EZGİ SERT

INVESTIGATING HIGH SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT WITH LEVEL OF SOURCES OF MATHEMATICS SELF-EFFICACY, GENDER AND SCHOOL TYPES

EZGİ SERT

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I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum and Instruction.

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ABSTRACT

INVESTIGATING HIGH SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT WITH LEVEL OF SOURCES OF MATHEMATICS SELF-EFFICACY, GENDER AND SCHOOL TYPES

Ezgi Sert

MA in Curriculum and Instruction

Advisor: Assoc. Prof. Dr. Erdat Çataloğlu

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The purpose of this study was to investigate high school students' mathematics achievement. Their mathematics achievement was determined by their latest mathematics Grade Point Average (GPA) results that were collected at the end of the first term of 2019-2020 academic year. Level of sources of mathematics self-efficacy, gender and school types were examined to gain information about their mathematics achievement by using descriptive research design. Descriptive statistics were used to analyze students' mathematics achievement in terms of level of sources of mathematics self-efficacy, gender and school types. The participants consisted of 9th, 10th and 11th grade students. A total of 644 students from private and state schools took part in this study. The Turkish version of the sources of mathematics self-efficacy survey developed by Perkmen (2016) was used to measure students' sources of mathematics self-efficacy. It was investigated whether there was a correlation between students' level of sources of mathematics self-efficacy and mathematics achievement or not. The results showed that there was a statistically significant and positive correlation between students' mathematics achievement and mastery experiences, vicarious experience, social persuasion, and psychological states. Also, independent sample t-tests were used to examine gender difference and school types in terms of students' mathematics achievement. There was a statistically significant mean difference between female and male students in favoring of female students' mathematics achievement with a medium effect size. Furthermore, there was a statistically significant mean difference between private and state schools with a small effect size in favoring of private high school students' mathematics achievement.

Keywords: Mathematics achievement, sources of mathematics self-efficacy, gender, school types, Turkish high school students

ÖZET

LİSE ÖĞRENCİLERİNİN MATEMATİK BAŞARININ MATEMATİK ÖZ-YETERLİĞİ KAYNAKLARININ DÜZEYİ, CİNSİYET VE OKUL TÜRÜ İLE İNCELENMESİ

Ezgi Sert

Eğitim Programları ve Öğretim Yüksek Lisans Programı

Danışman: Doç. Dr. Erdat Çataloğlu

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Bu çalışmanın amacı, lise öğrencilerinin matematik başarılarını araştırmaktır. Öğrencilerin matematik başarıları, 2019-2020 eğitim öğretim yılının birinci dönem sonunda toplanılan en son matematik dönem sonu notuna göre belirlendi. Betimleyici araştırma yöntemini kullanarak matematik başarıları hakkında bilgi edinmek için, matematik öz-yeterlik kaynaklarının düzeyi, cinsiyet ve okul türleri incelenmiştir. Öğrencilerin matematik başarılarını matematik öz-yeterlik kaynakları düzeyi, cinsiyet ve okul türleri açısından analiz etmek için betimleyici istatistik kullanılmıştır. Katılımcılar 9, 10 ve 11. sınıf öğrencilerinden oluşmaktadır. Bu çalışmaya özel ve devlet okullarından toplam 644 öğrenci katılmıştır. Öğrencilerin matematik öz-yeterlik kaynaklarını ölçmek için Perkmen (2016) tarafından geliştirilen matematik öz-yeterlik kaynakları anketinin Türkçe versiyonu kullanılmıştır. Öğrencilerin matematik öz-yeterlik kaynakları düzeyleri ile matematik başarıları arasında bir ilişki olup olmadığı araştırılmıştır. Öğrencilerin matematik başarıları ile kişisel deneyimleri, dolaylı deneyim ve sosyal ikna ve fizyolojik durumları arasında istatistiksel anlamlı ve pozitif bir korelasyon olduğunu göstermiştir. Ayrıca öğrencilerin matematik başarıları açısından cinsiyet farklılığını ve okul türlerini incelemek için iki bağımsız örneklemler t testi kullanılmıştır. Kız öğrencilerin matematik başarısı lehine, orta etki büyüklüğüne sahip olup kız ve erkek öğrenciler arasında istatistiksel olarak anlamlı bir fark bulunmuştur. Ayrıca özel lise öğrencilerinin matematik başarıları lehine küçük bir etki büyüklüğüne sahip olup özel ve devlet okulları arasında istatistiksel olarak anlamlı bir fark bulunmuştur.

Anahtar kelimeler: Matematik başarısı, matematik öz-yeterlik kaynakları, cinsiyet, okul türleri, Türk lise öğrencileri.

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CHAPTER 1: INTRODUCTION

Introduction

Mathematics firstly came out the needs of societies by using simple counting and measurement. In today's world, it is of great importance for other sciences to be part of modern societies, especially in the technology field. Also, it is surely beyond doubt that it appears in many areas of our lives. People can encounter essential concepts of mathematics and need it at every single minute of their lifetimes while making payments, telling the time, understanding simple graphs and diagrams, and performing arithmetic operations that are included in the basic impressions of mathematics (Işık et al., 2008).

Since mathematics is vital for societies and individuals alike, it is an important subject taught at all levels in schools. Despite an essential course studied by almost all students, yet most of students think that mathematics is one of the demanding subject to learn. The result of higher education institution examination showed that students had poor mathematics achievement, so it leaves room for much improvement (The Measurement, Selection and Placement Center [ÖSYM], 2020). Upon acknowledging that students perform poorly in mathematics, it becomes important to investigate the reasons why their mathematics achievement is so low.

Most of studies have been investigated to explain students' achievement in mathematics such as gender, different grade levels, creativity, mental ability, school types, cultural factors, socioeconomic status, income, metacognitive level, and so on because researchers investigate their relations with mathematics, factors affecting, etc. to create better learning and teaching environment. High school students' mathematics achievements were investigated by analysing of level of

sources of mathematics self-efficacy, gender differences and school types in this study.

Background

Acquisition of knowledge and skills through education life have a chance for students to show their own potential. Sources (e.g., interest, goals, motivation, and attitude etc.) nurturing their potential undoubtedly bring achievement in all areas, in also mathematics. Abín et al. (2020) stated that mathematics achievement is concerned with cognitive, emotional, and motivational skills. Ramdass (2011) defined it as consisting of cognitive, metacognitive, and motivational skills in addition to having the subject area of knowledge in mathematics. Needless to say, these constructs can enable researchers to gain information about students' mathematics achievement.

Self-efficacy is defined as people's beliefs about their abilities when facing with certain situations (Bandura, 1977). It is an essential construct having both cognitive and emotional processes (Schunk & Mullen, 2012) as it effects meaningful learning. Schunk (1989) stated that self-efficacy is of great importance to allow researchers to explain students' learning and their cognitive skills in different areas (Bandura, 1977; Pajares & Kranzler, 1995; Pajares & Miller, 1994) since it influences on the choice of doing an activity or not, coping with demanding issues and showing endeavours and perseverance in achievement (Bandura, 1977; Zimmerman 2000).

Self-efficacy in mathematics is referred that students' beliefs on finishing mathematical schoolwork very well by considering their own ability (Hackett & Betz, 1989; Lucas, 1999). Therefore, self-efficacy can be seen as an impressive guidance to investigate students' mathematics achievement (Schunk & Pajares,

2002). It is an effective role on mathematics achievement compared to personal past accomplishment and mathematics anxiety (Pajares & Miller, 1994). Furthermore, a statistically significant correlation was found between students' mathematical accomplishments and their self-efficacy in mathematics (Ayotola & Adedeji, 2009; Liu & Koirala, 2009).

Mastery experiences, vicarious experience, social persuasion, and psychological states are sources of self-efficacy (Bandura, 1986). Individuals' past experiences that shape their future feeling, thinking and actions to certain situations in their lives are named as mastery experiences are about. Past experiences have a strong effect on individuals' beliefs (Bandura, 1977; Joët et al., 2011; Klassen 2004; Kontaş & Özcan, 2017; Lent et al., 1992; Luzzo et al., 1999; Özcan & Kontaş, 2020; Yurt, 2014). Vicarious experience means that learning experience can be happened by observing actions of people. People can build their own beliefs on it by evaluating the results of a work done by others. Then, they decide whether they can do or not for it. Social persuasion is related to verbal comments (positive or negative statements) on the individuals' ability or performance to show. For example, a teacher says a student when facing with a difficult mathematical problem: "*I am sure that you can solve this problem*". This kind of positive statements can enable students to put more efforts and show persistence on their tasks. Psychological states are concerned with emotions, feeling, and psychical reactions that affect their individuals' beliefs. Sources of mathematics self-efficacy is students' sources of self-efficacy in mathematics course. Some studies were found the association between sources of self-efficacy in mathematics and accomplishment in mathematics as similar results within the framework of between accomplishment in mathematics and self-efficacy (Kontaş & Özcan, 2017; Ozcan et al., 2021; Özcan & Kontas, 2020).

Understanding these sources of self-efficacy provide us for getting the information about self-efficacy to enhance students' achievement in mathematics because they make contributions on building people's self-efficacy indirectly (Kandemir & Perkmen, 2017).

Problem

In Turkey, ÖSYM (2020) reported that the majority of graduate high school students gave 10 or less than 10 correct answers out of 40 mathematics questions consisted of 77% of the whole group in Basic Proficiency Test (TYT), which demonstrated that the students' mathematics achievement in TYT was at a low level. The average percentage of giving correct answers in TYT is 17.5% and the average percentage of giving unanswered answers is 68.1%. The average percentage of giving correct answers to mathematics questions in Field Qualification Test (AYT) is 24.9% and the average percentage of giving unanswered answers is 60%. The results of both tests conducted in 2020 shows room for improvement on high school students' mathematics achievement.

