



## A RESEARCH OF THE EFFECT OF ATTITUDE, ACHIEVEMENT, AND GENDER ON MATHEMATIC EDUCATION

Hasan Arslan, Murat Çanlı, Helena Maria Sabo

**Abstract.** Recent studies in math education focus on differences between behaviors and performances of male and female students. In this study, achievement and attitudes of middle school students to math were described in terms of gender and grade differences. The aim of this study is to determine whether any differences exist between female and male students' attitudes and successes of middle school toward mathematics. This research was designed as a descriptive research. Students (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grades) were registered to "Attitude Survey toward Mathematics". This survey is consisted of two parts. In the first part, there are demographic questions. The second part is 5-Likert type survey which is intended to learn students' attitudes toward mathematics. Secondly, in order to determine students' achievements from mathematics, their grades and their state exam results were used. Because of the possibility of differentiation in teachers' evaluation criteria and their objectivity on students' successes, both students' scores from state exam and their course grades were included to the analysis. The findings of this research indicate that attitude of the students toward mathematics and achievement scores in Mathematics have a significant difference in terms of their gender and grade levels. Female students performed more positive attitudes than male students toward Mathematics and female students had higher grades than male students.

**Keywords:** gender difference, Math education, 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grades, attitude and success toward Math

### 1. Introduction

"Mathematics is a tool in which students and youngsters get knowledge and experience about life, they learn how to deal with problems, and apply their knowledge into real life problems, they improve their ability about logical thinking and reasoning, and they are getting ready for their future." (Gömleksiz, 1997, p.V).

Many people consider mathematics as a key to open future career options (Stafslie, 2001). In the meantime, mathematics refers to improve a deep understanding about life and explanations for natural phenomena (Papanastasiou, 2002). Therefore, mathematics is in the middle of today's reform efforts that intend to establish a system for guiding students in their learning and understanding of mathematics (Smith, 2000; Franke and Kazemi, 2001).

The goal of those reform efforts is to learn why students are having difficulties toward learning mathematics. Research studies showed that there are many factors effecting students' views and attitudes about mathematics (Dursun & Dede, 2004; Koca & Şen, 2005). For instance, many concepts are symbolized in subjective terms in terms of representing the idea in mathematics (Yıldırım, 1996). Besides, education level in family, gender differences, and mathematical abilities of students are also factors to be counted as negative elements (Hare, 1999). In addition, socioeconomic level, culture, and language might be affective in students' learning of mathematics (Mecce, 1996; Papanastasiou, 2002).

In terms of considering gender, recent research efforts have pointed out that there is a significant difference between behaviors and performances of male and female students (Aydın, Bolukbasi, and Polat, 2005; Eceles, Adler and Mecce, 1984; Parker and Claxton, 1996). The reason of those differences is categorized as biological and sociological. At the beginning, structure of students' brain

was accepted as the main source of variation in gender difference; however, specialty based on gender was counted as a primary factor on later studies (Aksu, 1985). Besides, some researchers claim that the reason of low achievement in science for female students might be their cognitive differences (Otto, 1991), individual differences (Mecce & Holt, 1993), differences about mathematical ability (Linn & Hyde, 1989), differences in in- or out-class experiences (Johson, 1987; Tobin & Garnett, 1987), or differences in attitudes toward science.

On the other hand, some researchers emphasized that during first through 5th grades there is no difference revealed while 6th through 8th grades make differences on students. In addition to those findings, several researchers (Steinkamp and Maher, 1984; Wenston, 1974) consider those differences temporary which are going smaller through age. For mathematics, while students in 6<sup>th</sup> grade face with physical operations, students in 7<sup>th</sup> grade meet to transaction operations from physical to subjective, and students in 8<sup>th</sup> grade finally deal with subjective operations. In other words, first two steps of cognitive development theory are formed in middle school level.

In addition to cognitive development, there is also gender difference which might be a factor effecting attitudes toward Mathematics (Sayers, 1994; Aksu, 1991; Steinback and Gwizdala, 1995).

