills to daily life	I consider that I use mathematics effectively in daily life. (Matematiği günlük yaşamımda etkin olarak kullanabildiğimi düşünüyorum)

3.3.2 Mathematics Anxiety Scale (MANX)

The original MARS-A scale was developed by Richardson and Suinn (1972) and it was consisted of 98 Likert type items, including statements which are related to daily life, the complexity of numbers and the solutions of problems. The scale was evaluated with numerical values from 1(strongly disagree) to 5 (strongly agree). Therefore, the total anxiety scores of each participant ranged from 98 (low anxiety) to 490 (high anxiety). The reliability and factor analysis of MARS-A were employed

by Richardson and Suinn (1972) and the Cronbach Alpha coefficient was found .93. In this study, Mathematics Anxiety Scale (MANX) was used to measure the seventh grade students' level of anxiety towards mathematics. The MANX was adapted by Erol (1989) from Mathematics Anxiety Rating Scale (MARS-A). In this scale, the participants were asked to respond 45 items related to their level of anxiety towards mathematics. These items were gathered in four sub-dimensions; test anxiety, mathematics anxiety, anxiety in daily life and self confidence in mathematics.

In the first dimension of MANX, test anxiety refers to a psychological condition in which people experience extreme distress and anxiety in testing situations (Cherry, 2010). Second dimension mathematics anxiety includes items related to feeling of tension, apprehension, or fear that interferes with math performance (Ashcraft, 2002). Third dimension, anxiety in daily life indicates people's level of anxiety while using mathematics in daily life situations and last dimension self confidence in mathematics means a person's own judgments about his/her capabilities in doing mathematics. Table 3.4 displayed a sample item for each sub-dimension of MANX.

The participants used a 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Five was valued as the highest score and one as the lowest score for each item in the scale. Scores were added across the items to form a possible total score ranging from 45 (low anxiety) to 225 (high anxiety) for each participants. Moreover, the Cronbach Alpha coefficient was found .91 (Erol, 1989) where .70 was accepted as a reliable coefficient in educational researches (Pallant, 2005). All the items in the scale were given in Appendix B.

Table 3.4 Sample Items of MANX for each Sub-dimension

Sub-Dimension	Sample Item
Test Anxiety	I am very scared of mathematics pop-quizzes. (Habersiz matematik sınavı verilmesinden çok korkuyorum)
Mathematics Anxiety	I am confused in mathematics courses. (Matematik derslerinde kafam karışır)
Anxiety in Daily Life	I am even confused of excitement while calculating the change in the bus. (Otobüste alacağım paranın üstünü hesaplarken bile heyecandan kafam karışır)
Self confidence in Mathematics	I cannot even perform a simple mathematical operation such as addition while someone is watching. (Birisi beni izlerken toplama gibi basit bir işlemi bile yapamam)

3.3.3 Mathematics Attitude Scale (MAS)

In this study, Mathematics Attitude Scale – MAS was used to measure the seventh grade students' attitudes towards mathematics. Mathematics Attitude Scale was developed by Aşkar (1986) during a study observing juniors' and seniors' attitudes towards mathematics at college. In this scale, the participants were asked to answer 20 items related to their level of attitude towards mathematics. According to factor analysis results, Aşkar reported that the items were gathered in one component, level of attitudes toward mathematics. The level of attitudes towards mathematics indicates the students' degree of like or dislike of mathematics. A sample item for this component was presented in Table 3.5.

Table 3.5 Sample Item of MAS

Dimension	Sample Item
Level of attitudes towards mathematics	I get bored in mathematics courses. (Matematik dersinde canım sıkılır)

The participants used a 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Five was valued as the highest score and one as the lowest score for each item in the scale. The scores were added across items to form a possible total score ranging from 20 (low attitude) to 100 (high attitude) for each participants.

Aşkar (1986) found consistent estimates of reliability across samples with Cronbach alpha coefficient .96 where .70 was accepted as a reliable coefficient in educational researches (Pallant, 2005). All the items in the scale were given in Appendix C.

3.3.4 Students Level Determination Exam (SLDE)

In this study Mathematics Sub-Test of Students Level Determination Examination-2010 (SLDE) was used to measure 7^{th} grade students' actual mathematics scores at the end of the semester. The SLDE is a nationwide three stage examination implemented at the end of the 6^{th}, 7^{th} and 8^{th} grades to select and and place students into high schools. The SLDE includes questions from five content areas which are Turkish, Mathematics, Social Sciences, Science and Foreign Language. These are all multiple choice items with four choice alternatives. The number of questions in each sub-test was presented in Table 3.6. At the end of each academic year, elementary students enter SLDE and receive a score from this examination. Not only the score from SLDE, but also the grades in their reports influence the total score of that year's SLDE total score (MoNE, 2007).

Table 3.6 The Number of Questions Each Subtest of SLDE Contains

Sub-Tests	The number of questions
Turkish Achievement Test	19
Mathematics Achievement Test	16
Social Sciences Ach. Test	16
Science Achievement Test	16
Foreign Languages Ach. Test	13

The net score which can be taken from Mathematics Sub-Test of SLDE range from -5.33 to 16. If the student answers all the questions correctly, she/he would receive a score of 16. While determining the net score, three wrong responds cancel one correct respond and hence if students' answers all the questions wrongly, she/he receives a score of -5.33 from the exam. As mentioned above, SLDE is a nationwide examination with three stages implemented in 6^{th}, 7^{th} and 8^{th} grades to select and place students secondary education institutions hence, it was assumed that the test is valid and reliable**.**

3.4 Data Collection Procedure

The main purpose of this study is to investigate the relationship between mathematics anxiety, attitude towards mathematics, mathematics self efficacy and mathematics performance seventh grade students in Turkey with respect to gender or school type. Another purpose of the study is to investigate the role of three personal constructs and two demographics on predicting mathematics achievement. For these purposes, MSES, MARS and MAS were administered to 934 seventh grade students from both public and private elementary schools in the district of Çankaya. The questionnaires were administered at the end of fall semester of 2010-2011 academic years. Moreover, for mathematics achievement scores of students, Students Level Determination Examination (SLDE) mathematics test results were obtained from each school participated to the study.

At the beginning of the fall semester of academic year 2010-2011, the purpose and procedure of the study were explained to the researchers who developed the instruments used in this study. Their permissions were taken via e-mail to implement their scales in this research. Then, Human Subjects Ethics Committee approval was obtained from Middle East Technical University in order to ensure the participant confidentiality and informed decision. Lastly, the approval of Ministry of National Education (MoNE) was received for conducting the study in chosen public and private elementary schools. After all the official approvals were obtained, the researcher made contact with the school administers for administration of questionnaires. These approvals were presented in Appendix E.

During the administration of questionnaires, the researcher explained the students that their participation was not compulsory and would not affect their grades. The students were also assured that their answers will be reserved confidential and they were provided with information regarding the purpose of the study. Therefore, it was stated that the purpose of administering the questionnaires was to learn more about how the students feel to complete mathematics tasks successfully and view their worries or concerns related to mathematics. Then, the researcher informed the students about the instructions how to complete the questionnaires. Also, same explanations were given to all students and none of the students provided with extra information. Before administering the questionnaires, the researcher reminded to make sure the students in completing all the items on the questionnaires. The entire process took approximately forty-forty five minutes depending on the students. Those students who were absent that day were excluded from the study. For the mathematics achievements of students, 2010 SLDE Mathematics Sub-Test results lists were obtained from school administers for each school participated in the study. The SLDE 2010 results lists were obtained on the occasion that keep students name secret.

3.5 Data Analysis

In this study, quantitative data analysis methods were used in order to examine the research questions and test the hypothesis. For statistical analysis, the resulting scores of questionnaires were processed by using SPSS Statistics 17.0 for Windows. In quantitative analysis of data, both descriptive and inferential statistics were performed. Descriptive statistics included mean, standard deviations, and skewness and kurtosis values of all the scales as well as achievement scores. In addition to this, the frequency and percentages were included in order to describe the data better. As inferential statistics, firstly, two-way ANOVA was performed in order to investigate the difference in mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics achievement of seventh grade students in terms of gender and school type. Eta squared was calculated in order to explain the effect size. To state differently, it was examined to explain the practical significance of the findings. Moreover, multiple regression analysis was performed to test how well self efficacy, anxiety, attitude gender and school type predict the performance. In order to investigate the strength of the correlation between the combination of predictor variables (self efficacy, anxiety, attitude, gender and school type) and criterion variable (achievement), the coefficient of multiple correlations - R was calculated. The coefficient of determination – R^2 was also calculated to understand the percentage of variability among the mathematics achievement scores. It can also be attributed to differences in the scores on the predictor variables. In addition, Beta values of each predictor variable were presented in order to explain the unique contribution of each predictor to the total variance. Lastly, B values were used to present the weights of each predictor in the regression equation.

3.6 Internal and External Validity of Study

In the last part of the methodology chapter, internal validity threats and external validity of the study were discussed in detail.

3.6.1 Internal Validity of Study

Internal validity of the study means that "the degree to which observed differences on dependent variable affected only and directly by the independent variable, not any other variables" (Fraenkel & Wallen, 2006, p.344). Therefore, a researcher conducting a causal-comparative and correlational study should be alert to alternative explanation for the results found in the data. Major concern is to control whether any extraneous variable is responsible from the results obtained or not. However, it can be discussed that internal validity threats are sometimes irrelevant in causal-comparative and correlational studies (Fraenkel & Wallen, 2006).

Fraenkel and Wallen stated that some internal validity threats did not apply to correlational and causal comparative studies (2006). Implementation, history, maturation, attitude of subjects and regression threats are not applicable since no intervention occurs in this type of designs. However, there are other internal validity threats that do apply such as subject characteristics, location, instrumentation, testing and mortality.

Subject characteristics threat occurs "whenever two or more characteristics of individuals are correlated since there exist the possibility of another characteristic responsible for the relationship" (Fraenkel & Wallen, 2006, p. 170). To control subject characteristics threat, all the students were selected of the same grade level so that their personal characteristics such as age were similar to each other. Moreover, if there was an influence of an extraneous variable, it would have a similar effect for all the students. Hence, it was assumed that the participants were all in similar characteristics. Therefore, it was assumed that there was no subject characteristics threat.

Location threat refers to "the particular locations in which data collected or intervention is carried out, may create alternative explanations for the relationship" (Fraenkel & Wallen, 2006, p.172). In this study, the questionnaires were

administered in participants own classrooms however all classrooms did not have same conditions. For instance, classrooms in public schools were more crowded than private schools. Such a difference might affect negatively the results of the study. However, the researcher tried to keep conditions standard for all classes by implementing the questionnaires in their own classrooms and in their actual class hours. Hence, the location threat was taken under control.

Instrumentation threat is related to the way in which the instruments are used. There are three major types of instrumentation threat; instrument decay, data collector characteristics and data collector bias. Firstly, instrument decay is often the case when the instrument permits different interpretation of results due to fatigue of scorers (Fraenkel & Wallen, 2006). In this study, since the results were scored by the optical readers, instrument decay was not a threat for the study. Secondly, data collector characteristics threat refers to the possible different characteristics of data gatherers (Fraenkel & Wallen, 2006). That is, some characteristics of data collectors, age, gender or ethnicity, may affect the specific responses particularly with opinion and attitudinal instruments. In this study, in order to control this threat, the data were collected and analyzed by the same researcher. Also, same explanations were given to all students and none of the students provided with extra information. Lastly, data collector bias means the possibility of distorting the data to make certain outcomes more likely by the researcher (Fraenkel & Wallen, 2006). This was not the case in the study, since questionnaires were administered by the same researcher and the implementations and explanations were standard in all schools. As well as data read in optical reader and were not manipulated by anyone.

Testing threat refers to the experience of responding to an instrument might influence the participants responses to another instrument. In particular, testing threat occurs mostly in pretest-posttest design (Fraenkel & Wallen, 2006). In this study, the design was not pretest-posttest design, in which the questionnaires were not re-administered to participants. Moreover, all the questionnaires were administered once at the same time; hence testing was not a threat for the study.

Mortality threat was described as the "dropout of the subject from the study" (Fraenkel & Wallen, 2006, p.170). Fraenkel and Wallen (2007) stated that mortality was not a common threat for correlational designs, since the lost participants were excluded from the study. In this study, the instruments were administered to participants once and for a short time period (a lecture hour – 40 minutes). Moreover, the participants, who filled the scales in the administration, had a score for each variable whereas students who were absent in the administration were lost inevitably. Therefore, mortality was not a threat for internal validity of the study.

3.6.2 External Validity of Study

The term external validity refers to "the extent to which the results of a study can be generalized from a sample to a population" (Fraenkel & Wallen, 2006, p.111). The target population of this study was identified as all seventh grade students in Ankara. There were 335 public and 44 private elementary schools in Ankara during the study (MoNE, 2010) and hence the accessible population was determined as all the seventh grade students from 132 public and 29 private elementary schools in the Çankaya district of Ankara (MoNE, 2010). The participants of the study (934 seventh grade students) were selected from 13 elementary schools in Çankaya neighborhood. Despite the fact that the number of participants and number of schools would seem large enough for generalization, the selected sample's population generalizability was low, which was limited in generalizing the results of the study to intended population due to convenient sampling method. However, the results of this study can be generalized in some clearly defined conditions. This type of generalizability was called as ecological generalizability which indicates the degree to the results of the study extended to conditions or settings other than that prevailed in particular study (Fraenkel & Wallen, 2007). In the present study, the results could be generalized to all seventh grade students having the similar settings and conditions.

CHAPTER 4

RESULTS

The purpose of this research study was to investigate the influence of gender and school type on mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics achievement of seventh grade students. Besides, the role of mathematics self efficacy, anxiety, attitude, gender and school type on predicting mathematics achievement was also examined. The previous chapters were related to review of previous researches and methodology of the present study. In this chapter, results obtained from the analysis of data were summarized. This chapter includes two main parts; descriptive and inferential statistics. Descriptive statistics were given in the first part of the chapter and inferential statistics of quantitative analysis of data were presented in the second part of the chapter.

4.1 Descriptive Statistics

In this section, descriptive statistics regarding the Mathematics Self Efficacy Scale (MSES), Mathematics Anxiety Scale (MANX), Mathematics Attitude Scale (MAS) and Level Determination Exam (LDE) are given. The data were collected during the fall semester of the 2010-2011 academic year from the seventh grade students in public and private elementary schools. In total, 934 seventh grade students responded to all three scales. The descriptive statistics such as mean scores and standard deviations related to the self efficacy, anxiety, attitude and achievement with respect to gender or school type were given in Table 4.1, Table 4.2, Table 4.3 and Table 4.4. First of all, the standard deviation and mean scores of MSES with respect to gender and school type are listed in Table 4.1.