Mathematics is generally perceived as one of the challenging courses to be competent by most of students. Self-efficacy enables researchers to examine on the complexity of students' mathematics achievement because this construct allows researchers to explain human behaviour. Likewise, sources of self-efficacy in mathematics undoubtedly help us because it enables us to understand students' mathematics achievement by getting information from students' sources of that nurture their self-efficacy.

In this study, high school students' level of sources of self-efficacy in mathematics was used so as to get an idea about their mathematics achievement.

Also, their mathematics achievement was examined on gender differences and school types.

Purpose

The purpose of this study was to investigate students' mathematics achievement participating from 9th, 10th, and 11th grade high school students. High school students' mathematics achievement was determined by their latest mathematical final Grade Point Average (GPA) results that were gathered at the end of the first term of 2019-2020 academic year. Their mathematics achievements were investigated with level of sources of mathematics self-efficacy, school types and gender difference by conducting descriptive research design. A survey on sources of mathematics self-efficacy was applied to high school students so as to figure out students' level of sources of self-efficacy in mathematics. English version of this survey developed by Kandemir and Perkmen (2017). Turkish version of this survey developed by Perkmen (2016) was used in this study. For that purpose, it was investigated whether there is a correlation between high school students' mathematics achievement and their level of sources of self-efficacy in mathematics or not. Furthermore, gender differences and school type were analysed.

Research Questions

In this study, the research questions were presented below:

1. Is there a statistically significant correlation between students' mathematics achievement and level of sources of mathematics self-efficacy?
    a) Is there a correlation between students' mathematics achievement and mastery experiences?

b) Is there a correlation between students' mathematics achievement and vicarious experience?

c) Is there a correlation between students' mathematics achievement and social persuasion?

d) Is there a correlation between students' mathematics achievement and psychological states?

2. Do female and male students have a significantly difference in terms of their mathematics achievement?
3. Is there any statistically significant difference between students' mathematics achievement by school types?

Significance

Investigating a possible relationship of high school students' level of sources of mathematics self-efficacy level can provide teachers for increasing their students' mathematics achievement because being aware of these factors affecting students' achievement enable them to support their cognitive and affective domain positively. Students also can be aware of their own beliefs about mathematics, and they can organize their behaviours, feelings, and actions on mathematical tasks in a positive way. They can build their self-efficacy through by knowing previous mathematics experience to do it better for future, by observing role models, by being aware of psychological and emotional states, and by using encouraging verbal statements to students. These variables can help them create positive learning and teaching environment for them, when necessary, attention is given to them. Furthermore, they can get insights into supporting students' mathematics achievement.

Definition of Key Terms

Gender: High school students were described as female or male.

Mathematics achievement: Grade Point Average (GPA) scores of 9th, 10th, and 11th grade high school students at the end of the first term of 2019-2020 academic year were used in mathematics course. Their scores were used on the scale of 100. In this study, GPA is defined as the latest semester score reported by the students. In Turkish high school system, the end of semester score is usually the arithmetic average of at least two written exams and performance studies based on the regulations of Ministry of National Education.

Mathematics self-efficacy: It is students' beliefs about whether he/she are successful in mathematics.

School types: School types were used as private and state high schools.

Self-efficacy: Self-efficacy is a construct formed by individual's beliefs about whether he/she can accomplish in a task assigned to him/her.

Sources of self-efficacy: Mastery experiences, vicarious experience, social persuasion, and psychological states form a basis for people's self-efficacy (Bandura, 1986). Mastery experience means individual previous experience. Vicarious experience means observing and evaluating others. Social persuasion means verbal expressions from his/her environment that he/she can achieve a task. Psychological states mean giving reactions physically and psychologically when given a task to him/her (Perkmen, 2016).

Ethical Considerations

To conduct this study, getting permission from Ministry of National Education (MoNE), students who were volunteers, students' parents and school principals was done by the researcher. Also, the researcher implemented sources of mathematics self-efficacy instrument approved by the author.

CHAPTER 2: REVIEW OF RELATED LITERATURE

Introduction

The rudimentary concepts thought in formal mathematics courses is of great importance for individuals and societies in large. Besides, mathematics is fundamental tool of many other scientific disciplines. It helps us to further our skill in areas such as problem solving, scientific thinking, reasoning, association, generalization, communication, affective and psychomotor domains. It is a crucial subject in education because of having a crucial place in community. No surprise then that many studies have been conducted on all possible factors that affect students' mathematics understanding and achievement. Level of sources of mathematics self-efficacy, gender differences and school types are only three of them that used in this research.

In this study, the goal was to investigate mathematics achievement in high school students with concepts of sources of mathematics self-efficacy. It was also analysed in terms of gender difference and school types. Since sources of self-efficacy provides researchers with getting knowledge of people's beliefs on their abilities, according to Bandura (1995), it is a vital construct to figure out students' accomplishment in any subject, including mathematics subject. Also, gender differences and school types help us to give description on students' mathematics achievement.

This chapter is about reviewing the past studies on the related research questions in this study. The main titles for this section are given as follows:

- Self-efficacy
- Sources of mathematics self-efficacy and mathematics achievement

- Gender differences in mathematics achievement
- School types in mathematics achievement

Self-efficacy

Many theories have been conducted to understand and explain human behaviour such as psychodynamic theory, trait theory, and behaviourism. Another important exertion is the research being conducted in the scope of social cognitive theory. According to Bandura (1986), social cognitive theory is concerned with individual functioning being associated with triadic reciprocal. These consist of behaviour, cognitive and other personal factors, and environmental issues which interact with each other. He defined that people have capabilities under these associations. They are grouped as follows:

a) Symbolizing Capability: According to Bandura (1986), people use symbols through their cognitive processes that significantly affect their lives when learning (i.e., changing and adapting) their lives. They enable them to find meaning and forming about their lives. Symbols are represented and evolve in their minds according to their experiences.

b) Forethought Capability: People set goals considering their expectations and make decisions about their future plans. They think how to behave for the possible consequences in order to increase desirable future plans.

c) Vicarious Capability: People are able to learn from others by observing them.

d) Self-regulatory Capability: People can change their behaviours according to environmental factors, they develop personal standards which are internal standards to regulate their own behaviours. After setting their own personal standards, they observe their own performance and make

decisions about their behaviour by comparing themselves with the personal standards that they have developed.

e) Self-reflective Capability: People reflect their experiences, consider their own thinking processes about their own perspective and change their own thinking. Self-efficacy is an example for self-reflective capability.

Albert Bandura is a recognized as the conceiver of the theory of self-efficacy. This construct is defined as individual's beliefs about his/her capabilities in order to regulate and carry out their necessary actions that are required to handle possible events (Bandura, 1995). It affects people's motivation, thinking, feelings and actions in their lifetimes. In compliance with Bandura (1977, 1986), four fundamental sources shape human's efficacy that can be developed through their lives as below;

a) Mastery experiences: It referred as individuals' previous experiences in performing a task. It is believed that their self-efficacy increases when successful works are performed by them. However, their self-efficacy decreases when unsuccessful works are performed by them. Furthermore, once they are convinced that they are successful, they continue to struggle difficulties and quickly withdraw from failures. In school, for example, if a student did well his\her task in a previous mathematics activity, he\she may have a tendency to demonstrate high self-efficacy (Pajares & Usher, 2009).

b) Vicarious experience: This experience can occur by observing the works of others and making inferences on accomplishment or failure by comparing other people's work with their own abilities. Observing successful people provide continuous effort increases own belief that they

too can do the tasks required for success. For example, students can make a comparison with peers, classmates or adults to make a personal judgment own ability (Pajares & Usher, 2009).

c) Social persuasion: Once people are persuaded to have the ability for being an expert in certain tasks, they make more efforts and carry on performing even problems that arise. Positive feedback, encouragement, and confident comments on people help them to increase their self-efficacy.

d) Physiological states: Human physiological situations affect how they assess their self-efficacy. Privative reactions and tension can guide demonstrate deficient performance in a task, while positive attitudes can enhance their competence.

Bandura (1986) stated that mastery experience was of vital importance on forming individual' self-efficacy rather than the other sources (Joët et al., 2011; Klassen 2004; Lent et al., 1992; Luzzo et al., 1999; Özcan & Kültür, 2021; Yurt, 2014).

Bandura (1977) stated that most of human behaviour is mostly related to their cognitive processes. These processes provide human with predicting their future outcomes and finding ways to control these outcomes that influence their lives. According to his self-efficacy theory, self-efficacy is of great importance to analyse human behavioural changes by setting two expectations. One of them is an outcome expectation. It means that one's belief that a specific behaviour will bring about certain outcomes. The other one is an efficacy expectation. It means that one having confidence in terms of one's ability conduct the behaviour that will give rise to the desirable outcome. Efficacy expectations enable us to obtain knowledge of people's

effort and staying power against difficulties and stressful events. This shows that one having high self-efficacy shows a tendency to make more efforts in difficult situations.

According to Bandura (1977), efficacy expectations had three dimensions across activities and contexts as follows:

Magnitude: Magnitude of self-efficacy refers to be performed tasks given the different levels. For example, the difficulty level of mathematics may be like ranging from solving basic calculus questions to solving complex calculus questions.

Generality: The generality of self-efficacy means transferring people's self-efficacy beliefs across activities. For example, a student dislike reading in English, and also dislike speaking English (Kemer, 2006).

Strength: Strength of efficacy is concerning the degrees of people' confidence when they conduct assigned activities. For example, a student is asked to evaluate his/her own confidence when facing with one world problem in mathematics by giving rating scale to measure his/her own confident level.

This section provided and discussed the theoretical background on self-efficacy theory by providing foundational information with relevant examples.

Self-efficacy and/or Mathematics Self-efficacy and Mathematics Achievement

Self-efficacy theory provides another door that helps us to explain success and/or failure. This section explored the relationship between self-efficacy construct and mathematics education, especially for students' mathematics achievement.