This study has been intended to describe that whether any differences exist between female and male students at middle school level about their attitudes and successes toward mathematics.

### **1.1.1. Statement of the Problem**

Is there any significant difference between achievement and attitude toward mathematics in terms of gender?

### **1.1.2. Sub-Related Questions**

- a) Is there any significant difference between achievement in Mathematics and gender?
- b) Is there any significant difference between attitude toward Mathematics and gender?
- c) Is there any significant difference between achievement in Mathematics in terms of grades (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup>) and gender?
- d) Is there any significant difference between attitude toward Mathematics in terms of grades (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup>) and gender?

## **2. Method and Design of the Study**

This study was designed in lights of survey methodology in order to learn Turkish Elementary Schools students' successes in Mathematics and attitudes toward Mathematics in terms of gender. Participants of the study were located in one of the districts (Kandıra) of the city of Kocaeli. Data was consisted of students' class notes, mathematics part of their comparison exam results overall the city level, and an instrument for learning their attitudes. Besides, students' grades from Level Determination Exam which has been done in city level and their teachers' in-class evaluations were included as data sources.

### **2.1. Population and Sample of the Study**

Population of the study was 6<sup>th</sup> through 8<sup>th</sup> grade students' of Kandıra district's schools in the city of Kocaeli. Sample of the study was students of 4 elementary schools located in the district of Kandıra who were registered to 2006-2007 education term. 584 of 760 students were administered to a Mathematic Attitude Survey. 553 (92%) students have returned their responses.

### **2.2. Data Collection**

The instrument for data collection that was originally designed by Baykul (1990) as "Attitude Survey toward Mathematics" with 26 items was modified to 22 items. This survey is consisted of two parts. In the first part, there are two questions about students' gender and grade. The second part is 5-Likert type survey which is intended to learn students' attitudes toward mathematics, and has 22 statements with 13 positive and 9 reverse items.

The survey was used in a pilot group with 26 students from middle school level. In the pilot study, Cronbach Alpha number was found as 0.96.

### 2.3. Data Analysis

At the beginning of the data analysis, 9 reverse items were converted, and then the responses were analyzed in t-test and ANOVA. The results were examined in lights of the problem statements. Cronbach Alpha was calculated as  $\alpha = .94$ . In order to find the relationships between variables, t-test and ANOVA were applied to data.

In order to determine students' achievements from mathematics, their grades and their comparison exam results were used. Because of the possibility of differentiation in teachers' evaluation criteria and their objectivity on students' successes, both students' scores from comparison exam and their course grades were included to the analysis. Before using them, students' scores from the exam were converted to the grading system with 5 intervals, and then mean of the grades and those scores was calculated. Students' grades intervals as percentages in mathematics were also converted to the grading system with 5 intervals.

## 3. Findings

### 3.1. Students Demographic Characteristics

According to their genders, statistical analysis of the participants was as follows:

The number of participants in this study was 89 female and 108 male students of 197 students in 6<sup>th</sup> grade, 73 female and 98 male students of 171 students in 7<sup>th</sup> grade, 108 female and 77 male students of 185 students in 8<sup>th</sup> grade. Total number was 270 (49%) female and 283 (51%) male students of 553.

According their success from Mathematics, their scores were 1 for 112 (20%) students, 2 for 150 (27%) students, 3 for 109 (20%) students, 4 for 84 (15%) students and 5 for 98 (18%) students.

Mean of the attitude survey was  $X=3.40$ . According to the mean, students' attitudes toward Mathematics were positive.

### 3.2. Findings for Sub-related Questions

#### 3.2.1. Is there any significant difference between achievement in Mathematics and gender?

In order to find out the relationship between students' genders and their performances in mathematics, t-test was used. The findings were in the Table 1.