Table 4.1 Mean Scores of Self Efficacy with respect to Gender and School Type

Gender	School Type	Mean	Std. Deviation	N
Male	Public	48.48	11.926	242
	Private	47.52	11.111	235
	Total	48.01	11.530	477
Female	Public	46.83	12.289	239
	Private	45.96	12.925	218
	Total	46.42	12.590	457
Total	Public	47.66	12.124	481
	Private	46.77	12.030	453
	Total	47.23	12.080	934

The analysis for MSES was done with total scores of the items to obtain a self efficacy mean score for each student. As can be seen in Table 4.1, the mean score for public school students was 47.66 (*SD=12.124*) and that of private school students was 46.77 (*SD=12.030*). That is, mean self efficacy scores of public students were higher than that of private school students. The mean scores of MSES for different school types were reported as above the midpoint, which is 35 out of 70. This indicates that the participants of the study had relatively moderate levels of mathematics self efficacy. Furthermore, the results yielded that the mathematics self efficacy of males were greater than that of females for different school types. That is, males had higher mathematics self efficacy with mean score 48.48 (*SD= 11.926*) for public school and 47.52 (*SD= 11.111*) for private schools. On the other hand, mathematics self efficacy mean scores of females were 46.83 (*SD= 12.289*) for public school and 45.96 (*SD= 12.925*) for private schools.

The analysis for MANX was done with total scores of the items to obtain a mathematics anxiety mean score for each student. As can be seen in Table 4.2, the mean anxiety score of students in public school was slightly less than that of private school students. In particular, the mean anxiety score was 111.12 (*SD=37075*) for public school students and 112.96 (*SD= 36.693*) for private school students. When gender variable was investigated, it was observed that males' mean anxiety scores

were less than that of females for both school types. To state differently, males had lower mean anxiety scores than females in both school types. Particularly, males anxiety score was 106.63 (*SD=36.595*) for public schools and 112.03 (*SD=34.359*) for private schools. On the other hand, females anxiety score was 115.67 (*SD=37.079*) for public schools and 113.97 (*SD=39.109*) for private schools.

Table 4.2 Mean Scores of Anxiety with Respect to Gender and School Type

Gender	School Type	Mean	Std. Deviation	N
Male	Public	106.63	36.595	242
	Private	112.03	34.359	235
	Total	109.29	35.577	477
Female	Public	115.67	37.079	239
	Private	113.97	39.109	218
	Total	114.86	38.028	457
Total	Public	111.12	37.075	481
	Private	112.96	36.693	453
	Total	112.01	36.882	934

The analysis for MAS was done with total scores of the items to obtain an attitude score for each student. As can be seen in Table 4.3, attitude mean scores of private school students were relatively higher than that of public school students. To state differently, the mean score of private school students was 62.98 (*SD= 17.663*), whereas mean score of public school students was 58.50 (*SD= 16.897*). When gender variable was investigated for mean attitude scores, it was observed that females and males mean attitude scores were relatively moderate. That is, females' mean score was 61.69 (*SD= 17.088*) and that of males' was 59.42 (*SD=17.636*), which were around 60 out of 100. In addition, the results revealed that females mean attitude scores were higher than that of males for different school types. In particular, females mean attitude score was higher 60.61 (*SD=15.735*) for public school and 63.49 (*SD=18.376*) for private school, whereas males mean attitude score was 56.42 (*SD=17.757*) for public school and 62.51 (*SD=17.000*) for private school.

Table 4.3 Mean Scores of Attitude with Respect to Gender and School Type

Gender	School Type	Mean	Std. Deviation	N
Male	Public	56.42	17.757	242
	Private	62.51	17.000	235
	Total	59.42	17.636	477
Female	Public	60.61	15.735	239
	Private	63.49	18.376	218
	Total	61.69	17.088	457
Total	Public	58.50	16.897	481
	Private	62.98	17.663	453
	Total	60.68	17.408	934

Table 4.4 Mean Scores of Achievement with Respect to Gender and School Type

Gender	School Type	Mean	Std. Deviation	N
Male	Public	10.07	2.694	242
	Private	10.34	2.388	235
	Total	10.20	2.548	477
Female	Public	9.93	2.674	239
	Private	9.82	2.374	218
	Total	9.88	2.533	457
Total	Public	10.00	2.682	481
	Private	10.09	2.393	453
	Total	10.04	2.545	934

Students Level Determination Examination (SLDE) was analysed in order to obtain a mathematics achievement score for each student. As can be seen in Table 4.4, mean scores of mathematics achievement for public and private school students were approximately similar. That is, the mean achievement score for public school student was 10.00 (*SD= 2.682*) and that of private school students was 10.09 (*SD= 2.393*). When gender variable was inspected, it was seen that males outperformed females in mathematics achievements scores for both school types. To state differently, males had higher mathematics achievement scores when compared with females; with means scores 10.07 (*SD=2.694*) for public school and 10.34 (*SD=*

2.388) for private schools. On the other hand, mathematics achievement scores of females was 9.93 (*SD=2.674*) for public schools and 9.82 (*SD=2.374*) for private schools.

4.2 Inferential Statistics

In the previous section, demographic information of the participants and standard deviations and mean scores regarding MSES, MANX, MAS, and LDE with respect to gender and school type variables were given.

As mentioned before, the purpose of this study was to investigate the difference between mathematics self efficacy, mathematics anxiety, attitudes towards mathematics and mathematics achievement of seventh grades with respect to gender and school type. Moreover, the role of three attitudinal constructs (mathematics self efficacy, mathematics anxiety and attitude towards mathematics) and two demographics (gender and school type) on predicting mathematics achievement was also investigated. In order to examine the difference in self efficacy, anxiety, attitude and achievement in terms of gender and school type, two-way ANOVA was performed. In addition, multiple regression analysis was run to investigate the role of three attitudinal constructs and two demographics on predicting mathematics achievement of seventh grade students.

4.2.1 Difference in Mean Self Efficacy Scores with respect to Gender and School Type

The first research question was “Is there a significant mean difference in self efficacy scores in terms of gender and school type?”. In order to investigate the research question, preliminary analysis were conducted before two-way ANOVA was performed.

4.2.1.1 Assumptions of Two-Way ANOVA

Pallant (2007) mentioned three main assumptions to be assured before conducting two-way ANOVA; *level of measurement, independence of observations, normality and homogeneity of variance*.

Level of Measurement and Independence of Observations

Each of parametric approaches particularly, two-way ANOVA assumes that "the dependent variable of the study is measured at the interval or ratio level, that is using a continuous scale rather than discrete categories" (Pallant, 2007, p.203). In the present study, mathematics self efficacy was measured by the scores of the participants for MSES which were continuous; hence the level of measurement assumption was assured.

The observations that made up the data should be independent of one another, to state differently, each measurement should not be influenced by any other observation or measurement (Stevens, 1996). In the present study, there was not any situation that subjects were involved in an interaction with one another, when the measurements were applied in classroom. Hence, it was assumed that independence of observations assumption was assumed to be assured.

Normality

Normality is described as "a symmetrical, bell-shaped curve, which has the greatest frequency in the middle and relatively small frequencies on both extremes" (Gravetter & Wallnau, 2000, p.52). It is recommended to check Skewness and Kurtosis values and histograms for testing normality (Pallant, 2005). The term skewness refers to "the symmetry of distribution" and the term kurtosis indicates "the peakedness of the distribution" (Pallant, 2005, p.53). It was suggested that skewness and kurtosis values between -1 and +1 were required, but values between -

2 and + 2 is acceptable for normal distribution as well (Pallant, 2005). For perfect normality, values should be around zero (Pallant, 2005). In Table 4.5, skewness and kurtosis values of mean self efficacy scores for each group were summarized.

Table 4.5 Skewness and Kurtosis Values for Mean Self Efficacy Scores

	Skewness	Kurtosis
Males	-.891	.357
Females	-.638	-.347
Public Sch.	-.808	-.014
Private Sch.	-.724	-.037

As it can be seen from Table 4.5, the skewness and kurtosis values were ranged between -.891 and -.014, this indicated that there was no violation of normality assumption (Kunnan, 1998). Moreover, histograms with respect to gender and school type were given in Figure 4.1, Figure 4.2, Figure 4.3, and Figure 4.4.

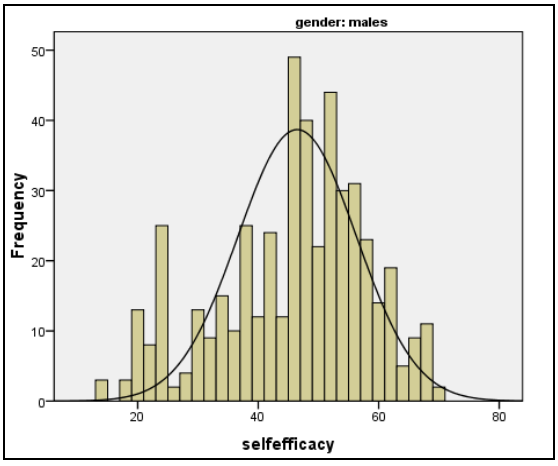

Figure 4.1 Histogram of mean self efficacy scores for males

In Table 4.5, the skewness and kurtosis values for males' self efficacy score were noted as -.891 and .357, which were in the required range between -1 and +1. Moreover, it was observed in Figure 4.1 that males' self efficacy scores were normally distributed. Hence, the normality assumption was assured for males' self efficacy scores.

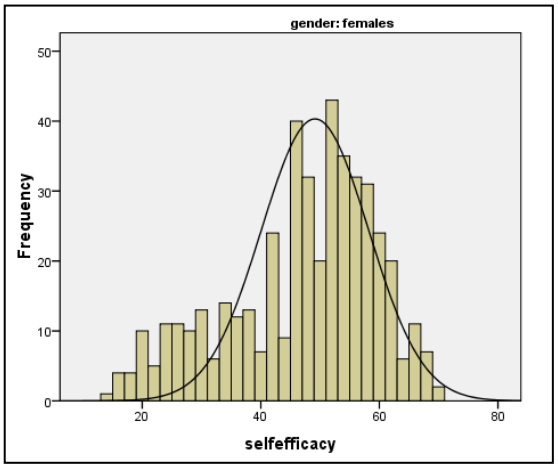

Figure 4.2 Histogram of mean self efficacy scores for females

From Table 4.5, the skewness and kurtosis values for females' self efficacy scores was reported as -.638 and -.347 within the acceptable range. Also, the normal curve on Figure 4.2 provided additional evidence for normality of females' self efficacy scores. Thus, normality assumption was satisfied for females' self efficacy scores too.

Table 4.5 displayed the skewness value as -.808 and kurtosis value -.014 for self efficacy scores of students in public schools. Moreover, Figure 4.3 assured the normal distribution of self efficacy scores of students in public school. Hence, it was assumed that normality assumption was satisfied for females' self efficacy scores too.

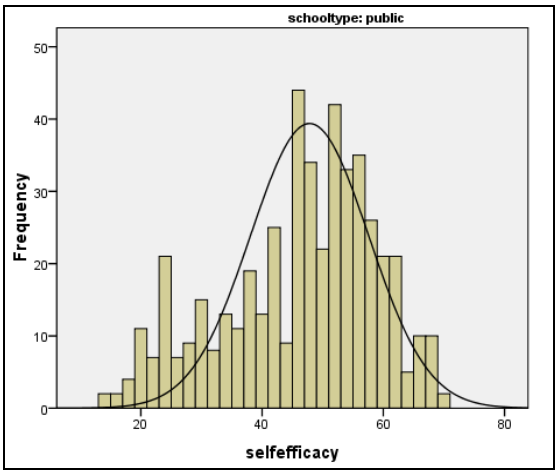

Figure 4.3 Histogram of mean self efficacy scores for public school students

As it was displayed in Table 4.5, the skewness and kurtosis values were -.724 and -.037. Moreover, it was revealed in Figure 4.4 that self efficacy scores of students in private school were normally distributed. For females, males, public and private schools, the above histograms with normal curves also gave additional evidence for normality of self efficacy scores. In summary, normality assumption was assured in the present study for self efficacy scores.

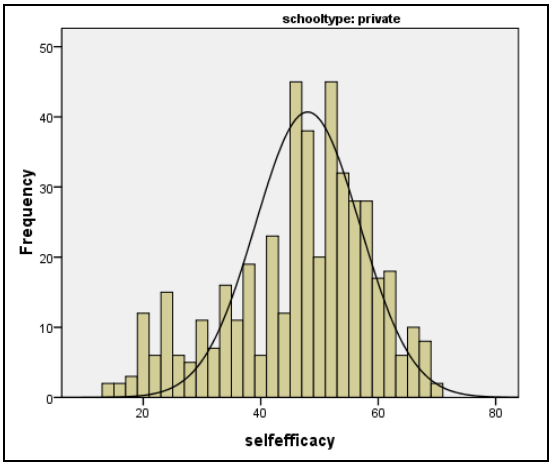

Figure 4.4 Histogram of mean self efficacy scores for private school students

Homogeneity of Variance

Homogeneity of variance was described as the equalness of the variance within each of the population (Pallant 2005). In order to determine whether homogeneity of variance was ensured, Levene's Test of Equality was examined. Pallant (2005) stated that significant result less than .05 would address that variance of the dependent variable across the groups was not equal. Table 4.6 displayed the results of Levene's Test of Equality.

Table 4.6 Levene's Test Results for Mean Self Efficacy Scores

	F	df1	df2	Sig
Self Efficacy	2.469	3	930	.061

As it was displayed that homogeneity of variance assumption was assured, since the significance value was greater than .05, [F (3,930) = 2.469, p= .061]. That is, the variance within each population was equally distributed. In summary, all the assumptions of two-way ANOVA was assured for investigating the difference in mean self efficacy scores with respect to gender and school type. Therefore, in the next section, the results of inferential statistics will be given.

4.2.1.2 Two-Way ANOVA Results of Mathematics Self Efficacy

In order to investigate the difference in self efficacy scores of students with respect to gender and school type, two-way ANOVA was performed at .05 significance level. Table 4.7 presented the results of the two-way ANOVA.

As it can be seen in Table 4.7, the results yielded that the interaction effect of gender and school type with respect to mean self efficacy scores was not statistically significant, [F (1,930) =.004, p= .952]. Moreover, Figure 4.5 indicates that males' mean self efficacy score was higher than that of females regardless of school type

and also students in public schools outperformed the students in private schools with respect to mean self efficacy scores regardless of gender.