Pajares and Miller (1994) analysed mathematics self-efficacy construct of 329 participants about solving mathematical problem solving by conducting path analysis study. According to the statistical results, the students' self-efficacy level was stronger rather than the past experience in this study on solving mathematical

problems when controlling the variables gender and ability level. Another path analysis was conducted by Parajes and Kranzler (1995) to examine the impact of high school students' mathematics self-efficacy, mental ability about their performance about solving mathematical problems. Also, their mathematics anxiety, their mathematics level and gender were used. The number of high school students was 329. By using these variables, they argued that students' performance in solving problems explained with %60. The finding showed that students' self-efficacy beliefs are of importance to solve mathematical problems when their mental ability are taken control.

Kitsantas et al. (2011) examined the relations among the students' homework materials, mathematics self-efficacy, spending time on their homework for their mathematical achievement in terms of gender and race. Program for International Student Assessment (PISA) 2003 data was used to conduct this study. Kitsantas et al. (2011) stated a strong correlation between mathematics achievement and self-efficacy in mathematics. Furthermore, it followed from the multiple regression analysis that mathematics self-efficacy is a powerful construct on explaining students' achievement in mathematics. In addition to this, Yıldırım (2011) investigated whether the relationships among Finnish, Japanese and Turkish students' self-efficacy and other constructs on mathematics achievement by using PISA 2003 data. Based on the consequences of the study, self-efficacy was found a positive impact on mathematics achievement for all three countries. Furthermore, this relation was found in Finland rather than the other countries. She argued that the increase in Finnish students' self-efficacy beliefs may be more effective with respect to reducing their anxiety rather than Turkish and Japanese students. Another PISA data study conducted by Kalaycıoğlu (2015) was concerned with investigating

students' mathematics achievement with some variables by using PISA 2012 data. It was found that mathematics self-efficacy was the most predicator rather than other variables on students' mathematics achievement attending from different countries. In England, the highest relation on students' mathematics achievement and self-efficacy in mathematics was seen when compared the other countries. She claimed that students' studies were effectively assessed in England. Since their portfolios includes the students' weaknesses and strengths on mathematics tasks, they may be able to show their own capability and performance on mathematics. Therefore, it may be the reason of having the highest relationships between these variables in England.

Üredi and Üredi (2005) investigated the relations 8th grade students' self-regulation planning and motivational opinions to find a predictive power of these variables on their mathematics achievement. Their results showed that students having high self-efficacy beliefs performed high mathematics achievement. Another middle school study conducted by Isiksal and Askar (2005) investigated whether the using of excel, autograph and traditional teaching method influence middle school students' self-efficacy in mathematics and mathematics achievement by conducting experimental data. The result of the post-test showed that students' self-efficacy in mathematics and mathematical accomplishment positively correlated.

Liu and Koirala (2009) examined the relationship between 10th grade students' self-efficacy in mathematics and their mathematical achievement. They used a correlational analysis collected from a survey. It follows from their correlational analysis that student having high sense of self-efficacy had high mathematics achievement scores. Hence, they argued that mathematics self-efficacy could be considered as a significant positive indicator for mathematics achievement.

Also, they stated that students who felt confident when demonstrating their performance in mathematics is likely to get high mathematics achievement. In particular, those who felt confident that they did a high score on mathematics tests, they grasped the most complicated materials offered by their mathematics teachers, and they showed higher performance on mathematics assignments, had the tendency to get high mathematics achievement.

Ayotola and Adedeji (2009) conducted a study on 352 students' mathematics achievement. They had three hypotheses to conduct this study. The first one was concerned with gender difference in mathematics. The second one was concerned with gender difference in mathematics self-efficacy. And the last one was concerned with examining the relationship self-efficacy in mathematics and mathematical achievement. Stratified random sampling was used from selected schools. Mathematics self-efficacy instrument and mathematical test including 25 mathematical problems were used. T-test and Spearman rank order corelation were conducted in the statistical analysis. According to the statistical results for the third hypothesis, there was a strong positive relation between these variables.

Studies on Sources of Self-efficacy and/or Sources of Mathematics Self-efficacy

As mentioned above the previous section, there is no doubt that sources of self-efficacy, that nurture the individuals' beliefs on their efficacy, have a power to give information about students' beliefs, capability, and emotions in life. Özcan and Kültür (2021) stated that sources of self-efficacy allow students' beliefs on their efficacy to improve in academic setting. Therefore, for a special purpose, they enable students to develop their self-efficacy in mathematics and indirectly mathematics achievement.

Lopez and Lent (1992) examined high school students' self-efficacy sources and self-efficacy in mathematics. They showed that a significant relation was found between each source and self-efficacy in mathematics. Furthermore, mastery experience was found a high relationship with their mathematics self-efficacy. They suggested the questioning students' existing mathematics beliefs, helping them to identify the effects of these existing beliefs on mathematics courses to improve their beliefs on current mathematics courses for their career.

Another study that reveals the importance of individual experience is Luzzo et al. (1999) conducted the experimental study about the enhancing 94 college students' self-efficacy who were undecide their career choices by analysing the effect of mastery experience and vicarious learning on self-efficacy construct on specific courses, career related items, their choices. Students were separated as four groups: the only mastery experience by helping them to enhance their self-efficacy, the only vicarious learning group by watching 15 minutes video to enhance their self-efficacy, including both of self-efficacy sources study and the control group respectively. The findings revealed that the first group attending only mastery experience study and the third group attending both self-efficacy sources study increased their self-efficacy level on decision of their career choices. It follows from these outcomes that students' self-efficacy was effectively determined their own experience rather than observing others.

Joët et al. (2011) analyzed the effect of sources of self-efficacy of 395 elementary school students on their self-regulatory beliefs and academic beliefs concerning about mathematics and France courses. Furthermore, they investigated each source with respect to gender differences and their self-efficacy level in classroom. The results showed that self- efficacy scores in classroom, social

persuasion and mastery experience explained students' mathematics self-efficacy. Psychological states explained their French self-efficacy with these three variables explained their mathematics self-efficacy. Also, male students showed better on the performance of mastery experience and social persuasion than female students. They recommended that getting more information about individual self-efficacy level from classroom studies would enable to enhance students' efforts. Also, they argued that domain specific tasks would be used to see their perseverance and their capability on specific task.

Studies on Sources of Self-efficacy and/or Sources of Mathematics Self-efficacy and Mathematics Achievement

Some research were conducted about sources of self-efficacy and/or sources of self-efficacy in mathematics and mathematics achievement**.** Lent et. al (1991) examined the relationships sources of self-efficacy on mathematics self-efficacy, self-efficacy, outcome expectations, giving importance to mathematics-related courses in college, and career choices. The participants (N = 138) were chosen from psychology courses. Sources of self-efficacy scale was consisted of 40 items. Each source had equal item numbers. Mathematics American College Testing Program (ACT) was used to measure their mathematics performance. This was used to measure their mastery experience. The findings showed that the sources of self-efficacy and each source had a significant correlation and overall mathematics achievement. Furthermore, another result was about finding significant correlations with personal performance accomplishments, social persuasion, and emotional arousal with test scores except vicarious learning.

Yurt (2014) analysed the relationships between sources of self-efficacy and mathematical success, the predictive power of sources of self-efficacy on

mathematical success and lastly the order of sources of self-efficacy in terms of the importance/effectiveness for mathematics achievement. The number participants were 350 middle school students. The findings showed that sources of self-efficacy were found high and medium relations with mathematics achievement. In particular, mastery experience was high significant relation with the other sources. Furthermore, mastery experience was a high predictor for mathematics achievement. He stated that the better the student has a successful past mathematics experience, the better he or she will be good about mathematics. Social persuasion and physiological states were found effective sources respectively. He argued that vicarious learning was not effective on mathematics achievement.

Kontaş and Özcan (2017) developed mathematics self-efficacy instrument by using English version of this instrument created by Usher and Pajares (2009). After conducted confirmatory factor analysis and reliability of the instrument, they were analysed the correlations between sources of mathematics self-efficacy, academic self-efficacy, ability and quality of education respectively. A positive corelation was found between mathematics achievement and each source. They investigated another study by conducting multiple linear regression about the students' mathematics achievement among high school students and their sources of mathematics self-efficacy. There were 281 students attending from the Mediterranean region of Turkey. Firstly, they showed that a significant and positive correlation between previous year of mathematics grade and each source respectively. The highest correlation was found with mastery experience. Also, the regression analysis showed that mastery experience had an most effect on mathematics achievement while the other sources had no effect on mathematics achievement. They suggested that teachers should give opportunities them to take place in class activities by

experiencing their own learning. Students' capability should be considered in learning process by supporting students' mathematics achievement level.

Özcan and Kültür (2021) investigated the relationships 12th grade students' sources of self-efficacy, standard test in mathematics and mathematical accomplishment received from one-semester mathematics mean scores. The number of participants 257 in Mediterranean part of Turkey. They found that a significant and positive correlation between mathematics course achievement or mathematics test achievement and each source respectively. According to their view, when showing positive increment of students' mathematics test achievement or mathematics course achievement, their mastery experiences, vicarious experience, social persuasion, and psychological states showed positive increment as well due to the nature of correlational study. Furthermore, mastery experience was the most predictive power for both mathematics achievement in the regression analysis.

Ozcan et al. (2021) examined the study on gifted and ungifted students by analysing their sources of mathematics self-efficacy for their mathematics achievement. The causal comparative study was conducted. They investigated whether the differences between gifted and ungifted students for their mathematical achievement. According to the result of one-way MANCOVA, an inconsistent result was found between gifted and ungifted students. After getting control their mathematics achievement, non-gifted students had a slight increment with each source, however; gifted students had a drastically decline with each source. They argued that the reason of this decline among gifted students was being perfect when doing mathematics. Another result was found that mathematics achievement plays important role on gifted and ungifted students' sources of mathematics self-efficacy.

Therefore, students should be able to be active in class by allowing them to more achievement experience in order to enhance their own capability and beliefs.