**Table 1.** *t-Test Analysis for Gender and Performance in Mathematics course*

Gender	N	Mean	Ss	t	P
Female	270	3.11	1.315	2.245	0.000
Male	283	2.56	1.396		

The data indicates that, there is a significant difference between female and male students in terms of their success in mathematics ( $P < 0.05$ ). Female students have higher scores than male students. While mean of female students' scores was 3.11, mean of male students' scores was 2.56. According to these results, female students are more successful than male students in mathematics.

### 3.2.2. Is there any significant difference between attitude toward Mathematics and gender?

In this problem, with using t-test a comparison was made between students' gender and their attitude toward mathematics (Table 2.).

**Table 2.** *t-Test Analysis for Gender and Attitude toward Mathematics course*

Gender	N	Mean	Ss	T	P
Female	270	3.48	0.922	2.134	0.033
Male	283	3.32	0.874		

There is a significant difference between female and male students in terms of their attitudes toward mathematics ( $P < 0.05$ ). As in their success, mean of female students' scores was higher than male students'. In other words, female students have more positive attitudes than male students toward mathematics.

### 3.2.3. Is there any significant difference between achievement in Mathematics in terms of grades (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup>) and gender?

In terms of gender, 6<sup>th</sup> grade students' success in mathematics was shown in Table 3. In order to figure out those values, t-test was applied to data.

**Table 3.** *6<sup>th</sup> Grade Students Gender-Performance t-test Results*

Gender	N	Mean	Ss	t	P
Female	89	3.2	1.29	0.999	0.319
Male	108	3.01	1.398		

While mean of female students' success in mathematics was 3.20, the value for male students' was 3.01. Although these means show that female students have higher scores than male students, there is no significant difference found between female and male students about their success in mathematics.

Second of all, 7<sup>th</sup> grade students were compared in t-test. Concerning gender, scores for students' success in mathematics were represented in Table 4.

**Table 4.** *7<sup>th</sup> Grade Students Gender-Performance t-test Results*

Gender	N	Mean	Ss	t	P
Female	73	2.95	1.332	3,299	0.001
Male	98	2.28	1.299		

Mean of success in mathematics for female students was 2.95 while mean for male students' was 2.28. As in 6<sup>th</sup> grade, female students in 7<sup>th</sup> grade has higher mean of their course scores. Unlike 6<sup>th</sup> graders, for 7<sup>th</sup> grade students, there is a significant difference between female and male students.

Finally, mean of scores for 8<sup>th</sup> grade students was shown as in a t-test Table 5. According to the table, female students got 3.16 as mean of their scores despite male students got 2.29. This means that there is a significant difference between female and male students. In other words, female students are more successful than male students in 8<sup>th</sup> grade mathematics course.

**Table 5.** 8<sup>th</sup> Grade Students Gender-Performance t-test Results

Gender	N	Mean	Ss	t	P
Female	108	3.16	1.332	4,352	0.000
Male	77	2.29	1.299		

### 3.2.4. Is there any significant difference between attitude toward Mathematics in terms of grades (6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup>) and gender?

In this part of the problem, means of responses for mathematics attitude survey of 6<sup>th</sup> grade students were searched for any relationship with students' genders (see Table 6).

**Table 6.** 6<sup>th</sup> Grade Students Gender-Attitude t-test Results

Gender	N	Mean	Ss	t	P
Female	89	3.86	0.68	1.883	0.061
Male	108	3.66	0.745		

According to t-test results, mean of the responses given to the attitude survey by 6<sup>th</sup> grade female and male students was 3.86 and 3.66, respectively. These numbers show that even though female students had higher mean of the scores, there is no significant difference between two genders in terms of attitude toward mathematics.

Among 7<sup>th</sup> graders, there is no significant difference in their responses to the survey as represented in Table 7. While the mean for female students was 3.41, the mean for male students was 3.24. This means that female students' scores were slightly higher than male students' scores.