Table 4.7 Self Efficacy with respect to Gender and School type

	Type III sum of square	Df	Mean Squares	F	Sig.	Partial Eta Squared
Gender	602.431	1	602.431	4.139	.042	.004
School Type	194.152	1	194.152	1. 334	.248	,001
Gender-School type	.525	1	.525	.004	.952	.000

Since there was no significant interaction effect of gender and school type, it was investigated whether there was a significant main effect of gender and school type on mean self efficacy scores. The results in Table 4.7 showed that gender had significant main effect on mean self efficacy scores [F (1,930) = 4.139, p=.042]. This indicated that the difference between mean self efficacy scores of males (*M=48.01, SD=11.530*) and females (*M=46.42, SD= 12.590*) was significant in the favor of males. In other words, males were more self efficious than females. Moreover, the effect size for gender (Partial eta square) was calculated as .004. According to Cohen's (1998) criterion (small 0.01, medium 0.06, and large 0.14), it was stated that the effect size of gender for the present study was relatively small. That is, the difference between males and females mean self efficacy score was of little practical significance.

In Table 4.7, the results also revealed that school type did not have significant main effect on mean self efficacy scores, [F (1,930) = 1.334, p=.248]. To state differently, the results indicated that mean self efficacy scores of public school students (*M=47.66, SD=12.124*) were higher than private school students' mean self

efficacy scores (*M=46.77, SD= 12.030*). However, this difference is not statistically significant.

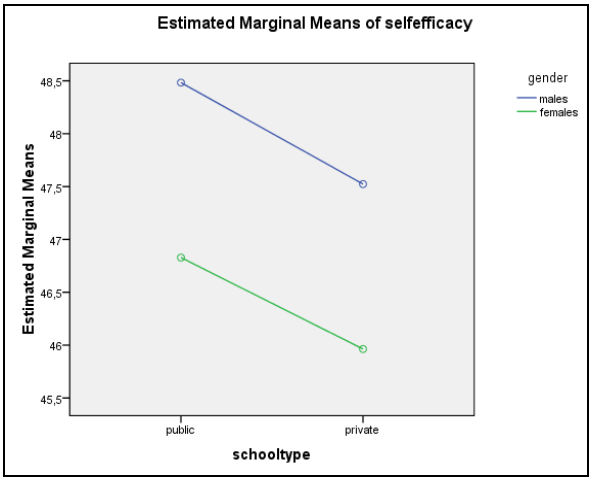

Figure 4.5 The relation between gender, school type and self efficacy

4.2.2 The difference in Mean Anxiety Scores with respect to Gender or School Type

The second research question was "Is there a significant mean difference in anxiety scores in terms of gender and school type?". In order to investigate the research question, preliminary analysis were conducted before two-way ANOVA was performed.

4.2.2.1 Assumptions of Two-Way ANOVA

The level of Measurement and Independence of Observations

As it was stated before, the dependent variable, mathematics anxiety, was measured by the mean scores of the participants for Mathematics Anxiety Scale-MANX which were continuous; hence the level of measurement assumption was

assured. Therefore, it was assumed that independence of observations assumption was assumed to be assured.

Normality

Another assumption to conduct two-way ANOVA is normality. In order to assure the normality assumption, the distribution for anxiety mean scores with respect to gender and school type was investigated by examining skewness and kurtosis values and histograms. In Table 4.8, skewness and kurtosis values of mean self efficacy scores for each group were summarized.

Table 4.8 Skewness and Kurtosis Values for Mean Anxiety Scores

	Skewness	Kurtosis
Males	1.012	.903
Females	.811	-.154
Public Sch.	1.018	.285
Private Sch.	.991	.316

As it can be seen from Table 4.8, the skewness and kurtosis values were ranged between 1.018 and -.154, this indicated that there was no violation of normality assumption (Kunnan, 1998). Besides, histograms with respect to gender and school type were given in Figure 4.6, Figure 4.7, Figure 4.8, and Figure 4.9.

In Table 4.8, the skewness and kurtosis values for males' anxiety scores were noted as 1.012 and .903, which were in the required range between -1 and +1. Moreover, it was observed in Figure 4.6 that males' anxiety scores were distributed normally. Hence, it was assumed that the normality assumption was assured for males' anxiety scores.

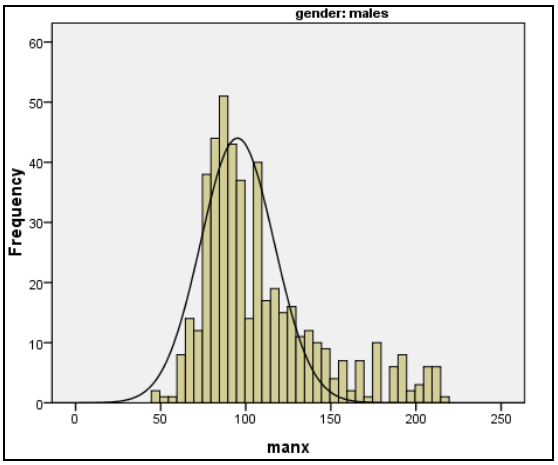

Figure 4.6 Histogram of mean anxiety scores for males

For distribution of females' anxiety score, it was observed from Table 4.8 that the skewness value was .811 and the kurtosis value was -.154. In addition, Figure 4.7 provided additional support for the normal distribution of females' anxiety scores. Thus, the normality assumption for female anxiety scores was satisfied.

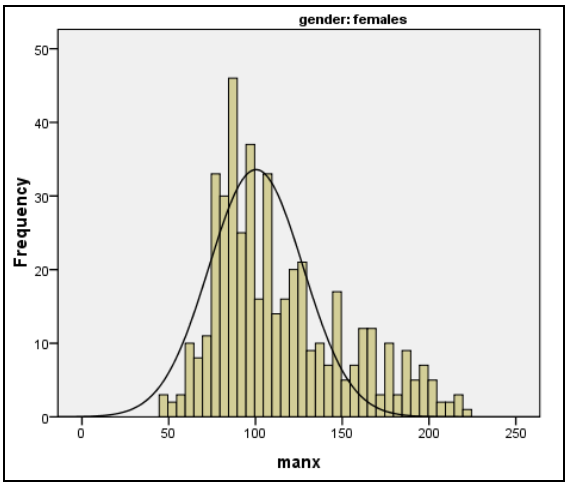

Figure 4.7 Histogram of mean anxiety scores for females

Table 4.8 displayed the skewness value as 1.018 and kurtosis value .285 for anxiety scores of students in public schools. Moreover, Figure 4.8 assured the normality of anxiety scores of students in public school.

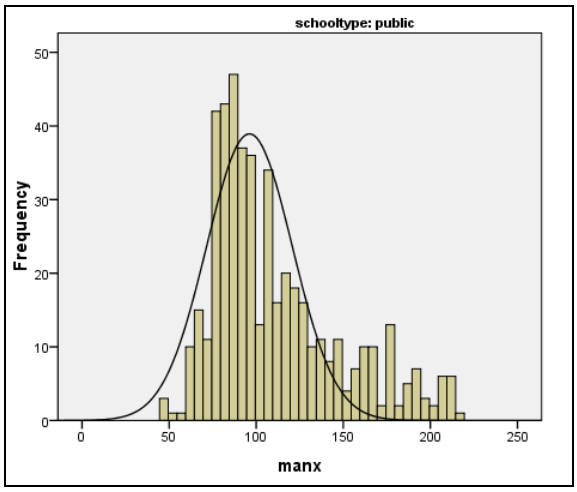

Figure 4.8 Histogram of mean anxiety scores for public school students

As it was presented in Table 4.8, the skewness and kurtosis values were .991 and .316. Moreover, it was revealed in Figure 4.9 that anxiety scores of students in private school were normally distributed. Hence, it was concluded that the distribution of anxiety scores of students in private school was assured the normality assumption. In brief, for all demographics, the above histograms with normal curves also gave additional evidence for normality of mean anxiety scores. Therefore, it was accepted that normality assumption was assured in the present study for anxiety scores.

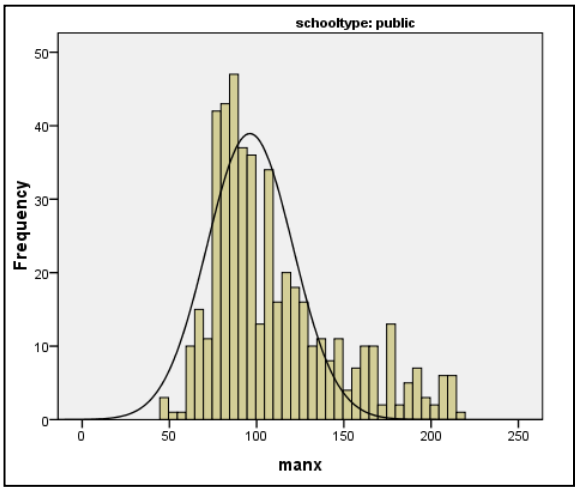

Figure 4.9 Histogram of mean anxiety scores for private school students

Homogeneity of Variance

Table 4.9 Levene's Test Results for Mean Anxiety Scores

	F	df1	df2	Sig
Anxiety	2.210	3	930	.085

As can be seen from Table 4.9, homogeneity of variance assumption was assured, since the significance value was greater than .05, [F (3,930) = 2.210, p= .085]. That is, the variance within each population was equally distributed.

4.2.2.2 Two-Way ANOVA Results of Mathematics Anxiety

In order to investigate the difference in anxiety scores of students with respect to gender or school type, two-way ANOVA was performed at .05 significance level. Table 4.10 presented the results of the two-way ANOVA.

Table 4.10 Anxiety with respect to Gender and School type

	Type III sum of square	Df	Mean Squares	F	Sig.	Partial Eta Squared
Gender	7030.817	1	7030.817	5.197	.023	.006
School Type	796.090	1	796.090	.588	.443	,001
Gender-School type	2994.009	1	2994.009	2.176	.140	.002

As it can be seen from Table 4.10, it was revealed that the interaction effect of gender or school type with respect to anxiety scores was not statistically significant, [F (1,930) =2.176, p= .140]. In particular, this indicated that females' mean anxiety scores were higher than that of males regardless their type of school

and also mean anxiety scores of private school students outperformed that of public school students regardless of gender.

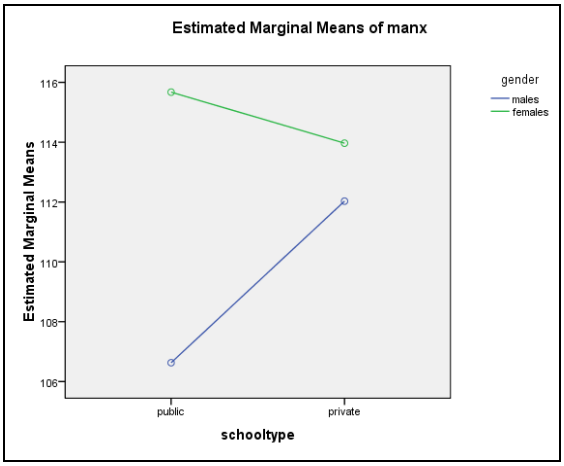

Figure 4.10 The relation between gender, school type and anxiety

Since there was not a significant interaction effect of gender and school type on anxiety scores, it was investigated whether there was a significant main effect of gender and school type. As can be seen from Table 4.10, the results revealed that gender had significant main effect on anxiety scores [F (1,930) = 5.197, p=.023]. This indicated that the difference between females mean anxiety scores (*M=114.86, SD=38.028*) and males mean anxiety scores (*M=109.29, SD= 35.577*) was statistically significant. This indicated that females were more anxious than males. Moreover, the effect size for gender (Partial eta square) was calculated as .006. According to Cohen's (1998) criterion (small 0.01, medium 0.06, and large 0.14), it was stated that the effect size of gender for the present study was relatively small. That is, the difference between males and females mean anxiety scores was of little practical significance.

In Table 4.10, the results also revealed that school type did not have significant main effect on anxiety scores, [F (1,930) = .588, p=.443]. To state differently, the results indicated that mean anxiety scores of students in public

schools (*M=111.12, SD=37.075*) were lower than that of private school (*M=112.96, SD= 36.693*). However, the difference was not statistically significant.

4.2.3 Difference in Mean Attitude Scores with respect to Gender and School Type

The third research question was "Is there a significant mean difference in attitude scores in terms of gender or school type?". In order to investigate the research question, preliminary analysis were conducted before two-way ANOVA was performed.

4.2.3.1 Assumptions of Two-Way ANOVA

As mentioned before, there are three main assumptions to be assured before conducting two-way ANOVA; *level of measurement, independence of observations, normality and homogeneity of variance* (Pallant, 2007).

Level of Measurement and Independence of Observations

In the present study, one of the dependent variables was the students' attitude towards mathematics. It was measured as the mean scores of the participants for the MAS, which was continuous; hence the level of measurement was assured. Moreover, the independence of observation assumptions was assumed to be assured, since there was not any interaction occurred among subjects and subjects did not influence each other during adapting the MAS.

Normality

In order to assure the normality assumption, skewness and kurtosis values and histograms were examined. In Table 4.11, skewness and kurtosis values of mean scores of attitude for each group were summarized.

Table 4.11 Skewness and Kurtosis Values for Mean Attitude Scores

	Skewness	Kurtosis
Males	-.263	-.618
Females	-.476	-.387
Public Sch.	-.333	-.521
Private Sch.	-.449	-.498

As it can be seen from Table 4.13, the skewness and kurtosis values were ranged between -.618 and -.263, this indicated that there was no violation of normality assumption (Kunnan, 1998). Moreover, histograms were given in Figure 4.11, Figure 4.12, Figure 4.13, and Figure 4.14.

Table 4.11 revealed that skewness (-.263) and kurtosis value (-.618) for distribution of male students' attitude scores was between the required range. Moreover, Figure 4.11 provided the histogram of attitude scores for males. Figure 4.11 indicated that the males' attitude scores were normally distributed and hence it was assumed that normality assumption was assured.