Gender Differences

There are many studies about the students' mathematics achievement in the world. One of the studies is to understand gender difference in mathematics achievement. The differences between females and males in mathematics achievement have been investigated within years (e.g., Fan et al., 1997; Hedges & Nowell, 1995; Peterson & Fennema, 1985).

The gender difference was not obviously seen in primary school, however females gradually started to decrease their achievement in secondary school and this difference became evident in high school years (Duru & Savaş, 2005). On the other hand, Hyde et al. (1990) analysed a meta-analysis study about gender differences in mathematics performance chosen from 100 studies. This study showed that problem solving in mathematics that is related to a part of mathematics achievement did not come out in primary and middle school between male and female students. But it appeared high school and college in favour of male students. Similarly, for high school students, Kimmel (1986) stated that males outperformed than females. On the other hand, Beller and Gafni (1996) stated that male students were good at mathematics achievement scores when compared to female students among ages 9- and 13-years old attending from different countries.

There were some studied conducted to understand the reasons of factors lead to gender differences. Some studies were found the reasons about genetic traits (Harris, 1981; Linn & Peterson, 1985) and cultural issues (Alkhateeb, 2001; Ubuz, 1999).

Gender differences in mathematics achievement vary in the past studies. Therefore, it is a still worry for people teaching mathematics (Ercikan et al., 2005). Some researchers found that females are less successful in mathematics than males. Some researchers found that no significant differences were found between them in mathematics achievement. Others found that the male students are less successful in mathematics than females. The literatures on these cases were searched in the following sections.

The Favour of Male Students in Mathematics Achievement

It was commonly acknowledged that male students outperform female students in mathematics achievement (e.g., Ayotola & Adedeji, 2009; Fennema 1974; Callahan & Glennon, 1968; Kimmel 1986; Leder 1985; Maccoby & Jacklin, 1974).

Fennema and Sherman (1977) analysed about the mathematics achievement of 589 female and 644 male students by using the Test of Academic Progress. Analysis of variances was used in their mathematics achievement by using school, gender difference, grades from 9 to 12, school by gender and school by grade. According to this analysis, a difference between female and male students was found in terms of their mathematics achievement; however, this difference was not big even if there was a study in favour of male students. There was another study including mathematics test. Another study conducted by Han (1993) investigated the students' ACT English and mathematics achievement scores and subject grade notes in terms of gender. There were 5100 participants in this study. The collected data was examined by juniors and seniors separately. The results of seniors' mathematics scores demonstrated that the male students were good at mathematics rather than the female students.

Asante (2010) investigated the Ghanaian students' mathematics achievement by analysing gender differences. The participants (109 male and 72 female students) were chosen by using convenient sampling. Their mathematics achievement was determined by looking at the mean of their school grades in three educational terms. Based on the independent t-test results, there was a statistically significant difference between male and female students in favour of male students in each term.

The Favour of Female Students in Mathematics Achievement

Alkhateeb (2001) investigated two thousand high school students' mathematics last grade received from Ministry of Education in terms of gender and also analysed on them by looking at the changes between the female and male students for ten years period in United Arab Emirates. Random sampling was used by choosing 2000 students. During the 10-year academic educational years, he stated that the female students showed better performance in mathematics than male students in the seven years being small effect size. He claimed that the reason of this difference could be explained cultural differences and decreased the differences between female and male students in terms of their mathematics achievement.

Ubuz (1999) analysed 10^{th} and 11^{th} grade students' understanding of the subject angles in geometry with respect to their errors, misconception, and gender. There were 67 students selected from a private school in Ankara. As a results of 5 open-ended questions about angles in terms of gender, the findings demonstrated that female students showed better performance than male students and also male students often leave questions unanswered instead of giving wrong answers. The reason why male students left questions more unanswered than female students may be that the mistakes of boys are less accepted by Turkish society.

No Gender Differences in Mathematics Achievement

Fennema and Sharman (1978) examined a study about gender differences among middle and high school students by using cognitive and affective variables. The results of this study showed no gender difference in a different cognitive level tests in mathematics. They claimed the reason, which those who male had better mathematics performance than female, was about the changing females' success compared to the past studies.

Peterson and Fennema (1985) investigated that the females and the males' students' mathematics achievement was determined by using mathematics achievement test including low level and high-level mathematics items. Low level items included knowledge and skills items. On the other hand, high level items included understanding and applications. The six female and male participants were randomly selected from the 36 fourth grade classes. It concluded that there was not significantly difference between female and male students by comparing post-test and their residualized gain scores study in their mathematics achievement. There was an only exception that male students showed a slightly better than female students on the high-level items in the pre-test. At the same year, Collins (1985) is also analysed gifted students' mathematics achievement with respect to gender. In this study, there were 67 students who were 10 or 11 years old. There was no significant difference between male and female students based on the results of the grade point averages of the students.

Bornholt et al. (1994) examined Australian students' (N=663) perceptions of achievement in both English and mathematics courses by looking at the gender difference. The Progressive Achievement Test of Mathematics was used to determine students' achievement scores. Multiple-choice test was implemented.

Apart from this, the students answered their achievement perception both specific and general. *Specific perceptions of achievement* were about the students' predictive score on each test performance. *General perceptions of achievement* were about current, future, talent, effort and task related to mathematics. The first result of this study showed that there was not significantly difference between female and male students based on the mathematics test. The second result was that female students showed consistency about their mathematics achievement scores they got, and their mathematics achievement scores they predicted rather than male students.

In Turkey, Işıksal and Aşkar (2005) conducted a study about using spreadsheet studies and traditional instruction on middle school students' mathematics achievement. When analysing this study with respect to gender, no significant result was found. This result was parallel to the study of Duru and Savaş (2005).

Inconsistent Situations About Gender Differences in Mathematics Achievement

Baker and Jones (1993) stated that the gender difference in mathematical achievement of 77000 students from different countries. Second International Mathematics Study (SIMS) was used to measure their mathematics achievement. According to their results, in France, Israel, Luxembourg, Netherlands, Ontario-Canada, Swaziland, the males showed the high performance when compared to the females. They also found that the males and females showed equal performance in British Colombia, England-Wales, Hong Kong, Japan, Nigeria, Scotland, Sweden, United States. On the other hand, the females showed high performance rather than the males in Belgium-French, Finland, Hungary, and Thailand. They concluded that the males were not superior to the females on average. Based on this result, they stated that the gender differences had been decreased over time.

Some researchers analysed students' achievement by looking at some branch of mathematics such as only algebra or only geometry or both of them. Ma (1995) investigated that the education system of four countries (British Columbia, Canada, Ontario, Hong Kong and Japan) by looking at gender differences from two population called as A and B in these countries in terms of mathematics achievement. Mathematics achievement was measured on algebra and geometry questions from the Second International Mathematics Study (SIMS). Stratified random sample was used in this study. Based on the result of ANOVA test, there was no statistically significant mean difference between female and male students in algebra. Similarly, Armstrong (1981), Hanna (1986) and Perl (1982) found the same result with the researcher about the study of algebra. However, boys showed better performance in geometry rather than girls in population B.

Liu and Wilson (2009) analysed gender differences in mathematics performance by using 2000 and 2003 PISA data. In 2000 assessments results, it was found that there was no significant difference between female and male students. Despite of this result, there was a significant difference between female and male students in the result of 2003 assessment. Male students showed better performance than female students. They analysed gender differences by investigating mathematics content domains. In 2000, two mathematics content domains were investigated as space and shape and change and relationship. Based on the result of change and relationship items, there was no statistically mean difference between male and female students. However, the result of the space and shape showed that the performance of male students were better rather than the performance of female students. On the other hand, in 2003, four mathematics content domains were investigated as space and shape, change and relationships, quantity, and uncertainty.

According to the results of space and shape, change and relationships, and uncertainty, male students showed better performance than female students. However, a significant difference between them was not observed in quantity items. For both years, it was concluded that male students were better about space and shape rather female students. Also, Battisa (1990) and Pattison and Grieve (1984) stated that male students performed better than female students about visual-spatial ability which is related to space and shape concept in their studies.

Baya'a (1990) studied about gender differences of Arab students in mathematics achievement and in mathematics anxiety in Israel by looking their socioeconomical situations. Two thousand students participated this study. Female and male students were equally participated. Their mathematics achievement was determined by their mathematics scores in the first three-month period. He found that male students having low socioeconomic level demonstrated better performance than female students. However, when looking at students having the high socioeconomic level, there was no significant difference between them. According to these results, he claimed that socioeconomic situation affects the gender differences in their mathematics achievement.

School Types

The fundamental principle of our educational system is to raise people with having knowledgeable, skills and good behaviours integrated with national values and competencies. While trying to gain knowledge, skills and behaviours through curricula, national values and competencies serve as the link that establishes the integrity among these knowledges, skills and behaviours (MoNE, 2018). Schools are one of great importance places for gaining knowledge, skills and good behaviours. However, gaining knowledge and skills can be seen in a different way in different

schools. There is no doubt that different school types like science and vocational has some different curriculum approaches in education system due to the aim of their foundation in Turkey. These differences can lead to their career choices, jobs, plans and achievement etc.

Schools are called private or state schools. There are differences between state and private schools. Koç (2019) stated that teachers in private schools mostly focus on students' academical development than teachers in public schools. The reason is related to teacher-student ratio in a class. When having ideally a low number of students within a class, teachers' interest and attention on their students increases even more. Also, Kandemir (2015) stated that private schools have high physical opportunities such as using technological tools and educational materials. However, in state schools, although it varies the region of Turkey, problems are experienced with such physical facilities and their solutions are not fixed immediately. In private schools, more attention is paid to parents rather than states schools. Garipağaoğlu (2015) stated that foreign languages and mathematics courses are given students in some private schools when using the lesson hours of painting, music, physical education and religious culture and ethics. Gürler (2020) stated that counseling education is of great importance to students' performance, achievement and skills in private schools. Students' skills are determined better. Thus, they can better train themselves with directed support. On the other hand, in state schools, counseling is not at the expected level. Students are generally lack of getting support from counseling in state schools.