**Table 7.** 7<sup>th</sup> Grade Students Gender-Attitude t-test Results

Gender	N	Mean	Ss	t	P
Female	73	3.41	0.956	1.255	0,211
Male	98	3.24	0.795		

Finally, same results for 8<sup>th</sup> grade students were analyzed by t-test (Table 8). According to the responses given to the survey, there is a significant difference between genders ( $P < 0.05$ ). The mean of female students' scores was 3.22, and the mean of male students' scores was 2.94. The means point out that female students' attitudes toward mathematics are more positive than male students' attitudes.

**Table 8.** 8<sup>th</sup> Grade Students Gender-Attitude t-test Results

Gender	N	Mean	Ss	t	P
Female	108	3.22	0.976	1.978	0.049
Male	77	2.94	0.961		

#### 4. Conclusion and Suggestions

Considering findings from data sources, this study revealed the following results:

Attitude of the students toward Mathematics was determined in lights of their gender. Female students showed more positive attitude than male students. As pointed out in Melencan's (1993) study, female students' scores also indicated a significant difference with male students' scores.

Success in a Mathematics course was analyzed by considering students' genders. According to students' grades from the course, female students ( $X=3.11$ ) had higher mean than male students ( $X=2.56$ ). Comparison of the means referred to a significant difference between female and male students. In other words, female students are more successful than male students in the Mathematics course.

In 6<sup>th</sup> grades, even though female students' course grades were higher than male students', this difference was not significant statistically. Female students' level of success in the course was close to male students' level of success.

In 7<sup>th</sup> and 8<sup>th</sup> graders, there is a significant difference between female and male students. In both grades, female students had higher achievement level in mathematics course than male students.

Considering all three grades, female students were more successful than male students in a mathematics course. In other words, among middle school students, female students had higher grades than male students.

Attitude toward Mathematics was not significantly different in 6<sup>th</sup> and 7<sup>th</sup> grades in terms of gender. Female and male students showed similar results in these two grades in their scores.

On the other hand, 8<sup>th</sup> graders showed significant difference in their attitude scores. Like indicated in Özlü's (2001) study, female students performed more positive attitudes than male students toward Mathematics.

In further research efforts, this study might be extended with considering other factors effective in attitude and achievement in Mathematics. And also, this study might be modified to a study in a secondary school level.

#### References

- [1] Aksu, M. (1985), *Ortaöğretim Kurumlarında Matematik Öğretimi ve Sorunları*, Ankara: T.E.D.Yay. Öğretim Dizisi No:3, Yorum-Basın Ltd. Şti.
- [2] Aksu, M. (1991), A longitudinal study on attitudes toward mathematics by department and sex at the university level, *School Science and Mathematics*, 91 (5), p. 185-192.