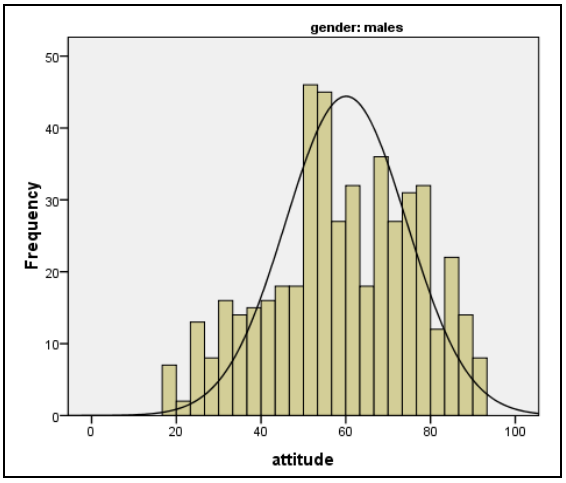

Figure 4.11 Histogram of mean attitude scores for males

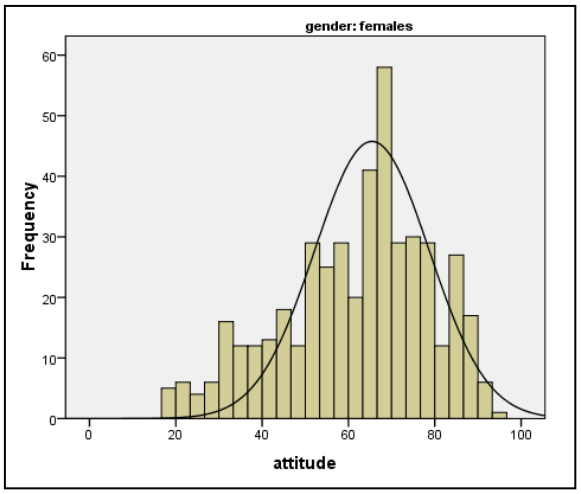

Figure 4.12 Histogram of mean attitude scores for females

As can be seen from Table 4.11, there was no violation of normality assumption with respect to skewness (-.476) and kurtosis values (-.387) for females' attitude scores. In addition, Figure 4.12 provided additional evidence of normal distribution for females' attitude scores. Thus, it was assumed that the normality assumption was not violated.

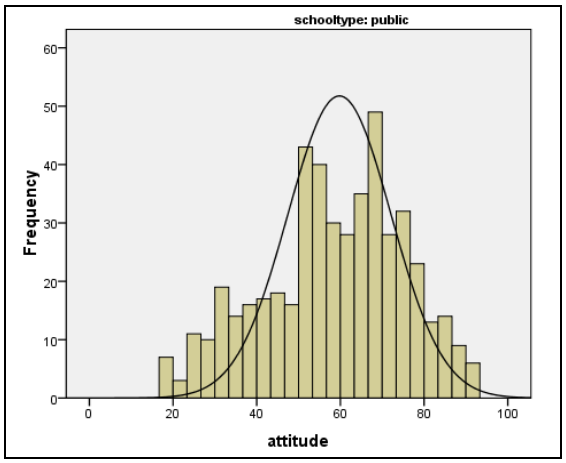

Figure 4.13 Histogram of mean attitude scores for public school students

The skewness and kurtosis values for attitude scores of students in public school were presented in Table 4.11 and these values were between the required range (-.333 and -.521, respectively). Also, Figure 4.13 displayed a normal distribution of attitude scores of students in public schools. Hence, it was concluded that the normality assumption was satisfied.

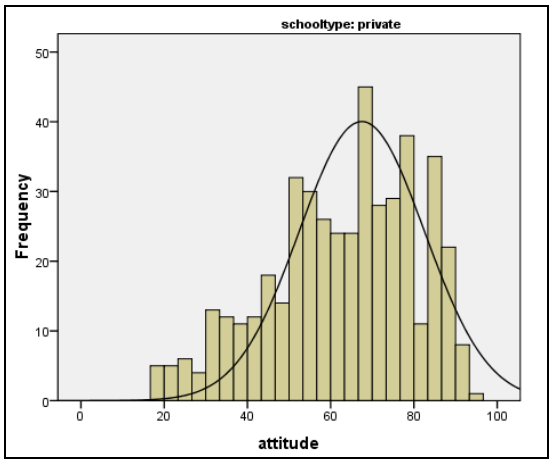

Figure 4.14 Histogram of mean attitude scores for private school students

As it was displayed in Table 4.11, the skewness and kurtosis values were -.449 and -.498. Moreover, it was revealed in Figure 4.14 that attitude scores of students in private school were normally distributed. Thus, the normality assumption was ensured. For all demographics, the above histograms with normal curves and skewness/kurtosis values gave additional evidence for normality of attitude scores.

Homogeneity of Variance

Table 4.12 presented that homogeneity of variance assumption was assured, since it was not statistically significant, [F (3,930) =1.899, p=.128]. That is, the variance within each population was equally distributed. To sum up, the assumptions of two-way ANOVA was satisfied for investigating the difference in mean attitude

scores with respect to gender or school type. Therefore, the results of inferential statistics will be presented in the next section.

Table 4.12 Levene's Test Results for Mean Attitude Scores

	F	df1	df2	Sig
Achievement	1.899	3	930	.128

4.2.3.2 Two-Way ANOVA Results of the attitude Towards Mathematics

In order to investigate the difference in mean attitude scores of students with respect to gender or school type, two-way ANOVA was performed at .05 significance level. Table 4.13 presented the results of the two-way ANOVA.

Table 4.13 Attitude with respect to Gender and School type

	Type III sum of square	df	Mean Squares	F	Sig.	Partial Eta Squared
Gender	1560.002	1	1560.002	5.260	.022	.006
School Type	4695.095	1	4695.095	15.830	.000	.017
Gender-School type	603.110	1	603.110	2.033	.154	.002

As it was observed from Table 4.13 and Figure 4.15, the results showed that the interaction effect between gender and school type on attitude scores was not statistically significant, [F (1,930) = 2.033, p>.154]. Therefore, it can be stated that regardless of school type, females' mean attitude score was higher than that of males'. In addition, mean attitude score of students in private school was more than that of students in public schools regardless of gender.

Since there was no interaction effect of gender and school type on attitude scores, it was investigated that whether there was a main effect of gender and school type. As it can be seen from Table 4.13, the results yielded that gender had significant main effect on mean attitude scores [F(1,930) = 5.260, p=.022]. That is, males' mean scores of attitude (*M=59.42, SD= 17.636*) was significantly less than females' (*M=61.69, SD=17.088*) with respect to total mean scores in attitude scores. In other words, males' attitude towards mathematics was lower than that of females'. Moreover, the effect size for gender was calculated as .006. That is, the actual differences in the mean values were small which means that the difference between females and males seemed to be of little practical significance.

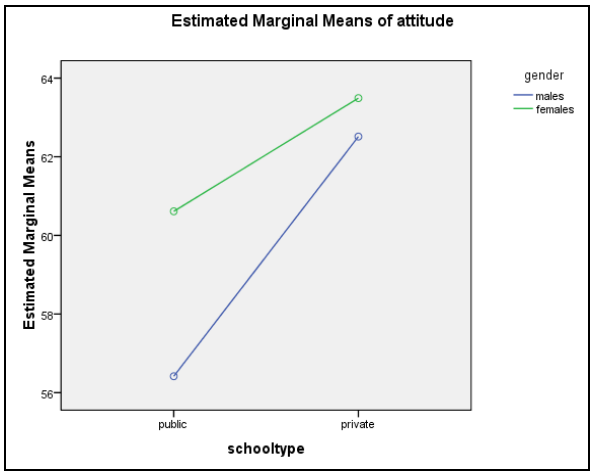

Figure 4.15 The relation between gender, school type and attitude

Since there was no interaction effect of gender or school type on attitude scores, it was investigated that whether there was a main effect of gender and school type. As it can be seen from Table 4.13, the results yielded that gender had significant main effect on mean attitude scores [F(1,930) = 5.260, p=.022]. That is, males' mean scores of attitude (*M=59.42, SD= 17.636*) was significantly less than females' (*M=61.69, SD=17.088*) with respect to total mean scores in attitude scores. In other words, males' attitude towards mathematics was lower than that of females'. Moreover, the effect size for gender was calculated as .006. That is, the actual

differences in the mean values were small which means that the difference between females and males seemed to be of little practical significance.

Besides, Table 4.13 revealed that school type had also significant main effect on mean attitude scores [F (1,930) = 15.830, p=.000]. That means the attitude scores of students in private schools (*M=62.98, SD=17.663*) were higher than mean attitude scores of students in public schools (*M=58.50, SD=16.897*). In other words, private school students had more positive attitudes towards mathematics than that of public school students did. The effect size for school type was calculated .017. Based on Cohen's criterion (1998), it was assumed to be a medium effect size which indicates the mean difference between public and private schools has a practical significance in education.

4.2.4 The difference in Mean Achievement Scores with respect to Gender and School Type

The fourth research question was "Is there a significant mean difference in achievement scores in terms of gender and school type?". In order to investigate the research question, preliminary analysis were conducted before two-way ANOVA was performed.

4.2.4.1 Assumptions of Two-Way ANOVA

As it was stated above, there are three main assumptions to be assured before conducting two-way ANOVA mentioned by Pallant (2007); *level of measurement, independence of observations, normality and homogeneity of variance.*

Level of Measurement and Independence of Observations

In this study, the students' mathematics achievement scores were measured as the mean scores of the participants for the LDE, which was continuous; hence it was

assumed that the level of measurement assumption was assured. Furthermore, independence of observations assumptions was assumed to be assured, since there was not any interaction occurred among subjects and subjects did not influence each other during Student Level Determination Examination.

Normality

In order to assure the normality assumption, the distribution for mean scores of achievement with respect to gender and school type was investigated by examining skewness and kurtosis values and histograms. In Table 4.14, skewness and kurtosis values of mean scores of attitude for each group were summarized.

Table 4.14 Skewness and Kurtosis Values for Mean Achievement Scores

	Skewness	Kurtosis
Males	-.750	.371
Females	-.571	.120
Public Sch.	-.642	-.061
Private Sch.	-.661	.366

As it can be seen from the Table 4.14, skewness and kurtosis values were ranged between -.750 and .371, which means that there was no violation of normality assumption for achievement score with respect to gender and school type.

Moreover, histograms with respect to gender and school type were given in Figure 4.16, Figure 4.17, Figure 4.18, and Figure 4.19. As can be seen from Table 4.14, the skewness (-.750) and kurtosis values (.371) did not violate the normality assumption for distribution of males' achievement scores. Also, Figure 4.16 provided an additional support for the normal distribution.

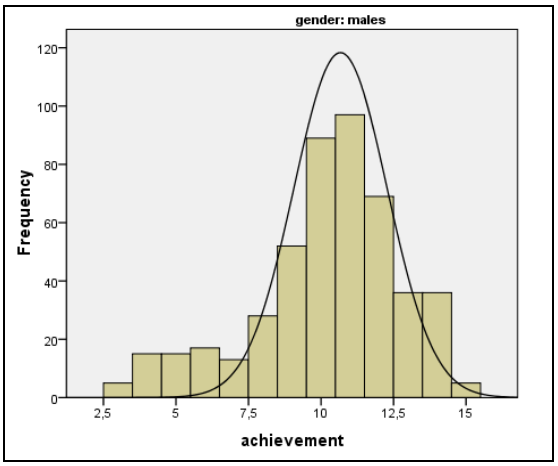

Figure 4.16 Histogram of mean achievement scores for males

The distribution of females' achievement scores did not violate normality assumption as well. In particular, the skewness and kurtosis values were -.571 and .120 respectively within the required range. Besides, the normal curve on Figure 4.17 gave another evidence to assure normality assumption for females' achievement scores.

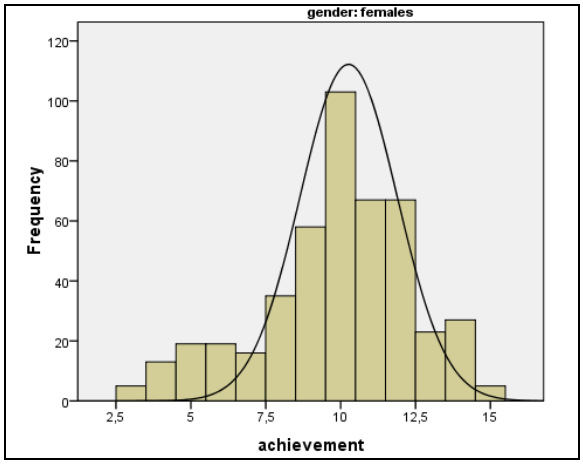

Figure 4.17 Histogram of mean achievement scores for females

The skewness and kurtosis values for achievement scores of students in public school were presented in Table 4.14 and these values were between the

required range (-.642 and -.061, respectively). Also, Figure 4.18 revealed a normal distribution of achievement scores of students in public schools. Hence, it was concluded that the normality assumption was satisfied.

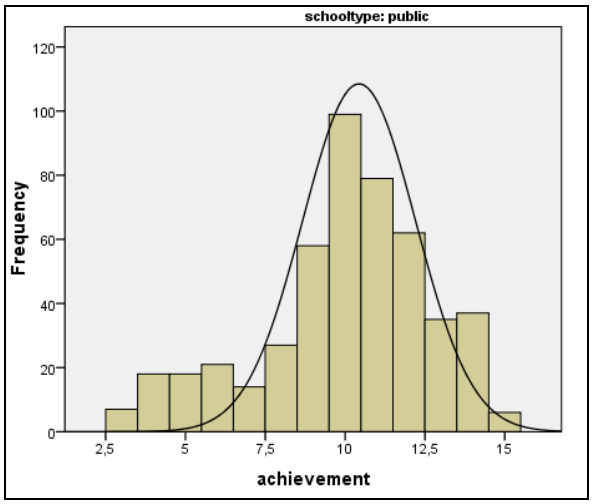

Figure 4.18 Histogram of mean achievement scores for public school students

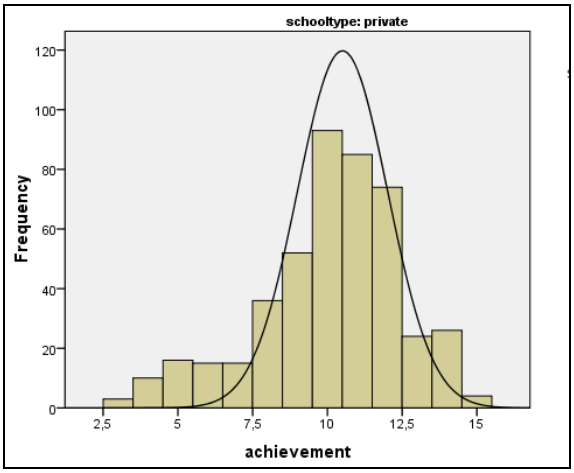

Figure 4.19 Histogram of mean achievement scores for private school students

In Table 4.14, the skewness and kurtosis values for achievement scores in private school were reported as -.661 and .366, which were in the required range between -1 and +1. Moreover, it was observed in Figure 4.19 that achievement

scores for private school were distributed normally. Hence, it was assumed that the normality assumption was assured for males' anxiety scores. All the histograms of achievement scores and skewness/kurtosis values revealed that the achievements scores were normally distributed both for males and females as well as public and private schools. Hence, it was assured that there was no violation of normality assumption.