Demir et al. (2010) examined students' mathematics achievement by analysing students' related variables and school related variables such as using educational materials and teacher-student ratio in PISA 2006 study. The researchers

found that student having high educational sources in school and low student-teacher ratio showed better mathematics achievement. They found that mean score of sciences were higher than general schools were close to each other in mathematics achievement. Another study conducted by Berberoğlu and Kalender (2005) was about investigating students' learning outcomes based on past years, school types, regions in Turkey by using national university entrance exam as an achievement variable. Also, PISA 2003 data was used to two studies. The findings on school types in national university exams revealed that general high schools and vocational high schools' students performed low level achievement in comparison to the other schools. On the other hand, PISA 2003 results showed that state schools' students showed low achievement. They argued that science schools' students showed high mathematics achievement scores rather than state schools for both exams. Savaş et al. (2010) analyzed the secondary students' mathematics achievement with some variables such as school type, family income, attitudes towards mathematics. According to the results of their descriptive and case study, students in private schools showed better mathematics achievement than students in state schools. He argued that having high mathematics achievement in private schools can be related to having well-equipment resources, having high socioeconomic status family, teacher-student ratio and etc. Cansız et al. (2017) stated a parallel result with finding about high students' achievement scores in private schools rather than state schools. On the other hand, the different result was found by the study of Recber et al. (2017) found no significant difference between state and private schools based on the students' achievement in mathematics.

Özer (2021) analysed the changes of vocational education and training in Education vision 2023 published by MoNE. He stated that training programs on their

provide students with enhancing their skills and knowledge by having more opportunities when compared to past curricula for vocational schools. MoNE conducted a project published in Education vision 2023 to reduce achievement gap in vocational schools compared to other school types. There were some improvements on enhancing teacher quality by supplying sources for them, setting up well-equipped laboratory and library, supplying educational resources, opportunities on both individual and social developments and also supporting parents.

CHAPTER 3: METHOD

Introduction

The purpose of the study was to gain information on high school students' mathematics achievement by analysing level of sources of mathematics self-efficacy, gender, and school types.

Research Design

A descriptive quantitative research design was the guide utilized as an exploration for high school students' mathematics achievement by analysing gender, school types and sources of mathematics self-efficacy in this study. Williams (2007) stated that descriptive research method enables researchers to investigate and describe the situation, as it happens in the present state, that is the current situation. Furthermore, Dulock (1993) stated that descriptive correlational study enables researchers to describe the association between one variable to another variable. Fraenkel et al. (2012) stated that a correlational study can be sometimes interpreted as a form of descriptive study since it enables the researchers to analyse an existing association between variables. Since the aim of this study was to understand and provide knowledge of high school students' mathematics achievement, the descriptive research method is appropriate for the scope of the study. Accordingly, descriptive statistics, correlational analysis and independent samples t test were used to describe the current situation about students' mathematics achievement on gender, school types, grades, and level of sources of mathematics self-efficacy.

Context

The study was implemented in Çankaya district of Ankara. High school students among 9th, 10th and 11th grade level students were selected from three private schools and two state schools. In this study, sources of mathematics self-efficacy survey was used as they are related mathematics achievement. Students' mathematics achievements were determined by collecting their GPA results were collected at the end of the first term of the 2019-2020 academic year. Furthermore, their gender and school type data were also recorded.

The researcher prepared a document that were required by the MoNE in order to conduct this study. The required information concerning this study were presented in the document. After the permission was granted by MoNE, data were collected from the allowed schools.

Participants

Population is a construct that refers to the whole. Sample is a set drawn from the whole, that is, from the population. In many research studies, it is not practical to contain all individuals of the whole, that is, from the population (Tuckman, 1994). Hence, the choice of the individuals is of great importance to conduct research. The process of the choice of the individuals who participate in the study is known as sampling. Because the goal is to find out information pertaining to the whole.

While it is not practical or even possible to include the whole, a common and agreed procedure is to select a representative sample. The set obtained through the process of sampling is known as the sample. So, basically the researcher defines the population which is "the group of people whom the survey is about" and then investigates in sampling, that is reaches "the group of people whom the researchers actually examine" (Dörnyei & Taguchi, 2010 p. 60). Dörnyei and Taguchi (2010)

stated that being a useful sample should be representative to the target population. The sample requires to be a representative of the whole population (Wiersma & Jurs, 2005). Undoubtedly, the process of sampling is very essential for any researcher.

A random sampling (also called probability sampling) is defined as having same probability to be chosen in the sample. This type of sampling method yields the highest degree towards validity of generalization of a defined population. Whenever possible a researcher should try to employee random sampling methods, starting with the simple random selection method. True randomness will eventually void bias, which in turn yields higher degree of validity in generalization (Gall et al., 2006).

Non-random sampling (also called nonprobability sampling) is a sampling technique in which researchers select biased samples. This type of sampling method yields relatively low power towards generalizability (Johnson & Christensen, 2008).

Research is constrained with real live problems; hence the sampling process is being dictated by these real-life limits. Most often sampling has to be done through convenience, for reasons such as the location of the sample, school, time, curriculum, administrator and so on (Gall et al., 2006). Convenience sampling was preferred in this study. Due to practical limitations such as residence, budget limits, travelling, and most importantly MoNE constrain, the researcher implemented this study in Çankaya, Ankara.

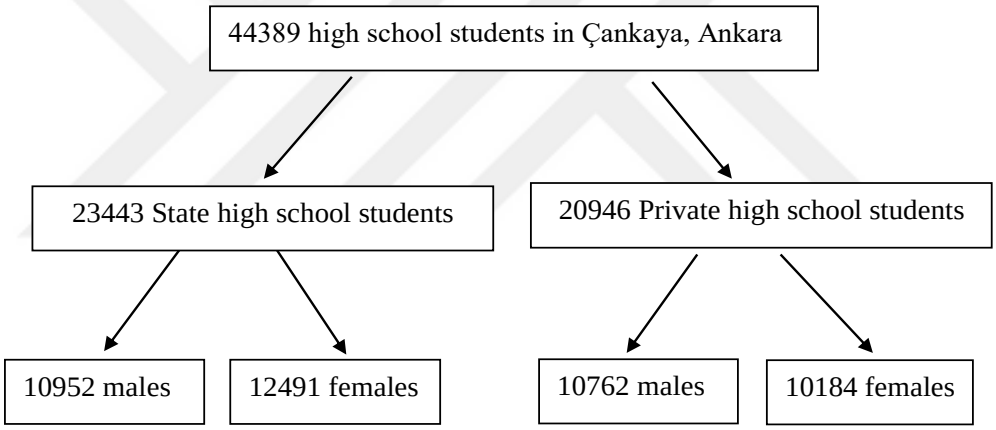
The Sampling Process

The researcher investigated the data and found in the 2017-2018 Education Statistics published by Ankara Provincial Directorate of National Education (2017) to get information about the number of high school female and male students from state and private schools in Çankaya to get a brief idea of school types and gender, Ankara before collecting data for this study.

As in Figure 1, there were 44389 high school students in Çankaya district. In state schools, there were 23443 students including 10952 males and 12491 females. In private schools, there were 20946 students being 10762 males and 10184 females. Also, in state schools, there were found 125 high schools. On the other hand, there were 36 high schools in private schools.

Figure 1

The Number of High School Students in Çankaya, Ankara from State and Private High Schools Based on 2017-2018 Education Statistics Report



During the data collection period, some school principals in Çankaya district did not concur with the permission that I got from Ministry of Education for this research. For some cases, some high school teachers did not want the researcher to apply a survey although school principals gave permission to her. Finally, the researcher conveniently reached five schools. Then the teachers were chosen conveniently to conduct this study in their courses. Based on their appropriate time, the researcher applied a survey for 9th, 10th and 11th grades high school students. The researcher reached 842 high school students, but 644 high school students included

in this study because of having inconsistent survey answers and those who do not fully answer in the given statements on survey.

Table 1 showed that there was a total of 644 students from selected state and private high schools. There were 209 students (32.45%) from two state high schools and 435 (67.45%) students from three private high schools.

Table 1

Participant High Schools and the Number of Students

High Schools	*n*	%
State	209	32.45
Private	435	67.55
Total	644	100

Table 2 showed that 287 of 644 students were female students (44.57%) and 357 of 644 were male students (55.43%). The number of female students was less when compared to the number male students.

Table 2

Gender Distribution of the Students

Gender	*n*	%
Female	287	44.57
Male	357	55.43
Total	644	100

Table 3 showed that there were 42 (20.1%) female students for state high schools while 167 (79.9%) were male students. On the other hand, for private high schools, there were 245 (56.32%) female students and 190 (43.78%) male students. The number of male students for both state and private schools were close to each

other. On the other hand, the number of female students in state schools were less than the number of female students in private schools.

Table 3

Gender Distribution of the Students by School Types (within)

High Schools	Number of Females (%)	Number of Males (%)	Total (%)
State	42 (20.1)	167 (79.9)	209 (100)
Private	245 (56.32)	190 (43.78)	435 (100)

Table 4 showed that there were 188 students (29.2%) for the 9th grade. For the 10th grade, there were 246 students (38.2%) while there were 210 students (32.6%) for the11th grade.

Table 4

Grade Distribution of the High School Students

Grade	*n*	*%*
9th grade	188	29.2
10th grade	246	38.2
11th grade	210	32.6
Total	644	100

Table 5 showed that the lowest number of participations in this study was seen for the 10th grade from state high schools with 49 students (19.9%). On the other hand, the highest amount of participation in this study was found for 10th grade from private high schools with 197 students (80.1%). For private high schools, the number of students for the 9th grade with 115 students (61.2%) were very comparable to the number of students for the 11th grade with 123 students (58.6%).

