# INVESTIGATION OF SELF-REGULATED LEARNING AND MOTIVATIONAL BELIEFS IN MATHEMATICS ACHIEVEMENT

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GÜLNUR ERGÖZ

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submitted by **GÜLNUR ERGÖZ** in partial fulfillment of the requirements for the degree of **Master of Science in Secondary Science and Mathematics Education Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen
Dean, Graduate School of **Natural and Applied Sciences** ____

Prof. Dr. Ömer Geban
Head of Department, **Secondary Science and Mathematics Education** ____

Assoc. Prof. Dr. Safure Bulut
Supervisor, **Secondary Science and Mathematics Education Dept., METU** ____

**Examining Committee Members:**

Assoc. Prof. Dr. Zahide Yıldırım
Computer Education and Instructional Technology Dept., METU _____

Assoc. Prof. Dr. Safure Bulut
Secondary Science and Mathematics Education Dept., METU _____

Assist. Prof. Dr. Melek Çakmak
Educational Sciences Dept., Gazi University _____

Assist. Prof. Dr. Erdinç Çakıroğlu
Elementary Education Dept., METU _____

Assist. Prof. Dr. Esen Uzuntiryaki
Secondary Science and Mathematics Education Dept., METU _____

**Date:** 16.07.2008

**I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.**

Name, Last Name: GÜLNUR ERGÖZ

Signature :

# ABSTRACT

INVESTIGATION OF SELF-REGULATED LEARNING AND MOTIVATIONAL BELIEFS IN MATHEMATICS ACHIEVEMENT

Ergöz, Gülnur

M.S., Department of Secondary Science and Mathematics Education

Supervisor: Assoc. Prof. Dr. Safure Bulut

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The purposes of this study are to investigate how mathematics achievement can be explained in terms of motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy for learning and performance and test anxiety), self-regulated learning components (cognitive strategy use and self-regulation), gender and school types and to determine the differences between two gender (girls and boys) and two school types (public schools and private schools) with respect to the variables above in the subject domain of mathematics.

The study was conducted in Istanbul and Ankara, two largest cities of Turkey, with 577 seventh-grade students (274 boys, 303 girls) from nine private and public schools. Motivated Strategies for Learning Questionnaire (MSLQ) and Mathematics Achievement Test (MAT) were used.

By using Linear Stepwise Regression and MANOVA, respectively, the results indicated that (1) The combined effect of three predictor variables (school type, self-efficacy and intrinsic goal orientation) on students' mathematics achievement was significant. Boys' mathematics achievement at public schools was significantly affected by extrinsic goal orientation and cognitive strategy use whereas self-efficacy and intrinsic goal orientation were two predictors for boys at private schools. Girls' mathematics achievement both at public and private schools was significantly affected by self-efficacy. (2) There was no statistically significant mean difference between girls and boys with respect to task value, self-efficacy and test anxiety. Also, there was no statistically significant mean difference between public schools and private schools with respect to extrinsic goal orientation, task value, self efficacy and self-regulation.

Keywords: motivational beliefs, self-regulated learning components, mathematics achievement, gender, school type

# ÖZ

ÖZ-DÜZENLEYİCİ ÖĞRENMENİN VE GÜDÜLEYİCİ İNANÇLARIN MATEMATİK BAŞARISI İÇİNDE ARAŞTIRILMASI

Ergöz, Gülnur
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Bu çalışmanın amaçları, matematik başarısının güdüleyici inançlar (içsel amaçlı odaklanma, dışsal amaçlı odaklanma, iş değeri, kontrol ve öğrenme değeri, öz-yeterlilik ve sınav kaygısı), öz-düzenleyici öğrenme bileşenleri (bilişsel yöntem kullanımı ve öz düzenleme), cinsiyet ve okul türü ile nasıl açıklanabileceğini araştırmak ve bu değişkenlerin matematik dersi için hem kızlar ve erkeklerde hem de özel ve devlet okullarında gösterdiği farklılıkları belirlemektir.