Homogeneity of Variance

Table 4.15 Levene's Test Results for Mean Achievement Scores

	F	df1	df2	Sig
Achievement	1.277	3	930	.281

As it was presented in Table 4.15 that homogeneity of variance assumption was assured, since it was not statistically significant, [F (3,930) =1.277, p=.281]. That is, the variance within each population was equally distributed.

4.2.4.2 Two-Way ANOVA Results of Mathematics Achievement

In order to investigate the difference in achievement scores of students with respect to gender and school type, two-way ANOVA was performed at .05 significance level. Table 4.16 presented the results of the two-way ANOVA.

Table 4.16 Achievement with respect to Gender and School type

	Type III sum of square	Df	Mean Squares	F	Sig.	Partial Eta Squared
Gender	25.785	1	25.785	3.992	.046	.004
School Type	1.301	1	.632	1.301	.654	.000
Gender-Sch.type	8.158	1	8.158	1.263	.261	.001

As it was observed from Table 4.16, the results showed that the interaction effect between gender and school type on mathematics achievements scores was not statistically significant, [F (1,930) = 1.263, p>.261]. That can be stated that regardless of school type, females' mean achievement score was lower than that of males'. Besides, total mathematics achievement of private school students was higher than that of public school students independent of gender.

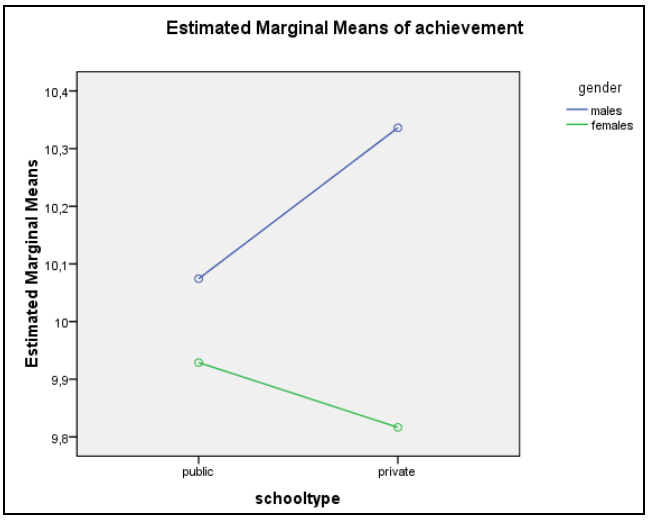

Figure 4.20 The relation between gender, school type and achievement

As it was also observed from Figure 4.20, there was no significant interaction effect of gender and school type on achievement scores. Furthermore, it was investigated whether there was a significant main effect of gender and school type on achievement scores. As it can be seen from Table 4.16, the results revealed that there was a statistically significant main effect for gender on achievement scores, F (1,930) = 3.992, p<.046. That is, the difference between achievement scores of males (*M=10.20, SD=2.548*) and females (*M=9.88, SD= 2.533*) was statistically significant. In other words, males outperformed females in mathematics achievement. Moreover, the effect size for gender was calculated as .004. That is, it was concluded that the effect size of gender for the present study was relatively small

and the difference between females and males seemed to be of little practical significance. Table 4.16 also showed that the school type did not have significant effect on achievement scores, [F (1,930) = 1.301, p=.654]. That is, the results indicated that mean achievement score of students in public schools (M=10.00, SD=2.682) were slightly less than that of private school (M=10.09, SD=2.393). However, the difference was not statistically significant.

4.2.5 The Role of Three Personal Constructs and Two Demographics on Predicting Achievement

In order to investigate the role of mathematics anxiety, attitude towards mathematics, mathematics self efficacy, gender or school type on predicting mathematics performance of seventh grade students, multiple regression analysis were performed. Before performing multiple regression analysis, pre-limenary analysis were conducted.

4.2.5.1 Assumptions of Multiple Regression Analysis

Before conducting the analysis, the assumptions of multiple regressions stated by Tabachnik and Fidell (2007) were checked. According to Tabachnik and Fidell (2007), multiple regression analysis is one of the fussier of statistical techniques and seven major assumptions of multiple regression analysis; sample size, multicollinearity and singularity, outliers, normality, linearity, and homoscedasticity, has to be satisfied for performing multiple regression analysis.

Sample Size

Multiple regression analysis is not a statistical technique to use on small samples due to issue of generalisability (Pallant, 2005). That is, with small samples researchers may obtain a result that cannot be repeated with other samples (Pallant, 2005). Hence, “if the results do not generalize to other samples, they are of little

scientific value" (Tabachnik & Fidell, 2007). Concerning the number of participants for multiple regression, Stevens (1996, p.72) offered that 15 subjects per predictor variables were sufficient for reliable social science research. Moreover, Tabachnik and Fidell provided "a formula for satisfying sample size requirements, considering the number of predictor variables: N > 50 + 8*m (where m = number of predictors)" (2007, p.123).

In this study, there was one criterion variable, *mathematics performance*, while there were five predictor variables, *mathematics self efficacy, mathematics anxiety, attitude towards mathematics, gender and school type*. According to Stevens (1996) sample size requirements, 75 participants were sufficient for this study (regression analysis with five predictor variables). On the other hand, according to Tabachnik and Fidell (2007), required sample size for five predictor variables was at least 90 participants (N > 50 + 8*5). The sample of this study consisted of 934 seventh grade elementary school students which assured the requirements of both Stevens (1996) and Tabachnik & Fidell (2007).

Multicollinearity and Singularity

Multicollinearity and singularity refers to the relationship among the independent variables. Multiple regression analysis views multicollinearity and singularity as a threat since these do not contribute a reliable regression model (Pallant, 2005). Multicollinearity occurs when the correlation among predictor variables are too high or not (R = .9 or above). Similarly, singularity exists when a predictor variable is a combination of other predictor variables (Tabachnik & Fidell, 2007). For multicollinearity and singularity assumptions, it is important to check whether the correlation among each of predictor variables is not too high (R = .9 or above) (Tabachnik & Fidell, 2007). Table 4.17 displayed the correlations between the variables in this study.

As it can be seen from Table 4.17, none of the bi-variate correlations between the predictor variables was not above .9. Hence, multicollinearity and singularity assumption was not violated.

Table 4.17 Summary of Correlations among Variables

	Achievement	S.eff.	Anxiety	Attitude	Gender	Sch.type
Achievement	1.000	-	-	-	-	-
Self Efficacy	.535*	-	-	-	-	-
Anxiety	-.420*	-.576*	-	-	-	-
Attitude	.535*	.713*	-.473*	-	-	-
Gender	-,364*	-.366*	.376*	.374*	-	-
School type	.117	-.237	.125	.229*	-.016	-

According to *collinearity diagnostics* as a part of multiple regression analysis, two values are provided Tolerance and VIF. Tolerance value refers to "how much of the variability of the specified predictor is not explained by other predictors in the model" (Pallant, 2005). According to Tabachnik and Fidell (2007), if tolerance value is too small (less than .10), multiple correlations with other predictors are too high (possibility of multicollinearity and singularity). On the other hand, VIF value is just the inverse of tolerance value and above 10 would be a concern for multicollinearity and singularity (Pallant, 2005). Table 4.18 presented Tolerance and VIF values of predictor variables.

As presented below, Table 4.18 revealed that tolerance values of mathematics self efficacy, anxiety, attitude, gender and school type did not violate multicollinearity and singularity (.399, .657 and .445, .958 and .945 respectively).

Similarly, VIF values of predictors did not violate multicollinearity and singularity as well (2.504, 1.523, 2.245, 1.044 and 1.058 respectively). Hence, tolerance and VIF values provided additional evidence for multicollinearity and singularity.

Table 4.18 Tolerance and VIF Values

MODEL	Tolerance	VIF
Self Efficacy	.399	2.504
Anxiety	.657	1.523
Attitude	.445	2.245
Gender	.958	1.044
School Type	.945	1.058

Outliers

Outliers refers to extreme scores (very high or very low scores) on the set of data (Pallant, 2005). Multiple regression analysis is very sensitive to extreme scores since these scores may have a significant impact on the regression equation and the slope of regression line. Therefore, checking for extreme scores was part of initial data screening process in this study. According to Tabachnik and Fidell, easier procedure for detecting outliers is requesting the standardized residual plot from SPSS (Scatterplot) during multiple regression analysis (2007, p.128). Standardized residual values above about 3.3 or less than -3.3, reflecting the outliers, either excluded from the data or given a score too high/too low but not too different from the remaining cluster of scores (Tabachnik & Fidell, 2007). Figure 4.21 displayed distribution of cases' standardized residuals in scatterplot for this study.

From Figure 4.21 one can easily conclude that there exist five or six extreme cases with more than 3.3 or less than -3.3. However, these outliers were not excluded from the study or given a similar score reflecting remaining cluster of scores, since "few outliers in a study with large enough sample can be ignored" (Tabachnik & Fidell, 2007, p.128). Hence, outliers assumption was assured that there was no violation.

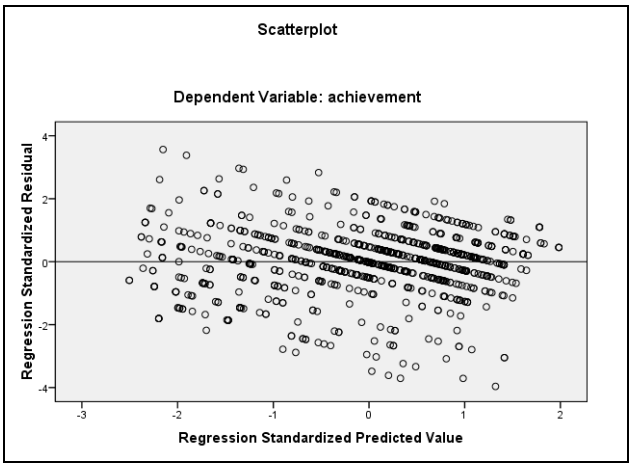

Figure 4.21 Distribution of Standardized Residual Values

Normality

As it was examined before in two-way ANOVA, the distribution of self efficacy, anxiety, attitude and achievement scores with respect to gender and school type was normal. Hence, it was concluded that the normality assumption was assured for all variables in the study.

Linearity

Linearity indicates that the residuals should have straight line relationship with predicted dependent variable scores (Pallant, 2005). That is, the relationship between criterion variable and predictor variables are linear in nature. If the

relationship between these variables is not linear, the results may underestimate the actual relationship. This underestimation carries two risks: "increased chance of a Type II error for that independent variable, and, in the case of multiple regression, an increased risk of Type I errors (overestimation) for other independent variables that share variance with that independent variable" (Osborne, 2002). In order to detect linearity, a preferable method is to check plots of the standardized residuals as a function of standardized predicted values (Pallant, 2005). Linearity is demonstrated when half of the residuals are above the zero line at some predicted values and half of them below the zero line at other predicted values on the scatterplot. Moreover, the distribution of the values should be in rectangular shape instead of curved shapes (Tabachnik & Fidell, 2007). Figure 4.21 displayed the distributions of standardized residuals. From Figure 4.21 in outliers assumption of multiple regression analysis, it was easily observed that the residuals were equally distributed below and above the zero line on the scatterplot. Moreover, the residuals constituted a rectangular shape, satisfying the requirements of Tabachnik and Fidell (2007).

Homoscedasticity

Homoscedasticity indicates that the variance of the residuals about predicted dependent variable scores should be the same for all predicted scores (Pallant, 2005). That is, variance of errors is the same across all levels of the independent variables (Osborne, 2002). According to Tabachnik and Fidell, slight heteroscedasticity has little impact on analysis whereas when homoscedasticity is violated, it may lead serious distortion of findings by increasing the possibility of Type I error (2007). Homoscedasticity assumption is more preferably detected "by visual examination of a plot of the standardized residuals (the errors) by the regression standardized predicted value" (Osborne & Waters, 2002). In particular, homoscedasticity is demonstrated when residuals are randomly scattered around 0 (the horizontal line), providing a relatively even distribution (Tabachnik & Fidell, 2007). Figure 4.21 displayed the distributions of standardized residuals and it is revealed that the residuals plot is the same width approximately for most of the values of the predicted

dependent variable. That is, the cluster of points was approximately the same width all over and gathered around the zero line. Hence, it was assured that there was no violation of homoscedasticity assumption.

4.2.5.2 Results of Multiple Regression Analysis

To investigate whether the three measures of students' beliefs of mathematics (self efficacy, anxiety and attitude) and two demographics (gender and school type) predict mathematics achievements of seventh grade students or not, multiple regression analysis was run. The results were presented in Table 4.19 Table 4.20 and Table 4.21.

As it can be seen from Table 4.19, the linear combination of personal constructs (self efficacy, anxiety and attitude) and demographics (gender and school type) was significantly related to achievement scores, [F (5,928)=100.295, p=.000]. That is, the provided model consisted of personal constructs and demographics significantly predicted the achievement scores.

Table 4.19 ANOVA

Model	Sum of Squares	Df	Mean Squares	F	Sig.
Regression	2119.705	5	423.941	100.295	.000[a]
Residuals	3922.582	928	4.227		
Total	6042.287	933			

Moreover, to find out how much of the overall variance is explained by the variables of interest (self efficacy, anxiety, attitude, gender and school type), the r-square value was noted in the Model Summary table. Summary of the model for the study was presented in Table 4.20.

Table 4.20 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.592	.351	.347	2.056

Table 4.20 revealed that, the sample multiple correlation coefficient was .592 and R-square = .351, [F (5,928) =100.295, p=.000]. That is, approximately 35 % of the variance of achievement scores in the sample can be accounted for by the linear combination of personal constructs and demographics of interest.

According to Tabachnik and Fidell, r-square value below .4 indicates poor regression fit, between .4 and .7 moderate fit and above .7 strong fit (2007). Indeed, the regression was found a relatively moderate fit for this study. In addition, to investigate which of the variables included in the model contributed to the prediction of the achievement scores and to reflect the relative strengths of individual predictors, it is important to analyze Coefficients Table of multiple regression analysis. Table 4.21 presented summary of Coefficients Table.