Table 5

Grade Distribution of the Students by School Types (within)

Grades	Number of State High Schools (%)	Number of Private High Schools (%)	Total (%)
9th grade	73 (38.8)	115 (61.2)	188 (100)
10th grade	49 (19.9)	197 (80.1)	246 (100)
11th grade	87 (41.43)	123 (58.57)	210 (100)

Table 6 showed that the number of male students were more than the number of female students for each grade level. On the other hand, for the 11th grade, the number of female students were comparable to the number of male students.

Table 6

Grade Distribution of the Students by Gender (within)

Grades	Numbers of Females (%)	Numbers of Males (%)	Total (%)
9th grade	77 (41.0)	111 (59.0)	118 (100)
10th grade	110 (44.7)	136 (55.3)	246 (100)
11th grade	100 (47.6)	110 (52.4)	210 (100)

Mathematics Achievement Description

Pandey (2017) stated that mathematics achievement is the competence demonstrated by students in the field of mathematics. Mathematics achievement is gained by the outcomes of knowledge, understanding and skills at a certain stage. It is measured by using achievement test in mathematics.

Ministry of National Education Secondary Education of Regulation (2019) reported that students' achievement was determined the intended learning outcomes

of the courses in related curriculum, written exams, practical exams, performance studies and projects, and the scores gained in skill training/internship in enterprises. At least two written exams from each course must be implemented. Based on the characteristics of the schools, students have two performance grades from all courses and prepare a project from at least one course in each academic year. One of performance scores is related to students' individual performance. The other performance score is related to students' preparation for lessons, attendance, being active in lessons and having good behaviour. Appropriate measurement instruments are used to measure students' achievement by considering validity and reliability of the used instrument. Answer keys, rubrics or checklists are used based on the characteristics of the measurement tool.

The semester score of a course consists of students' scores gained by at least two written exams, performance studies, and project scores if any that are determined by taking the arithmetic mean of all grades. To be successful in a course, students are required to take 50 out of 100. In this study, students' mathematics achievement was used as their GPA results at the end of the first term of the 2019-2020 academic year.

Instrumentation

Surveys enable researchers to collect information from big number of individuals effectively shortly for the purpose of studying the characteristics of a population (Check & Schutt, 2012). Sources of mathematics self-efficacy instrument was used in this study.

Sources of Mathematics Self-efficacy Survey

The researcher located the English version of sources of mathematics self-efficacy instrument for secondary students developed by Kandemir and Perkmen (2017). Then the researcher used Turkish version of the survey translated by

Perkmen (2016). The researcher got permission from the authors of the survey due to the ethical issues before applying the survey. This instrument consisted of 24 items. Also, these items included four sources. These were mastery experiences, vicarious experience, social persuasion, and physiological states. For the English version of the survey, Cronbach's *alpha* values were reported .87, .80, .87, and .83, respectively. For the Turkish version of the survey, Cronbach's *alpha* values were reported .87, .80, .93, and .94, respectively.

The term reliability is referred as being consistency of scores or answers presented an instrument and also Cronbach's alpha value should be .70 and higher than it (Fraenkel & Wallen, 2006). In this study, item reliability was found. Cronbach's *alpha* values were calculated .88, .76, .88, .88 respectively as in the same source of self-efficacy order of the author of the instrument. Reversed coded was implemented for 4, 6, 8, 11, 15, 18 and 21items in this instrument. Table 7 showed each source of mathematics self-efficacy survey and their item numbers.

The survey consists of a five-point Likert scale. The scale was stated as 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree in this survey. The survey was given in Appendix A.

Table 7

Sources of Mathematics Self-efficacy Survey and the Item Numbers

Sources of Mathematics Self-efficacy	Item Numbers
Mastery Experiences	1, 6, 9, 16, 19, 22
Vicarious Experience	2, 7, 10, 12, 17, 23
Social Persuasion	3, 5, 13, 14, 20, 24
Physiological States	4, 8, 11, 15, 18, 21

Method of Data Collection

The researcher got in contact with the school principals and arranged a time to visit after granted the permission from MoNE. The researcher briefly explained her study to the teachers. Sources of mathematics self-efficacy survey was applied in the classes of the volunteered students and teachers. The researcher gave information to high school students about the study before the researcher distributed the surveys to them. They answered the items approximately in 20 minutes. The researcher did not intervene to affect the survey results.

Methods of Data Analysis

In this study, the researcher used Statistical Package for the Social Sciences (SPSS) 26.0 and MS Excel to examine and to analyse the data. Independent samples t-test and correlation analysis were conducted to get information about the data. Before conducting these tests, the normality assumption was controlled for the data to determine whether using parametric test or non-parametric tests. Parametric tests were conducted since the values of skewness and kurtosis were found between -2 and 2 (George & Malley, 2016). Descriptive statistical information was reported by finding mean, median, minimum, maximum, range, standard deviation, skewness and kurtosis. Reverse coded was conducted on negative items in the instrument. Then, reliability of sources of mathematics self-efficacy survey was conducted.

CHAPTER 4: RESULTS

Introduction

The purpose of this study was to investigate high school students' level of sources of mathematics self-efficacy to learn whether they are related to their mathematics achievement. Their mathematics achievements were analysed by gender and school types. In this study, students' GPA results at the end of the first education semester of the 2019-2020 were used as their mathematics achievement.

This chapter includes the results of statistical tests. Pearson correlation coefficient and independent samples t-test were conducted. Also, descriptive statistical analyses were computed to get a sense of general perspectives of the data. This chapter consists of data normality and statistical analysis address to each research question. The outputs of the descriptive statistical analyses were provided followed by the related statistical tests for each question.

Data Normality

To check the normality of data, it is known that the values of skewness and kurtosis should be zero to get symmetric distribution. Also, it is assumed that data is normally distributed when the values of skewness and kurtosis are between -1 and 1. On the other hand, normal distribution in data is still acceptable when the values of skewness and kurtosis are between -2 and 2 (George & Malley, 2016).

The Results of the First Research Question

The first research question was 'is there a correlation between students' mathematics achievement and level of sources of mathematics self-efficacy?' It has subquestions as follows:

a) Is there a correlation between students' mathematics achievement and mastery experiences?
b) Is there a correlation between students' mathematics achievement and vicarious experience?
c) Is there a correlation between students' mathematics achievement and social persuasion?
d) Is there a correlation between students' mathematics achievement and psychological states?

The frequency table was reported for students' level of sources of mathematics self-efficacy to provide descriptive statistical information for the research question. Then the correlation coefficient for each source for mathematics self-efficacy was computed to answer this research question.

As shown in Table 8, the highest mean score was found to be physiological states with 21.69 (*SD* = 6.14). The mean score of mastery experience was very close to psychological states (*M* = 21.32, *SD* = 5.88). The lowest mean score was social persuasion with 18.88 (*SD* = 5.27) and the mean score of vicarious learning was 20.52 (*SD* = 5.91). Since the values of skewness and kurtosis of level of sources of mathematics self-efficacy were between -1 and 1, the data was normally distributed. The minimum value of each source had 6 and the maximum value of each source had 30.

Table 8

Descriptive Results for Students' Level of Sources of Mathematics Self-efficacy

Sources of Mathematics Self-efficacy	*N*	*M*	Median	*SD*	Skewness	Kurtosis	Range	Minimum	Maximum
Mastery Experiences	644	21.32	22.00	5.88	-0.05	-0.04	24	6	30

Table 8 (cont'd)

Descriptive Results for Students' Level of Sources of Mathematics Self-efficacy

Sources of Mathematics Self-efficacy	*N*	*M*	Median	*SD*	Skewness	Kurtosis	Range	Minimum	Maximum
Vicarious Experience	644	20.52	20.52	5.91	-0.04	-0.05	24	6	30
Social Persuasion	644	18.88	19.00	5.27	-0.02	-0.02	24	6	30
Physiological States	644	21.69	22.00	6.14	-0.06	-0.03	24	6	30
Total	644	82.40	84.00	19.92	-0.05	-0.17	96	24	120

As described in Table 9, the correlation was calculated between students' mathematics achievement and their mastery experiences. The result of Pearson product-moment correlation coefficient showed that there was a statistically significant and positive relation between students' mathematics achievement and mastery experiences, $r(642) = .741$, $p < .001$.

Table 9

The Correlation Between Students' Mathematics Achievement and Mastery Experiences

	Mathematics Achievement	Mastery Experiences
Mathematics Achievement	1	.741*

*. Correlation is significant at the 0.01 level (2-tailed).

As described in Table 10, the correlation was computed between students' mathematics achievement and vicarious experience. The result of Pearson product-moment correlation coefficient demonstrated that there was a statistically significant and positive relation between students' mathematics achievement and vicarious experience, $r(642) = .616$, $p < .001$.

Table 10

The Correlation Between Students' Mathematics Achievement and Vicarious Experience

	Mathematics Achievement	Vicarious Experience
Mathematics Achievement	1	.616*

*. Correlation is significant at the 0.01 level (2-tailed).

As stated in Table 11, the correlation was calculated between high school students' mathematics achievement and social persuasion. The result of Pearson product-moment correlation coefficient showed that there was a statistically significant and positive relation between students' mathematics achievement and social persuasion, $r(642) = .441$, $p < .001$.

Table 11

The Correlation Between Students' Mathematics Achievement and Social Persuasion

	Mathematics Achievement	Social Persuasion
Mathematics Achievement	1	.441*

*. Correlation is significant at the 0.01 level (2-tailed).

As given in Table 12, the correlation was calculated between high school students' mathematics achievement and physiological states. The result of Pearson product-moment correlation coefficient showed that there was a statistically significant and positive correlation between students' mathematics achievement and physiological states, $r(642) = .503$ $p < .001$.

Table 12

The Correlation Between Students' Mathematics Achievement and Physiological States

	Mathematics Achievement	Physiological States
Mathematics Achievement	1	. 503*

*. Correlation is significant at the 0.01 level (2-tailed).