- [3] Aydın, Ş., Bölükbaşı, O. ve Polat, Ü. (2005), *Niğde ili "Ortaöğretim Kurumlarında Okuyan Öğrencilerin Matematik Dersine Karşı Kalıplaşmış Tutumları"*, XIV. Ulusal Eğitim Bilimleri Kongresi, (28-30 Eylül 2005), Denizli: Pamukkale Üniversitesi.
- [4] Baykul, Y. (1990), *İlkokul Beşinci Sınıftan Lise ve Dengi Okulların Son Sınıflarına Kadar Matematik ve Fen Derslerine Karşı Tutumda Görülen Değişmeler ve Öğrenci Seçme Sınavındaki Başarı ile İlişkili Olduğu Düşünülen Bazı Faktörler*, Ankara: ÖSYM Yayınları.
- [5] Dursun, Ş., & Dede, Y. (2004), Öğrencilerin Matematikte Başarısını Etkileyen Faktörler: Matematik Öğretmenlerinin Görüşleri Bakımından, *Gazi Eğitim Fakültesi Dergisi*, 24 (2), p. 217-230.
- [6] Eceles, J.S. , Adler, T.F. and Mecce, J.L. (1984), Sex Differences in Achievement: A test of Alternate Theories. *Journal of Personality and Social Psychology*, 6, p.26 – 43.
- [7] Franke, L., & Kazemi, E. (2001), Learning to Teach Mathematics: Focus on Student Thinking. *Theory into Practice*, 40 (2), p. 102-109.
- [8] Gömleksiz, M. (1997), *Kubaşık Öğrenme: Temel Eğitim Dördüncü Sınıf Öğrencilerin Matematik Başarısı ve Arkadaşlık İlişkileri Üzerine Deneysel Bir Çalışma*, Adana: Baki Kitabevi.
- [9] Hare, M. (1999), *Revealing What Urban Early Childhood Teachers Think About Mathematics and How They Teach It: Implications For Practice*, University Of North Texas, December, s.11.
- [10] Johson, S. (1987), Gender Differences in Science: Parallels in Interest, Experience and Performance, *International Journal of Science Education*, 9 (4), p. 467– 481.
- [11] Koca, A.Ö. and Şen, A.İ. (2005), Orta Öğretim Öğrencilerinin Matematik ve Fen Derslerine Yönelik Olan Olumlu Tutumları ve Nedenleri, *Eurasian Journal of Education Research*, 18, p.186-201.
- [12] Linn, M. and Hyde, J. (1989), Gender Mathematics and Science, *Educational Researcher*, 18 (8), p.17 – 27.
- [13] Otto, P.D. (1991), One Science, One Sex? *School Science and Mathematics*, 91 (8), p. 367-372.
- [14] Özlü, Ö. (2001), *Ortaöğretim Öğrencilerinin Matematiğe Karşı Tutumları*, Yayınlanmamış Yüksek Lisans Tezi, Marmara Üniversitesi, İstanbul.
- [15] Papanastasiou, C. (2002), Effects of Background and School Factors on the Mathematics Achievement, *Educational Research and Evaluation*, 8 (1), p.55-70.
- [16] Parker-Prince, S. and Claxton, A. (1996), Teachers' Perceptions of Gender Differences in Their Students, Paper presented at the Annual Convention of the National Association of School Psychologists.
- [17] Sayers, R. (1994), Gender differences in Mathematics Education in Zambia, *Educational Studies in Mathematics*, 26, p.389-403.
- [18] Smith, M. (2000), Reflecting on practice: Redefining Success In Mathematics Teaching And Learning, *Mathematics Teaching in the Middle School*, February, 5 (6), 378-382.
- [19] Staflien, C. (2001), *Gender Differences in Achievement in Mathematics*, November 16. [http://www.math.wisc.edu/~weinberg/MathEd/Gender\\_Term\\_Paper.doc](http://www.math.wisc.edu/~weinberg/MathEd/Gender_Term_Paper.doc) (2007, March 15).
- [20] Steinback, M. and Gwizdala, J. (1995), Gender differences in Mathematics attitudes of secondary students, *School Science and Mathematics*, 95 (1), p.36-41.
- [21] Steinkamp, M. and Maehr, M. L. (1984), Gender differences in motivational orientations toward achievement in school science: a quantitative synthesis, *American Educational Research Journal*. 21(1), p.39-59.
- [22] Tobin, K. and Garnett, P. (1987), Gender Related Differences in Science Activities, *Science Education*, 71, p. 91-103.

[23] Yıldırım, C. (1996), *Matematiksel Düşünme*, Second Edition, İstanbul: Remzi Kitabevi.

### Authors

**Hasan Arslan**, Canakkale Onsekiz Mart University, Canakkale, Turkey.  
E-mail: [arslan.phd@gmail.com](mailto:arslan.phd@gmail.com)

**Murat anlı**, Celal Bayar University, Manisa, Turkey.  
E-mail: [murat.canli@cbu.edu.tr](mailto:murat.canli@cbu.edu.tr)

**Helena Maria Sabo**, Babes-Bolyai University, Cluj-Napoca, Romania.  
E-mail: [helena-maria.sabo@gmx.net](mailto:helena-maria.sabo@gmx.net)