Table 4.21 Summary of Coefficients

Model	B	Std. Error	Beta	t	Sig.	Part-R
Constant	6.604	.590		11.068	.000	
S. Efficacy	.048	.009	.314	5.453	.000	.210
Anxiety	-.009	.002	-.135	-4.147	.000	-.110
Attitude	.046	.006	.224	7.930	.000	.144
Gender	-.318	.137	-.063	-2.315	.021	-.061
Sch. Type	-.067	.138	-.013	-.484	.628	-.013

As observed in Table 4.24, except school type, all the variables made a statistically significant unique contribution to the prediction of achievement scores. From standardized Beta Values, it was found that self efficacy (Beta=.314, p=.000), anxiety (Beta= -.135, p=.000), attitude (Beta=.224, p=.000) and gender (Beta= -.063, p= .021) significantly predicted achievement scores. As expected, anxiety had negative beta values. That is, for anxiety, negative beta indicated that high anxiety scores accounted for low achievement scores. On the other hand, for gender, negative beta indicated males' achievement scores were higher than that of females. Besides, Unstandardized B Values reflected the weights associated with the regression equation. The regression equation with a demographic (gender) and three predictors of personal constructs was significantly related to achievement, R^2= .35, F (5,928) = 100.295, p=.000.

According to these B weights, the regression equation as follows:

$$\text{Achievement} = .048_{\text{efficacy}} - .009_{\text{anxiety}} + .046_{\text{attitude}} - .318_{\text{gender}} + 6.604$$

Correlation Coefficient (Part-R). The square of Part-R indicates unique contribution of the variable to the total R square. That is, "how much of the total variance in the dependent variable is uniquely explained by the variable and how much R square change if it was not included in the model" (Tabachnik & Fidell, 2007, p.145). In Table 4.24, self efficacy was recorded the highest part correlation coefficient, (Part-R = .210, p<.001), indicating self efficacy uniquely explains 4.5 percent of the variance in achievement scores. Moreover, anxiety had a moderate part correlation coefficient, (Part-R = -.110, p<.001), indicating 1.2% unique contribution of total variance in achievement scores. Similarly, attitude reported the lowest part correlation coefficient, (Part-R = .144, p<.01), indicating 2.1% unique contribution to total variance. Besides, gender was recorded the lowest significant part correlation coefficient, (Part-R = -.061, p<.01), meaning .4 percent of variance in achievement scores could be explained uniquely by this variable while, the school type did not make a significant contribution to total variance.

In summary, the purpose of the present study is to investigate the relationships among mathematics self efficacy, mathematics anxiety, attitude towards mathematics and mathematics achievements in terms of gender or school type. Another purpose is to examine the role of three personal constructs (mathematics self efficacy, mathematics anxiety and attitude towards mathematics) and two demographics (Gender and school type) on predicting mathematics performance. The results of two-way ANOVA revealed that gender had an influence on self efficacy, anxiety, attitude and achievement. In particular, males had higher mean self efficacy and achievement scores, whereas females had higher mean attitude and anxiety scores. In addition, school type had an influence just on attitude scores of students in the favor of private schools. On the other hand, the results of multiple regression analysis yielded that the model composed of three personal constructs and two demographics significantly predicted the achievement scores. In the next section, discussion of results, implications and some recommendations will be given.

CHAPTER 5

DISCUSSION and CONCLUSION

The main purpose of this study was to investigate seventh grade students' mathematics self efficacy, mathematics anxiety, attitudes towards mathematics and achievement in mathematics in terms of gender or school type. The other purpose of the study was to investigate the role of the three personal constructs (self efficacy, anxiety and attitude) and two demographics (gender and school type) on predicting mathematics achievement of seventh grade students. This chapter focused on the discussion of the findings in line with the previous studies. In addition, implications and recommendations for further studies will be presented.

5.1 Discussion of the Findings for Gender

As it was mentioned before,the students' beliefs, feelings and emotions about mathematics reflect whether they can successfully perform a specific mathematics task at a specified level or not (Schunk, 1984). Therefore, information about affective factors help boys and girls in different schools in determining how much effort they should expend in order to complete a task (Bandura, 1986). Hence, it was believed that the findings of the present study could present some clues about the influence of on gender on mathematics beliefs, confidence and emotions.

One concern regarding gender for this study was to investigate mean the difference in seventh grade boys' and girls' mathematics self efficacy scores. The results revealed that there was a significant mean difference between males and females regarding mathematics self efficacy beliefs. In particular, males obtained significantly higher scores in Mathematics Self Efficacy Scale-MSES than females. The fact that males outperformed females in mathematics self efficacy beliefs was consistent with the previous studies favoring boys in mathematics self efficacy (Betz

& Hackett, 1989; Pajares & Miller, 1995). For instance, Betz and Hackett (1989) stated that mathematics self efficacy expectations of male undergraduates were stronger than those of females. Similarly, it was found that males in high school were superior over females in mathematics self efficacy scores (Hyde, Fennema & Lamon, 1990). This difference might arise from the influence of stereotype that males are better than females in mathematics (Manger & Eikeland, 1998). To state differently, Moe and Pazzaglia (2006) stated that if gender difference is mentioned in a specific task, a subject can motivate students and enhance the quality of performance. For instance, males' superiority in mathematics might be exposed to students who participated in this study. Therefore, males' might feel themselves more confident in mathematics than females. On the contrary, if the superiority of opposite gender is stressed, the subject can demotivate students and reduce students' performance. Thus, in the present study, some of the female participants might be exposed to feel inferiority of males in mathematics by their parents, teachers or peers in their school and daily life. This might influence females' motivation negatively for learning mathematics and decrease the amount of time and energy spent on the mathematics. Therefore, mathematics self efficacy beliefs of females might be found less than that of males in the present study.

The other concern related to gender was to investigate mean difference in seventh grade males' and females' mathematics anxiety scores. The results of the study indicated that there was a significant mean difference in mathematics anxiety scores of males and females. In particular, anxiety levels of females were found to be higher than that of males. This result was supported by many researchers in the literature (Hembree, 1990; Tobias, 1982; Wigfield & Eccles, 1992). For instance, Wigfield and Eccles (1992) investigated the sexual difference in mathematics achievement, students' anxiety and self confidence. It was concluded that girls had lower self confidence and greater anxiety than boys. Consistent with the findings, Tobias (1982) found that girls had higher mathematics anxiety than boys in mathematics courses and exams. One possible reason for this difference in mathematics anxiety might be biological. That is, the difference might stem from

genetic sex hormones. For instance, Seeman (1997) basing on her conclusion on the investigation of females sex hormones, reported that "the estrogens are neuroprotective with respect to neuronal degeneration, growth and susceptibility to toxins. The cyclic fluctuations of estrogens enhances the response to stress, which confers susceptibility to depression and anxiety" (p.1641). Therefore, mathematics anxiety of females might be higher than that of males in this study due to genetic reasons. Another reason for the difference in anxiety might be psychosocial. That is, social roles in the culture and experiences might be an important factor for the gender difference in mathematics anxiety. Historically, boys are given more freedom, authority and responsibility than girls in Turkish culture (Baloğlu, 2010). Hence, boys do not hesitate to take risks and try, whereas females take less or even none. Therefore, males feel less anxious to try when they meet a challenging task. This might be the reason of males' lower anxiety scores in this study.

Another concern for the influence of gender was to investigate mean difference in seventh grade males' and females' attitude towards mathematics scores. Results showed that there was a significant mean difference in attitude scores of males and females. In particular, females' attitude towards mathematics was higher than that of males. The fact that females outperformed males on attitude scores contradicts earlier studies that reported males' superiority in attitude scores (Aiken, 1970; Neale, 1969). However, there exist some studies favoring females' attitude towards mathematics in elementary years (Savaş & Duru, 2005). Savaş and Duru (2005) reported that females' attitudes towards mathematics were higher than that of males and girls also had a significantly more positive career interests related to mathematics than boys. The source of this difference might be attributed to the role female mathematics teachers in the present study. According to MoNE (2010), the number of female mathematics teachers in primary and elementary schools has been increased since the reform movements in mathematics curriculum in 2005. Even for the present study, more than half of the mathematics teachers were female. If the teachers' influence as a role model on students' expectations, attitudes and future career plans is considered, this might enhance females' emotional disposition toward

mathematics positively. Hence, it is possible to find out the superiority of female students' attitudes towards mathematics in this study.

The last concern regarding gender was to investigate mean difference in seventh grade males' and females' mathematics achievement scores. Results of the study yielded that there was significant mean difference in mathematics achievement scores of boys and girls. Indeed, males outperformed females with respect to mathematics scores. The fact that males are superior in mathematics supports the findings of previous studies (Fennema, 1974; Taşdemir, 2009; Wood, 1976). For instance, Taşdemir (2009) and Fennema (1974) declared the fact that mathematics was a male domain and hence males' mathematics achievement was greater than that of female counterparts. This difference might stem from the sociocultural practices and stereotype effect. In particular, stereotype that boys are better at mathematics is still alive and strong. Hyde (2004) stated that most of the parents and teachers still believe that skewed view in the favor of boys, not lack of aptitude, might promote boys performance, confidence in receiving mathematics courses, and pursuing mathematics as a career in the future. This might be the source of males superiority in mathematics. Another similar possible reason of this difference might be the biologically secondary mathematics abilities. Geary (1996) mentioned that both males and females had two sets of mathematics abilities such as biologically primary and biologically secondary mathematics abilities. It was stated that biologically primary mathematics abilities were innate set of mathematics characteristics such as numerosity, ordinality, counting and simple arithmetic which reflects why no difference exists between young males and females in mathematics. On the contrary, biologically secondary characteristics were more complex algebra and calculus skills. These skills arise only through interaction with the specific sociocultural practices (Geary, 1996). In this study, since male students significantly outperformed female students, one possible explanation might be that sociocultural practices might enhance the development of secondary mathematical abilities in males more than in females, in line with Geary's view. Moreover, the difference in mathematics achievement might stem from genetics of males and females (Kimura & Hampson,

1994). That is, in the literature, it was claimed that the left hemisphere of an individual realizes for analytical/logical thinking in both verbal and numerical operations while right hemisphere is specialized in social tasks, artistic efforts and body image (Capparo, 2001). In particular, males are more likely to use their left hemisphere (Kimura & Hampson, 1994) and they become more advantageous over females in mathematics (Capparo, 2001). Hence, this might be the reason of males' superiority in mathematics achievement over females for the present study. Therefore, it is possible to find out significant difference in males' and females' mathematics performances in the favor of males.

In brief, all the findings of the study revealed that gender had a significant influence on self efficacy, anxiety, attitude and achievement. In particular, males were superior in self efficacy and achievement, whereas females had higher scores in anxiety and attitude. That is, males were more self efficious, high mathematics achievers and less anxious. On the other hand, females were less confident and more anxious but they had more positive attitude towards mathematics. As mentioned above, the reasons of differences might be attributed to stereotype effect, social cultural practices, genetic sex hormones and biologically secondary abilities.

5.2 Discussion of the Findings for the Influence of School Type

The other concern for this study was to investigate the mean difference in personal constructs and mathematics performances of seventh grade students in public and private schools. The findings of the study revealed that the students' attitude towards mathematics were differentiated in the favor of private schools, while there was not a significant influence of school type on mathematics self efficacy beliefs, mathematics anxiety and mathematics achievement. This result contradicts with the previous studies reporting significant difference between public and private schools favoring private school students (Lubienski, 2003). One possible explanation for non-significant influence of school type might be the fact that the differences in personal constructs and achievement do not appear until late

elementary years (Ma, 1999). To state differently, both male and female students' emotions, feelings and beliefs about mathematics begin to shape through high school years (Hyde, Fennema & Lamon, 1990). Therefore, in line with these views, one can conclude that students' in different type of elementary schools might have similar characteristics, expectations and beliefs towards mathematics during primary and elementary years. Hence, this might lead similar confidentiality or fears and worry on mathematics performances' of seventh grade students in both public and private schools. Therefore, it is possible to find no significant difference in mathematics self efficacy, anxiety and achievement scores between public and private school students.

The results also showed that the seventh grade students' attitudes towards mathematics were significantly different with respect to school type. In particular, private school students attitude towards mathematics were higher than that of public school students. The result was consistent with the former studies favoring private schools on the issue (Lubienski, 2003). One possible reason for this difference might be the fact that private schools are commercial business enterprises which run for the pleasure principle of students and their parents. That is, to be able to enhance their market price and gain more students, emotional and academic satisfaction is given more importance in private schools than in public schools. For this purpose, several investments to technology, facilities and conveniences have been made by private schools to enhance the quality of education and draw parents' attention to school as well as students'. Hence, these facilities might enhance the private school students' emotional disposition towards mathematics more than that public school students'. Therefore, it is possible to find significant difference in attitude towards mathematics in the favor of private schools.

5.3 Discussion of the Findings for the Role of Variables in Predicting Mathematics Achievement

The last aspect of the present study was investigating the role of personal factors (self efficacy, anxiety and attitude) and demographics (gender and school

type) on predicting mathematics achievement of seventh grade students. The results of multiple regression analysis revealed that the provided model significantly predicted the mathematics achievements of students. Moreover, each variable other than school type made significant unique contribution in explaining mathematics scores of students. This result is consistent with former researches supporting the influence of self efficacy, anxiety, attitude and gender in predicting mathematics achievement (Hyde, Fennema & Lamon, 1990; Pajares & Miller, 1995; Wigfield & Eccles, 1992). In addition, self efficacy made the highest unique contribution. This totally supports the findings of studies in the literature that self efficacy is one of the best predictor of achievement (Pajares & Miller, 1994). On the other hand, the school type does not have any contribution in explaining mathematics performance. Similarly, no significant difference was detected mathematics performance of students both in public and private schools in the present study. The reason might be the fact that the gap between public and private schools' level of achievement is getting smaller with the reform movements in Turkish Minister of National Education. In fact, equity in opportunities and excellence in education is promoted in Turkish Education System. For instance, common nationwide new mathematics curriculum has been implemented in all type of elementary schools. In addition, all students in different schools are provided with the same mathematics textbooks for free. That is, students in private and public schools have similar educational opportunities. This might lead similar mathematics performances in public and private schools. Therefore, it is possible to find no influence of school type in explaining mathematics achievement.

5.4 Recommendations and Implications for Future Researches

This study was mainly focused on investigating the seventh grade students' mathematics self efficacy, mathematics anxiety, attitudes towards mathematics and achievement in mathematics in terms of gender or school type. In addition, the ability of three personal constructs, mathematics self efficacy, mathematics anxiety and attitudes towards mathematics, and two demographics, gender and school type, in

predicting achievement level of seventh grade students was also investigated. Based on the results of the study, some recommendations and implications can be proposed for future researches.