Mastery experience, social persuasion, vicarious experience and psychological states were found to be positive and statistically significant relations with students' mathematics achievement. According to the results of Pearson product-moment corelation coefficient, mastery experience was a strong positive association with students' mathematics achievement when compared to the other sources.

The Results of the Second Research Question

The second research question was 'do female and male students have significantly difference in terms of their mathematics achievements?' To analyse this question, the frequency table of students' mathematics achievement by gender were firstly reported to provide descriptive information for the research question. After that, independent samples t-test was used to evaluate the research question.

As shown in Table 13, there were 287 female students and 357 male students. The mean score for female students was 84.76 (*SD* = 13.45) and the mean score for male students was 77.68 (*SD* = 18.14). This means that the mean mathematics achievement scores of female students were higher than the mean mathematics achievement scores of male students. Since the value of kurtosis was between -2 and 2 for both male and female students, the data were normally distributed. To test a statistically mean difference between female and male students in terms of mathematics achievement, independent sample t-test was used.

Table 13

Descriptive Results for Students' Mathematics Achievement by Gender

Gender	*N*	*M*	Median	*SD*	Skewness	Kurtosis	Range	Minimum	Maximum
Female	287	84.76	89.00	13.45	-1.01	0.32	55.00	45.00	100.00
Male	357	77.68	80.00	18.14	-0.75	-0.04	86.00	14.00	100.00

As shown in Table 14, independent samples t-test was conducted to show whether there was a statistically significant mean difference between female and male students with respect to their mathematics achievement scores. Firstly, the homogeneity of variance test was conducted to check the assumption of variance between the two independent groups. For the statistical test, an alpha value of .05 was set. The null hypothesis was that there is no statistically significant variance difference between the two groups. Levene's test for the equality of variances was found as $F(644) = 31.917$, $p < .001$. Since $p < .001$ is less than alpha value, the null hypothesis was rejected. As a result, there was a statistically significant variance difference between the two groups. Therefore, variances were not equal between the two groups. To check mean difference between two groups, the null hypothesis was that there is no statistically significant mean difference between female and male students for their mathematics achievement scores. Since $p < .001$ is less than alpha value, the null hypothesis was rejected. The results of independent samples t-test indicated that there is a statistically mean difference between female students (M = 84.76, SD = 13.45) and male students (M = 77.68, SD = 18.14) in favour of female students in terms of students' mathematics achievement scores, $t(642) = 5.506$, $p < .001$ (two-tailed). To see a practical significance between the two groups, Cohen's d was calculated by using the effect size calculator for t-test (Social Science Statistics, 2021). Based on the result of Cohen's d effect size value (d = .44), a medium practical significance was found between the two groups.

Table 14

Independent Samples t-test Result of Students' Mathematics Achievement by Gender

		F	*p*	*t*	*df*	*p*	Mean Difference
Mathematics Achievement	Equal variances not assumed	31.917	.000	5.683	637.993	.000	7.078

The Results of the Third Question

The third research question was 'are there any statistically significant difference between students' mathematics achievement by school types?'. The frequency table of students' mathematics achievement scores by state and private high schools firstly were analysed to provide descriptive information for the research question. After that, independent samples t-test was used to evaluate the research question.

As shown in Table 15, the mean mathematics achievement score of state school students was 77.55 (*SD* = 20.20) whereas the mean score of private school students was 82.41 (*SD* = 14.29). Therefore, the mean score of private high school students for mathematics achievement was higher than the mean score of state high school students. Since the values of skewness and kurtosis were between -2 and 2 for both school types, data were normally distributed.

Table 15

Descriptive Results for Students' Mathematics Achievement by School Types

High Schools	*N*	*M*	Median	*SD*	Skewness	Kurtosis	Range	Minimum	Maximum
State	209	77.55	78.00	20.20	-0.590	-0.571	86.00	14.00	100.00
Private	435	82.41	85.00	14.29	-1.067	0.900	77.00	23.00	100.00

As shown in Table 16, independent samples t-test was conducted since state and private schools are two independent groups. Firstly, to check the assumption of variance, the homogeneity of variance test was conducted between the two independent groups. An alpha value of .05 was set. The null hypothesis was that there is no statistically significant variance difference between the two groups. Levene's test for the equality of variances was obtained as $F(644) = 63.255$, $p < .002$. Since $p < .002$ is less than alpha value, the null hypothesis was rejected. As a consequence, there was a statistically significant variance difference between the two groups. So, variances were not equal between the two groups. To check mean difference between two groups, the null hypothesis was that there is no statistically significant mean difference between state school students and private school students for their mathematics achievement scores. Since $p < .002$ is less than alpha value, the null hypothesis was rejected. The results of this statistical test indicated that there was a statistically mean difference between state school students ($M = 77.55$, $SD = 20.20$) and private school students ($M = 82.41$, $SD = 14.29$) in favour of private school students in terms of students' mathematics achievement scores, $t(311.432) = -3.127$ $p < .002$ (two-tailed). Also, Cohen's d effect size value ($d = .28$) was found as low practical significance between two groups.

Table 16

Independent Samples t-test Result of Students' Mathematics Achievement by School Types

		F	*p*	*t*	*df*	*p*	Mean Difference
Mathematics Achievement	Equal Variances not Assumed	63.255	.000	-3.127	311.432	.002	-4.866

CHAPTER 5: DISCUSSION

Introduction

The aim of this research study is to investigate whether there is a correlation between high school students' level of sources of mathematics self-efficacy and their mathematics achievement or not. Furthermore, their mathematics achievements were investigated by gender and school types. The statistical findings reported in the previous section were discussed in this chapter.

Overview of the Study

In this study, high school students' mathematics achievements were investigated by considering their relations with level of sources of mathematics self-efficacy, and also were analyzed gender and school types. To determine students' mathematics achievement, high school students reported their latest mathematical final GPA results at the end of the first education semester of 2019-2020. Sources of mathematics self-efficacy instrument was utilized to measure their sources of mathematics self-efficacy.

The researcher wanted to find an answer for each following research question:

1) Is there a statistically significant correlation between students' mathematics achievement and level of sources of their mathematics self-efficacy?
    a) Is there a correlation between students' mathematics achievement and mastery experiences?
    b) Is there a correlation between students' mathematics achievement and vicarious experience?

c) Is there a correlation between students' mathematics achievement and social persuasion?

d) Is there a correlation between students' mathematics achievement and psychological states?

2) Do female and male students have a significantly difference in terms of their mathematics achievement?

3) Is there any statistically significant difference between students' mathematics achievement by school types?

Discussion of Major Findings

The First Research Question

For the first research question stated in the overview of study, based on the results of Pearson product-moment correlation coefficient, the highest positive correlation was found between high school students' mathematics achievement and their mastery experiences, $r = .741$, $p < .001$. The second highest positive correlation was found to be vicarious experience with being $r = .616$, $p < .001$. Then, a significant and positive correlation was found between mathematics achievement and physiological states with $r = .503$, $p < .001$. A moderate positive correlation was found between high school students' mathematics achievement and social persuasion, $r = .441$, $p < .001$. In the literature, Kontaş and Özcan (2017), Özcan and Kontaş (2020), and Özcan and Kültür (2021) reported similar results about findings between the sources of mathematics self-efficacy and mathematics achievement. Lent et al. (1991) also found statistically significant correlations between three of four sources mathematics achievement except vicarious learning. These past studies highlighted that mastery experience showed a strong positive correlation with mathematical achievement as stated in this study. When dealing with vicarious

experience from these studies, the mixed findings was reported. Kontaş and Özcan (2017), and Özcan and Kontaş (2020) found a positive correlation between vicarious experience and mathematics achievement among middle and high school students respectively. A similar that is a parallel result was seen in the study of Özcan and Kültür (2021) for 12th grade high school students. However, Lent et al. (1991) stated that there was no correlation between vicarious experience and mathematics achievement among university students. One obvious reason might be the level of students. Lent et al. (1991) had participants that were university students whereas this study used data high school students.

The Second Research Question

For the second research question stated in the overview of study, the findings showed that the mean mathematics achievement scores of female students (M = 84.76, SD = 13.45) were higher than the mean mathematics achievement scores of male students (M = 77.68, SD = 18.14). The male students had more dispersed than the female students with respect to mathematics achievement scores. The result of independent samples t-test showed that there was a statistically significant mean difference between female students and male students in favoring of female students with having medium effect size. In the past studies, Alkhateeb (2001) investigated high school students' mathematics last grade taken from Ministry of Education in terms of gender and also examined them for ten years period in United Arab Emirates. By using random sampling method, he analysed during the 10-year academic educational years from 2000 students. He concluded that the female students were better than male students for the seven years despite of being small effect size. He claimed that the reason of this difference could be explained cultural differences. Also, in the study of Baker and Jones (1993) found high performance

from female students in Belgium-French, Finland, Hungary, and Thailand. Ubuz (1999) found that gender differences in favour of female students at 10^{th} and 11^{th} grades. She stated that male students preferred to leave unanswered questions instead of giving wrong answers because of the Turkish cultural characteristics.

On the other hand, most of studies showed that male students performed better in mathematics rather than female students (e.g., Asante, 2010; Beller & Gafni, 1996; Callahan & Glennon, 1968; Fennema 1974; Fennema & Sherman 1977; Han, 1993; Kimmel 1986; Leder 1985; Maccoby & Jacklin, 1974). Apart from these results, some studies showed no gender differences in mathematics achievement (Bornholt et al., 1994; Fennema & Sharman, 1978; Işıksal & Aşkar, 2005; Peterson & Fennema, 1985). This area is clearly controversial, and researcher are reporting mixed findings.