The design of this study was a kind of causal comparative and correlation research design. Indeed, the purpose of the design was to explain and predict the existing relationship and differences among variables. However, finding a significant relation among variables did not mean the reasons of differences in achievement scores only due to predictor variables. Therefore, experimental studies might be conducted in order to investigate the likelihood of causal connections among these variables. In addition, other personal constructs (self concept and self regulation) and demographics (grade level) can be inserted in future studies. On the other hand, this study was a typical quantitative study, which means that the study was limited to inferences of the numeric data collected from questionnaires. However, the inference made from these numeric data might not reflect in depth results among the variables. Therefore, future studies might be supported by qualitative data. That is, the students are asked to write self reports or interviews are conducted so as to describe the complete picture of the relationship in given constructs. Furthermore, the design of this study had some limitations for generalisability as well. To illustrate, sampling method of the study was convenience sampling which indicates that the researcher collect data from the individuals who are readily available (Fraenkel & Wallen, 2006). In order to generalize the findings of the study to the population, further research could be conducted by using random sampling of elementary schools in Ankara.

The present study analyzed only the data collected from the seventh grade students in public and private elementary schools so this restricts the researcher to generalize the findings to all elementary students. Therefore, a similar study might be conducted with different grades (6^{th}, 7^{th} and 8^{th}) in both public and private elementary schools so that the effects of grade level might be included in the analysis. This study also examined only the current self beliefs of participants about

mathematics. However, changes in self beliefs of students were not reported in the study. Therefore, future research should utilize the longitudinal studies to investigate how these self beliefs change over time. In particular, cohort study design, "samples of a population whose members do not change over time", will be good alternative to check (Pallant, 2005, p.398).

Finally, based on the results of this study, some implications for mathematics teachers, educators, counselors and mathematics curriculum developers could be stated. As mentioned before, determination of students' personal constructs was of great importance in predicting performance and understanding the differences in mathematics achievements of elementary students. This study revealed that self efficacy, anxiety, attitude and gender were significantly correlated with achievement. Therefore, mathematics teachers and educators should be informed that a number of motivational variables play an important role in students mathematics achievements. Hence, seminars related to the mediating role of attitudinal and motivational constructs in mathematics achievement should be scheduled for mathematics teachers with the participation of social scientists, educationalist, faculties and counselors before the academic year. Moreover, curriculum developers could promote activity based learning in mathematics by inserting activities, games and etc. to mathematics curriculum and textbooks which are beneficial to improve students' attitude towards mathematics. In addition, these can be helpful on decreasing the level of mathematics anxiety. So that, mathematics teachers and teacher educators plan their activities and courses accordingly in order to make teaching and learning of mathematics more efficient and effective.

The mathematics abilities of people can be developed from early childhood education till the end of their lives. Based on the related literature and the present study, early detection of personal constructs is of great importance in influencing an individual's distance to mathematics. Therefore, both counselor services at schools and mathematics teacher should be aware about the importance of personal factors in shaping students' future mathematics trajectories. Hence, the inventories and questionnaires of motivational variables can be implemented to primary and

elementary students at the beginning and end of each academic year and the results put forward a picture of possible reasons of weaknesses and strengths in mathematics. So that, mathematics teachers move toward students according to these results and no child left behind in mathematics lessons.

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APPENDICES

APPENDIX A

MATHEMATICS SELF EFFICACY SCALE – MSES

Matematik Öz-yeterlilik Algısı Ölçeği

Bu anket, öğrencilerin matematik dersine ilişkin öz-yeterlilik algılarını tespit etmeyi amaçlamaktadır. Ankette her biri bir cümlelik 14 madde vardır. Aşağıdaki seçenekler bütün maddeler için ortaktır. Her maddenin sizi ne kadar doğru tanımladığını bu seçeneklere göre belirtiniz. Kendinize uygun olduğunu düşündüğünüz seçeneği (X) işareti ile işaretleyiniz ve lütfen her bir maddeyi cevaplamaya özen gösteriniz.

(1)Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kararsızım (4)Katılıyorum (5) Kesinlikle Katılıyorum

	Kesinlikle Katılmıyorum	Katılmıyorum (2)	Kararsızım (3)	Katılıyorum	Kesinlikle Katılıyorum
1) Matematiği günlük yaşamımda etkin olarak kullanabildiğimi düşünüyorum.	(1)	(2)	(3)	(4)	(5)
2) Günümü/zamanımı planlarken matematiksel düşünürüm.	(1)	(2)	(3)	(4)	(5)
3) Matematiğin benim için uygun bir uğraş olmadığını düşünüyorum.	(1)	(2)	(3)	(4)	(5)
4) Matematikte problem çözme konusunda kendimi yeterli hissediyorum.	(1)	(2)	(3)	(4)	(5)
5) Yeterince uğraşırsam her türlü matematik problemini çözebilirim.	(1)	(2)	(3)	(4)	(5)
6) Problem çözerken yanlış adımlar atıyorum duygusu taşırım.	(1)	(2)	(3)	(4)	(5)
7) Problem çözerken beklenmedik bir durumla karşılaştığımda telaşa kapılırım.	(1)	(2)	(3)	(4)	(5)
8) Matematiksel yapılar ve teoremler içinde dolaşıp yeni, küçük keşifler yapabilirim.	(1)	(2)	(3)	(4)	(5)
9) Matematikte yeni bir durumla karşılaştığımda nasıl davranmam gerektiğini bilirim.	(1)	(2)	(3)	(4)	(5)

10) Matematiğe çevremdekiler kadar hâkim olmanın benim için imkânsız olduğuna inanırım.	(1)	(2)	(3)	(4)	(5)
11) Problem çözmekle geçirdiğim zamanların büyük bölümünü kayıp olarak görüyorum.	(1)	(2)	(3)	(4)	(5)
12) Matematik çalışırken kendime olan güvenimin azaldığını fark ediyorum.	(1)	(2)	(3)	(4)	(5)
13) Matematikle ilgili sorunlarında çevremdekilere kolaylıkla yardım edebilirim.	(1)	(2)	(3)	(4)	(5)
14) Yaşam içindeki her türlü probleme matematiksel yaklaşımla çözüm önerileri getirebilirim.	(1)	(2)	(3)	(4)	(5)

APPENDIX B

MATHEMATICS ANXIETY SCALE - MANX

Matematik Kaygısı Ölçeği

Bu anket, öğrencilerin matematik dersine ilişkin kaygı durumlarını tespit etmeyi amaçlamaktadır. Ankette her biri bir cümlelik 45 madde vardır. Aşağıdaki seçenekler bütün maddeler için ortaktır. Her maddenin sizi ne kadar doğru tanımladığını bu seçeneklere göre belirtiniz. Kendinize uygun olduğunu düşündüğünüz seçeneği (X) işareti ile işaretleyiniz ve lütfen her bir maddeyi cevaplamaya özen gösteriniz.

(1)Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kararsızım (4)Katılıyorum (5) Kesinlikle Katılıyorum

	Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Kararsızım (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
1) Matematik dersinde bir arkadaşım tahtaya kalktığında onun yerinde olmadığıma sevinirim.	(1)	(2)	(3)	(4)	(5)
2) Bir genel sınavın matematik kısmına gelince paniğe kapılırım.	(1)	(2)	(3)	(4)	(5)
3) Cevabı tam olarak bilmediğim bir soru için tahtaya kalktığımda içimi korku kaplar.	(1)	(2)	(3)	(4)	(5)
4) Matematik ödevi yapmaktan hoşlanırım.	(1)	(2)	(3)	(4)	(5)
5) Fen derslerindeki formüller bana sevimsiz gelir.	(1)	(2)	(3)	(4)	(5)
6) Çok sayıda matematik probleminden oluşan ödev verildiğinde paniğe kapılırım.	(1)	(2)	(3)	(4)	(5)
7) Zor bir matematik konusunu çalışmak için kitabı elime aldığımda karnıma ağrılar girer.	(1)	(2)	(3)	(4)	(5)
8) Matematik sınavına bir saat kala hiçbir şey düşünemez olurum.	(1)	(2)	(3)	(4)	(5)
9) Kantinde alacağım paranın üstünü hesaplarken bile kafam karışır, paraları çoğu zaman sayamadan alırım.	(1)	(2)	(3)	(4)	(5)
10) Üyesi olduğum eğitsel kolun hesaplarını ben tutmak isterim.	(1)	(2)	(3)	(4)	(5)

11) Karnemi aldığımda matematik notuna bakmaya korkarım.	(1)	(2)	(3)	(4)	(5)
12) Çözebildiğim problemlerin bile açıklamasını yapmaya çekinirim.	(1)	(2)	(3)	(4)	(5)
13) Bir konunun sözlü anlatılması yerine sayı veya grafiklerle anlatılması hoşuma gider.	(1)	(2)	(3)	(4)	(5)
14) Matematik sınavından bir gün önce kendimi çok kötü hissederim.	(1)	(2)	(3)	(4)	(5)
15) Bir satıcının para üstünü yanlış verdiğini düşünsem bile, birisi beni izlerken hesap yapamayacağım için, sesimi çıkartmadığım olur.	(1)	(2)	(3)	(4)	(5)
16) Matematik kitabı beni huzursuz eder.	(1)	(2)	(3)	(4)	(5)
17) Birisi beni izlerken toplama bile yapamam.	(1)	(2)	(3)	(4)	(5)
18) Önemli matematik sınavlarında öyle heyecanlı olurum ki bütün bildiklerim unuturum.	(1)	(2)	(3)	(4)	(5)
19) Öğretmen habersiz bir matematik sınavı verdiğinde ödüm kopar.	(1)	(2)	(3)	(4)	(5)
20) Sene başında ilk matematik dersine umutla girerim.	(1)	(2)	(3)	(4)	(5)
21) Matematik sınavına çalışırken, alacağım notu düşünmekten doğru dürüst hazırlanmadığım olmuştur.	(1)	(2)	(3)	(4)	(5)
22) Matematik kitabının sayfalarını karıştırırken başaramayacağım duygusuna kapılırım.	(1)	(2)	(3)	(4)	(5)
23) Matematik dersinde anlamadığım yerleri sormaya cesaret edemem.	(1)	(2)	(3)	(4)	(5)
24) Karnemdeki notların ortalamasını hesaplarken bile rahatsızlık duyarım.	(1)	(2)	(3)	(4)	(5)
25) Matematik sınavına bir hafta kala bende huzursuzluk başlar.	(1)	(2)	(3)	(4)	(5)
26) Zamanla ilgili hesap yapmak bile bana rahatsızlık verir.	(1)	(2)	(3)	(4)	(5)
27) Dersten sonra anlamadığım bir yeri matematik öğretmenime rahatça sorabilirim.	(1)	(2)	(3)	(4)	(5)
28) Başarısız olduğumu düşündüğüm matematik sınavının sonucunu beklerken çok heyecanlı ve karamsar olurum.	(1)	(2)	(3)	(4)	(5)

29) Bir ilkokul öğrencisinin matematik ödevine yardım etmem istense çözemeyeceğim soruların çıkmasından korkup yardım etmeyi reddedebilirim.	(1)	(2)	(3)	(4)	(5)
30) Liseden mezun oluncaya kadar öğrenmem gereken matematik konularını düşündüğümde, bir gün okulu bitirebileceğimden kuşku duyarım.	(1)	(2)	(3)	(4)	(5)
31) Sayılarla uğraşmak keyfimi kaçırır.	(1)	(2)	(3)	(4)	(5)
32) Geometri sorularını zevkli bulmacalara benzetirim.	(1)	(2)	(3)	(4)	(5)
33) Arkadaşım bir problemin çözümünü onu anlamadığımı fark ettiğimde bütün sinirlerim gerilir.	(1)	(2)	(3)	(4)	(5)
34) Matematik dersinde kafam karışır.	(1)	(2)	(3)	(4)	(5)
35) Sosyal derslerin en sevdiğim kısımları azda olsa matematiğe yer veren bölümleridir.	(1)	(2)	(3)	(4)	(5)
36) Matematik dersinde öğretmeni dinlemekte güçlük çekiyorum.	(1)	(2)	(3)	(4)	(5)
37) Bir sonraki dersin matematik olduğunu bilmek canımı sıkar.	(1)	(2)	(3)	(4)	(5)
38) Günlük yaşamda basit de olsa, matematik problemleri çözüp hesap yapmak zorunluluğu canımı sıkar.	(1)	(2)	(3)	(4)	(5)
39) Matematik kitabı içimi karartır.	(1)	(2)	(3)	(4)	(5)
40) Herhangi bir matematik kitabını açıp problemlerle dolu bir sayfaya bakmak beni mutlu eder.	(1)	(2)	(3)	(4)	(5)
41) Bir problem verildiğinde çözüm için gereken formülü hatırlayamazsam paniğe kapılırım.	(1)	(2)	(3)	(4)	(5)
42) Matematik sınavından 5 dakika önce kalbim hızla çarpmaya başlar.	(1)	(2)	(3)	(4)	(5)
43) Başarılı olduğumu düşündüğüm zaman matematik sınavının sonucunu beklerken rahat ve huzurlu olabilirim.	(1)	(2)	(3)	(4)	(5)
44) Üzerinde bir süre çalıştığım bir matematik sorusunu öğretmen tahtada çözmemi isterse heyecandan yaptığımı unuturum.	(1)	(2)	(3)	(4)	(5)

45) Bir arkadaşım dergide çıkan matematik sorusunu çözmemi isterse en basit soruları bile çözemeyip mahcup olmaktan korkarım.	(1)	(2)	(3)	(4)	(5)

APPENDIX C

MATHEMATICS ATTITUDES SCALE - MAS

Matematik Tutum Ölçeği

Bu anket, öğrencilerin matematik dersine ilişkin tutumlarını belirlemeyi amaçlamaktadır. Ankette her biri bir cümlelik 20 madde bulunmaktadır. Aşağıdaki seçenekler bütün maddeler için ortaktır. Her maddenin sizi ne kadar doğru tanımladığını bu seçeneklere göre belirtiniz. Kendinize uygun olduğunu düşündüğünüz seçeneği (X) işareti ile işaretleyiniz ve lütfen her bir maddeyi cevaplamaya özen gösteriniz.

(1)Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kararsızım (4)Katılıyorum (5) Kesinlikle Katılıyorum

	Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Kararsızım (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
1) Matematik sevdiğim bir derstir.	(1)	(2)	(3)	(4)	(5)
2) Matematik dersine girerken büyük sıkıntı duyarım.	(1)	(2)	(3)	(4)	(5)
3) Matematik dersi olmasa öğrencilik hayatı daha zevkli olur.	(1)	(2)	(3)	(4)	(5)
4) Arkadaşlarımla matematik tartışmaktan zevk alırım.	(1)	(2)	(3)	(4)	(5)
5) Matematiğe ayrılan ders saatlerinin fazla olmasını dilerim.	(1)	(2)	(3)	(4)	(5)
6) Matematik dersi çalışırken canım sıkılır.	(1)	(2)	(3)	(4)	(5)
7) Matematik dersi benim için angaryadır.	(1)	(2)	(3)	(4)	(5)
8) Matematikten hoşlanırım.	(1)	(2)	(3)	(4)	(5)
9) Matematik dersinde zaman geçmez.	(1)	(2)	(3)	(4)	(5)

10) Matematik dersi sınavından çekinirim.	(1)	(2)	(3)	(4)	(5)
11) Matematik benim için ilgi çekicidir.	(1)	(2)	(3)	(4)	(5)
12) Matematik bütün dersler içinde en korktuğum derstir.	(1)	(2)	(3)	(4)	(5)
13) Yıllarca matematik okusam bıkmam.	(1)	(2)	(3)	(4)	(5)
14) Diğer derslere göre matematiği daha çok severek çalışırım.	(1)	(2)	(3)	(4)	(5)
15) Matematik beni huzursuz eder.	(1)	(2)	(3)	(4)	(5)
16) Matematik beni ürkütür.	(1)	(2)	(3)	(4)	(5)
17) Matematik dersi eğlenceli bir derstir.	(1)	(2)	(3)	(4)	(5)
18) Matematik dersinde neşe duyarım.	(1)	(2)	(3)	(4)	(5)
19) Derslerin içinde en sevimsizi matematiktir.	(1)	(2)	(3)	(4)	(5)
20) Çalışma zamanımın çoğunu matematiğe ayırmak isterim.	(1)	(2)	(3)	(4)	(5)

APPENDIX D

MATHEMATICS LEVEL DETERMINATION EXAM 2010

6. SINIF MATEMATİK A

1. $2828 + 543 = 543 + \square$ ve $\triangle \times (36 \times 3) - (28 \times 36) \times 3$ olduğuna göre, $\square - \triangle$ işleminin sonucu kaçtır?

A) 2600 B) 2792 C) 2800 D) 2856

2.

Omlet yapımında kullanılan malzemeler	Menemen yapımında kullanılan malzemeler
• Patates • Soğan • Maydanoz • Yumurta • Yağ • Tuz	• Biber • Domates • Soğan • Maydanoz • Yumurta • Yağ • Tuz

Omlet yapımında kullanılan malzemelerin kümesi A, menemen yapımında kullanılan malzemelerin kümesi B olsun. Buna göre, elemanı sadece patates olan küme aşağıdakilerden hangisidir?

A) $A - B$ B) $B - A$
C) $A \cap B$ D) $A \cup B$

3. Kedi ve köpeklerin bulunduğu bir hayvan barınağındaki kedilerin sayısının köpeklerin sayısına oranı $\frac{1}{4}$'tür. Aşağıdakilerden hangisi bu barınaktaki kedi ve köpeklerin toplam sayısı olabilir?

A) 44 B) 80 C) 92 D) 108

4.

Benzin göstergesi şekildeki gibi olan bir aracın deposunda 23,4 litre benzin vardır. İbre sıfırı gösterdiğinde aracın deposu boş olduğuna göre, bu aracın deposu kaç litrelliktir?

A) 56 B) 60,2 C) 62,4 D) 64

5.

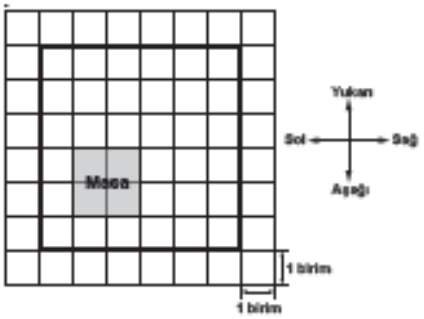
Bir dosya kâğıdı şekildeki gibi katlanıp açılıyor. Şekle göre, aşağıdakilerin hangisindeki açılar bütünlerdir?

A) 1 ve 2 B) 3 ve 4
C) 2 ve 4 D) 4 ve 5

6. Bir kitabın son iki sayfasının numaralarının toplamı 301'dir. Bu kitabın son sayfa numarası kaçtır?

A) 150 B) 151 C) 300 D) 301

7.



Şekilde bir oda ve içerisindeki masanın krokisi verilmiştir. Masa, aşağıdakilerden hangisindeki gibi ötelenirse odanın ortasında yer alır?

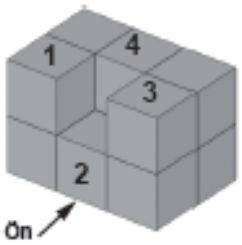
A) 2 birim yukarı
1 birim sağa

B) 1 birim yukarı
2 birim sağa

C) 2 birim yukarı
2 birim sağa

D) 1 birim yukarı
1 birim sağa

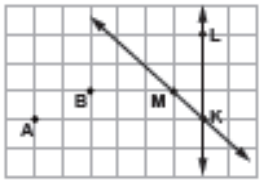
8.



Şekildeki yapıda numaralandırılmış birim küplerden hangisi çıkartılırsa yapının önden görünümü değişir?

A) 1 B) 2 C) 3 D) 4

9.



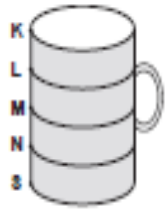
Verilen şekilde, aşağıdakilerden hangisi çizilirse bir üçgen elde edilir?

A) [AB B) [BM] C) [MB D) BK

10. Sınıfınızdaki kapının yüksekliği, aşağıdakilerden hangisi olabilir?

A) 2 cm B) 2 m C) 2 hm D) 2 km

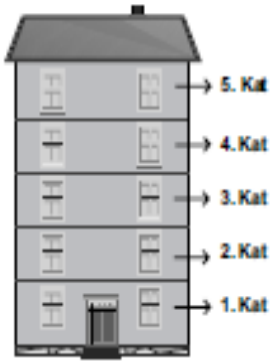
11.



Bir ayrıtının uzunluğu 9 cm olan küp şeklindeki bir kabın tamamı su ile doludur. Bu kaptaki su, yukarıda gösterilen silindir şeklindeki 1 litrelik boş sürahiye boşaltılıyor. Eş bölmeli bu sürahideki suyun seviyesi hangi noktalar arasında olur?

A) K ile L B) L ile M
C) M ile N D) N ile S

12.



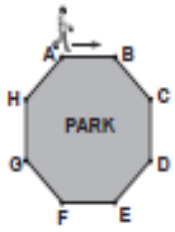
Şekildeki 5 katlı kooperatif binasının her katında aynı sayıda daire vardır. Daireler kooperatif üyelerine çekiliş yapılarak dağıtılacaktır. Çekilen ilk dairenin üçüncü katta olma olasılığı nedir?

A) $\frac{1}{5}$ B) $\frac{1}{3}$ C) $\frac{3}{5}$ D) $\frac{2}{3}$

13. Okul kantinlerinde sağlık koşullarına uyulup uyulmadığı araştırılacaktır. Bu amaçla hazırlanacak ankette, aşağıdaki sorulardan hangisinin yer almasına gerek yoktur?

A) Tost makinelerini hangi sıklıkla temizliyorsunuz?
B) Böceklere karşı düzenli olarak ilaçlama yapıyor musunuz?
C) Satılan ürünlerin son kullanma tarihine dikkat ediyor musunuz?
D) Günlük kazancınız ne kadardır?

14.



İlhan, düzgün sekizgen şeklindeki parkın çevresinde ok yönünde yürüyüş yapmaktadır. Yürüyüşe A noktasından başlayan İlhan, parkın çevresinin $\frac{3}{5}$'ünü yürüdüğünde hangi noktalar arasında olur?

A) C ile D B) D ile E
C) E ile F D) F ile G

15. Tablo: Yumurtaların Boylarına Göre Fiyatları

BOY	FİYAT (Kr)
Büyük	23
Orta	18
Küçük	18

Bir tavukçunun sattığı yumurtaların fiyatları tabloda verilmiştir. Her boydan birer yumurta alan müşteri, bir yumurta için ortalama kaç kuruş ödemiş olur?

A) 17 B) 18 C) 19 D) 20

16. a lirası olan bir kişinin, fiyatları aynı olan gömleklerden 5 tane satın aldığında 12 lirası artıyor. Bir gömleğin fiyatının kaç lira olduğunu gösteren cebirsel ifade aşağıdakilerden hangisidir?

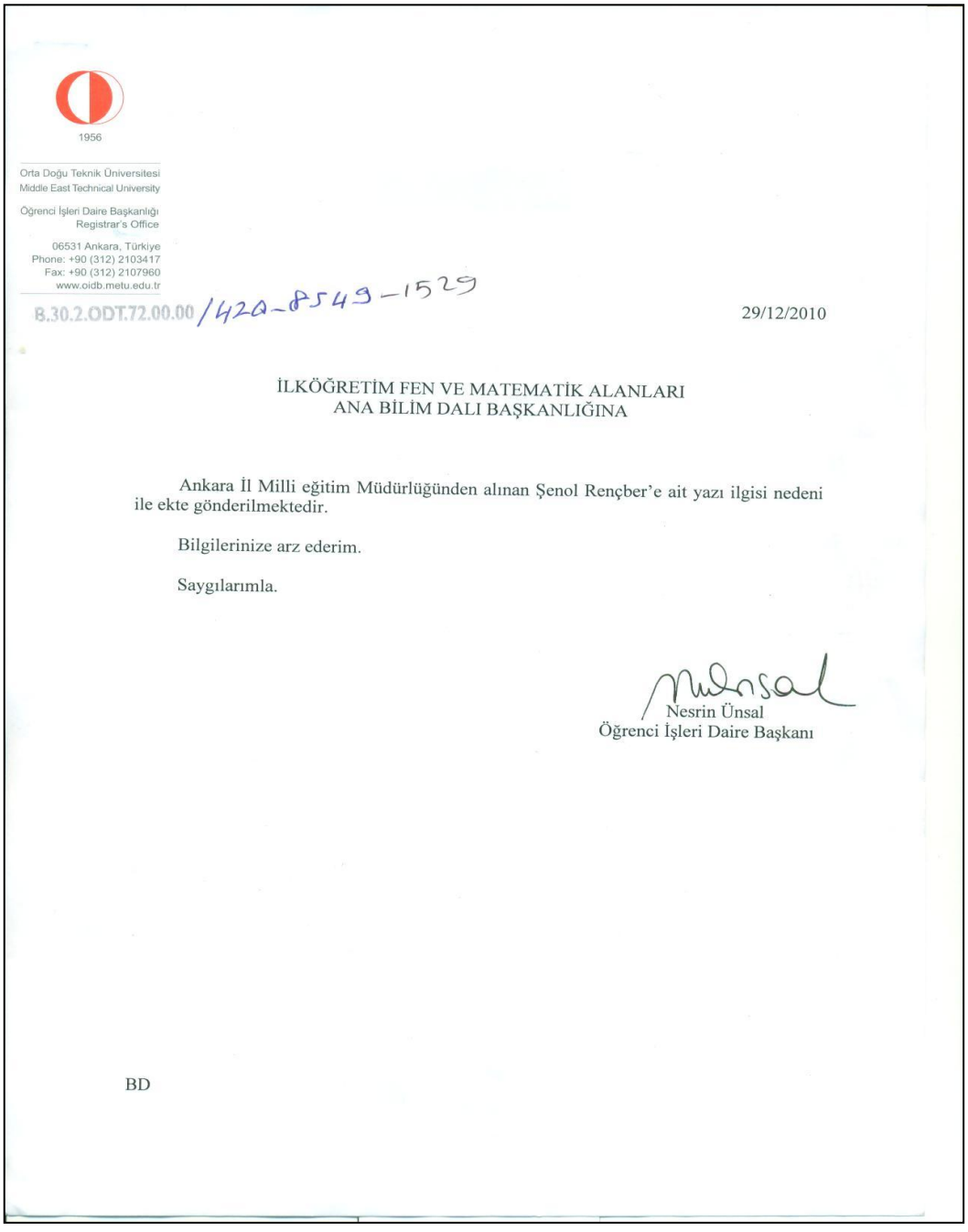
A) $\frac{a-12}{5}$ B) $\frac{a}{5}+12$

C) $\frac{a}{5}-12$ D) $\frac{a+12}{5}$

MATEMATİK TESTİ BİTTİ.
FEN VE TEKNOLOJİ TESTİNE GEÇİNİZ.

APPENDIX E

PERMISSIONS



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29/12/2010

İLKÖĞRETİM FEN VE MATEMATİK ALANLARI
ANA BİLİM DALI BAŞKANLIĞINA

Ankara İl Milli eğitim Müdürlüğünden alınan Şenol Rençber'e ait yazı ilgisi nedeni ile ekte gönderilmektedir.

Bilgilerinize arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

BD

ÖĞRENCİ İŞLERİ DAİRESİ BAŞKANLIĞI
Ev. Arş. Md. Saat :

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : İstatistik Bölümü
SAYI : B.B.08.4.MEM.4.06.00.04-312/ 108918 29/12/2010
KONU : Araştırma İzni
Şenol RENÇBER

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Sosyal Bilimler Enstitüsü)

İlgi : a) MEB Bağlı Okul ve Kurumlarda Yapılacak Araştırma ve Araştırma Desteğine Yönelik İzin ve Uygulama Yönergesi.
b) Üniversiteniz Sosyal Bilimler Enstitüsünün 25/11/2010 tarih ve 7970 sayılı yazısı.

Üniversiteniz Sosyal Bilimler Enstitüsü İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı Yüksek Lisans Programı öğrencisi Şenol RENÇBER'İN **"7. Sınıf Öğrencilerinin Matematik Öz Yeterlik Algısı, Matematik Kaygısı, Matematik Dersine Karşı Tutumları ve Matematik Tutumları Arasındaki İlişkinin İncelenmesi"** konulu çalışma yapma isteği Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Mühürlü anketler (7 sayfadan oluşan) ekte gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD/disket) Müdürlüğümüz İstatistik Bölümüne gönderilmesini rica ederim.

Gülçin UYSAL
Müdür a.
Müdür Yardımcısı

EKLER :
Anket (7 sayfa)

27.12.10 022313

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