The Third Research Question

For the third and last research question given in the overview of the study, the result of independent samples t-test demonstrated that there was a statistically significant mean difference between state high school students (M = 77.55, SD = 20.20) and private high school students (M = 82.41, SD = 14.29) with respect to their mathematics achievements even if effect size was found as low. It follows from this result that state school students' scores were more spread out from the mean value compared to private schools. In the literature, Savaş et al. (2010) and Cansız et al. (2019) had a similar result in favoring of private schools for students' mathematics achievement. Savaş et al. (2010) stated that the success of private schools in mathematics may be having good quality of resources, socioeconomic status, the ratio between teacher and students etc.

Implications for Practice

In the nature of correlation analysis, we can talk about possible relationships between two variables rather than manipulation on variables (Fraenkel et al., 2012). The results from the first research question, students' sources of mathematics self-efficacy were positively correlated with their mathematics achievement by looking at the bivariate correlation analysis except psychological states. Because of existing correlation, construct such as self-efficacy might play a role in teaching and learning mathematics. Then one obvious outcome would be teacher student relation in the affective domain might needed to be taken into consideration. For example, teachers' feedback might play an even great importance of increasing students' own capability and skills to enhance students' mathematics achievement in class. Nowadays the literature is reporting that Giving constructive and encouraging feedback would allow students to become aware of their own ability. Furthermore, to encourage their efforts could enhance their self-efficacy and result in a better mathematics performance. So content delivery is not the only dimension that effects the teaching and learning of mathematics. Our results support that teachers could help students who are lacking confidence in mathematics. Optimal challenging activities could be used per students' needs.

Another important source of information are students' past mathematics achievement results which would be readily available to, teachers or school counselors. They could use this information to profile students. According to students' needs, teachers then could help students to deal with optimal difficulties in mathematical tasks. So, they can be aware of their progress in their own pace and construct better experience in mathematics by drawing students' attention about their beliefs, emotions, feelings on mathematics and their mathematics achievement. Also,

teachers, peers or any person from social environment (such as parents) could be used a role model for some students to enhance their mathematics achievement. In class, group work could enable students who have tendency to learn by observing others or like to being a social environment to show their mathematical potential.

Cultural differences and ages of students could lead to different results on the correlation between vicarious experience and mathematics achievement according to the results of the studies of Lent et al. (1991), Kontaş and Özcan (2017), Özcan and Kontaş (2020), and Özcan and Kültür (2021). The participants in the mentioned research of Lent et al. (1991) were White, Black, Hispanic, Asian/Pacific Islander from university students. On the other hand, the participants in the study of Kontaş and Özcan (2017) were high school students and middle school students in South of Turkey. The participants in the study of Özcan and Kültür (2021) were high school students in Mediterranean part of Turkey. According to Vygotsky's sociocultural theory (1962), culture provides children with transforming their mental ability into higher-level cognitive skills. When assessing the cognitive development of children, culture cannot be ignored. So, it can be argued that their mental abilities of mathematics might also be culturally dependent.

The second finding in this study is that female students showed better mathematics scores rather than male students. This is not a big surprise for Turkish education system. We in Turkey mixed gender classrooms were female and male equally treated in terms of educational aspects. Moreover, parents value mathematics. Hence females are also expected to do well in mathematics. Teachers or counsellors can analyse students' progress to understand this gender difference in mathematics achievement. There are some reasons could be for this such as conceptual understanding, attitudes towards mathematics, socioeconomic level or

time spending on mathematics course and etc. Some of them could be seen in the classroom, so teachers can be aware of students' knowledge, skills, performance and needs. Teachers should be aware of setting high expectations and equally participations in class activities without making any discrimination between female and male. Also, cultural, and sociocultural reasons could lead to gender differences in mathematics achievement.

The last finding in this study is that private schools' students performed better mathematics achievement than that of state school students. This particular result is not unexpected. Usually, private schools have access to better high technological tools, educational resources, and pedagogical related materials in schools. Private school administration usually monitors students' performance. Having these kinds of facilities enable students to show their potential knowledge and skills in mathematics.

Implications for Further Research

To get a deeper information about this study, qualitative data can be used such as interviewing with students, or teachers.

The correlation between sources of mathematics self-efficacy and mathematics achievement could be analyzed from different cultures and ages to get a better idea about vicarious experiences of individuals.

The reasons why female students' mathematics achievement is better than male students can be investigated.

This study was implemented among high school students in Ankara. In the other countries, it could be used. On the other hand, it can be conducted in primary schools or middle schools as well.

Limitations

This study was limited to the answers given by students. Students may not have accurately expressed their thoughts on a survey. Time constraint was a problem for the researcher. Convenient sampling was used for private schools and state schools in Ankara. This study cannot be generalized for all high school students. Also, in this study, students' GPA scores were assumed to be equally weighted measures for all participants.

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Appendix A

Turkish Version of Sources of Mathematics Self-efficacy

Matematik Öz-yeterliği Kaynakları Ölçeği

Bu anket, öğrencilerin matematik öz-yeterliği kaynaklarını tespit etmeyi amaçlamıştır. Ankette toplam 24 madde bulunmaktadır. Lütfen ifadeleri dikkatlice okuyarak samimi ve doğru bir şekilde anketi doldurunuz. Aşağıda verilen her bir ifadeye ilişkin kendinize uygun olduğunu düşündüğünüz seçeneği (X) işareti ile işaretleyiniz.

Kesinlikle katılmıyorum (1) Katılmıyorum (2) Ne katılıyorum ne katılmıyorum (3) Katılıyorum (4) Kesinlikle katılıyorum (5)

İFADELER	Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Ne katılıyorum Ne katılmıyorum (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
1) Matematik sınavlarında yüksek notlar alırım.	1	2	3	4	5
2) Büyüklerimin (Anne, baba, büyük kardeşlerin) matematikte başarılı olması beni daha çok çalışmaya iter.	1	2	3	4	5
3) Ailem matematikte iyi olduğumu söyler.	1	2	3	4	5
4) Matematik ödevlerini yapmaya başladığımda sıkıntı basar.	1	2	3	4	5
5) Tahtada problem çözdüğüm zaman öğretmenim tarafından takdir edilirim.	1	2	3	4	5
6) Ne kadar çalışırsam çalışayım matematikte başarılı olamıyorum.	1	2	3	4	5
7) Matematikte arkadaşlarımın benden daha başarılı olduklarını görmek beni daha çok çalışmaya sevk eder.	1	2	3	4	5

8) Matematik ödevleri bütün enerjimi alır.	1	2	3	4	5
9) Şimdiye kadar matematikte başarılı oldum.	1	2	3	4	5
10) Matematik öğretmenimi problem çözerken gördüğüm zaman kendimi onun yerine koyabiliyorum.	1	2	3	4	5
11) Matematik problemlerini çözerken bütün vücudumun gerildiğini hissederim.	1	2	3	4	5
12) Matematikte kendimle yarışırım.	1	2	3	4	5
13) Arkadaşlarım matematikte iyi olduğumu söyler.	1	2	3	4	5
14) Matematik dersindeki grup çalışmalarında arkadaşlarım benimle çalışmak ister.	1	2	3	4	5
15) Matematikte yeni konu öğreneceğimi düşündüğüm zaman canım sıkılır.	1	2	3	4	5
16) Zor matematik ödevlerini bile yapabilirim.	1	2	3	4	5
17) Sınıf arkadaşımı tahtada problem çözerken gördüğüm zaman kendimi onun yerine koyabiliyorum.	1	2	3	4	5
18) Matematik ödevlerini yaparken sanki beynim duruyor.	1	2	3	4	5
19) En son aldığım karnede matematik notum yüksekti.	1	2	3	4	5
20) Başkaları matematiğe karşı bir yeteneğimin olduğunu söyler.	1	2	3	4	5
21) Matematik derslerinde kendimi gergin hissederim.	1	2	3	4	5
22) Matematik ödevlerimi tam ve doğru yaparım.	1	2	3	4	5
23) Zor matematik problemlerini çözerken kendimi düşünebiliyorum.	1	2	3	4	5
24) Matematikteki başarımdan dolayı övgü alırım.	1	2	3	4	5

Appendix B

Demographic Form

1. **Cinsiyeti**

   a) Kız b) Erkek

2. **En son matematik dönem sonu notunuz:** …/100

3. **Matematik dersi karne notunuz genelde aşağıdakilerden hangisidir?**

   a) Düşük b) Orta c) İyi

Appendix C

Approval of the MoNE

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

Sayı : 14588481-605.99-E.18849522 03.10.2019
Konu : Araştırma izni

BİLKENT ÜNİVERSİTESİ REKTÖRLÜĞÜNE

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b) MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğü'nün 2017/25 nolu Genelgesi.

Üniversiteniz Eğitim Bilimleri Enstitüsü Yüksek Lisans Öğrencisi Ezgi SERT'in **"Lise Öğrencilerinin Öz-Yeterlikleri, Matematiğe Yönelik Tutumları ve Matematik Başarılarının İncelenmesi"** konulu tezi kapsamında Çankaya ilçesine bağlı ekli listedeki okullarda uygulanacak olan veri toplama araçları ilgi (b) Genelge çerçevesinde incelenmiştir.

Yapılan inceleme sonucunda, söz konusu araştırmanın Müdürlüğümüzde muhafaza edilen ölçme araçlarının; Türkiye Cumhuriyeti Anayasası, Millî Eğitim Temel Kanunu ile Türk Milli Eğitiminin genel amaçlarına uygun olarak, ilgili yasal düzenlemelerde belirtilen ilke, esas ve amaçlara aykırılık teşkil etmeyecek, eğitim-öğretim faaliyetlerini aksatmayacak şekilde okul ve kurum yöneticilerinin sorumluluğunda gönüllülük esasına göre uygulanması Müdürlüğümüzce uygun görülmüştür.

Bilgilerinizi ve gereğini rica ederim.

Turan AKPINAR
Vali a.
Milli Eğitim Müdürü

Ek:
Uygulama araçları (5 sayfa)
Okul listesi (1 sayfa)
Dağıtım:
Gereği:
Bilkent Üniversitesi Rektörlüğü
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