Bu çalışma, Türkiye'nin iki büyük kenti olan İstanbul ve Ankara'da, 9 farklı özel ve devlet okullarından seçilen 577 (274 erkek, 303 kız) 7. sınıf öğrencisiyle yapılmıştır. Öğrenmeye Güdümlü Yaklaşımlar Anketi (ÖGYA) ve Matematik Başarı Testi (MBT) veri toplama araçları kullanılmıştır.

Sırasıyla Lineer Sıralı Regresyon, Pearson Korelasyonu ve Çoklu Varyans Analizi kullanılarak çıkan sonuçlar şunları göstermiştir : (1) Okul çeşidi, öz-yeterlilik ve içsel amaçlı odaklanma olmak üzere üç değişkenin öğrencilerin matematik başarısına toplu etkisinin anlamlı olduğu bulunmuştur. Devlet okullarındaki erkeklerin matematik başarısında dışsal amaçlı odaklanma ve bilişsel yöntem kullanımının anlamlı olduğu saptanırken, özel okullardaki erkeklerin matematik başarısında öz-yeterlilik ve içsel amaçlı odaklanmanın anlamlı olduğu saptanmıştır. Hem devlet okullarındaki hem de özel okullardaki kızların matematik başarısında öz-yeterliliğin anlamlı olduğu bulunmuştur. (2) Kızlar ve erkekler arasında, iş değeri, öz-yeterlilik ve sınav kaygısına göre anlamlı bir ortalama farkına rastlanmamıştır. Ayrıca, devlet ve özel okullar arasında, dışsal amaçlı odaklanma, iş değeri, öz-yeterlilik ve öz düzenlemeye göre de anlamlı bir ortalama farkına rastlanmamıştır.

Anahtar Sözcükler: güdüleyici inançlar, öz düzenleyici öğrenme bileşenleri, matematik başarısı, cinsiyet, okul türü

***To My Parents***
***For their love and support***

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| MSLQ | : Motivated Strategies for Learning Questionnaire |
| Intr | : Intrinsic Goal Orientation |
| Extr | : Extrinsic Goal Orientation |
| Taskva | : Task Value |
| Contro | : Control and Learning Beliefs |
| Selfef | : Self-efficacy for Learning and Performance |
| Testan | : Test anxiety |
| Rehear | : Rehearsal |
| Elab | : Elaboration |
| Organ | : Organisation |
| Crit | : Critical Thinking |
| Meta | : Metacognitive Self-regulation |
| Time | : Time and Study Environment Management |
| Effort | : Effort Regulation |
| Peer | : Peer Learning |
| Help | : Help Seeking |
| Csu | : Cognitive Strategy Use |
| Sr | : Self-regulation |
| Stype | : School Type |
| Mach | : Mathematics Achievement |
| RMSEA | : Root Mean Square Error of Approximation |
| SRMR | : Standardized Root Mean Square Residual |
| GFI | : Goodness of Fit Index |
| AGFI | : Adjusted Goodness of Fit Index |
| S. λ | : Standardized Lamb |

# CHAPTER 1

# INTRODUCTION

Mathematics has become increasingly important in this technological age and so it is even more important for all of us. Because of this reason, parents want their children to do mathematics and to be successful in it. They want them to understand mathematics and to make connections with their daily lives. In order to achieve this result, good teaching practices should involve the students being active in the process and make them respect and enjoy mathematics, recognizing its usefulness and appreciating the subject in its own right (Peng, 2002). Also Kyriakides (2004) did his research about sex and social class relations in school effectiveness in mathematics lectures. According to him, there were two reasons in choosing mathematics. These reasons were: Mathematics was an important subject and some cross-cultural analyses were possible in mathematics since it was a core subject in all countries. Students have different mathematics abilities and mathematics achievement from each other. In the study of Lepmann and Afanasjev (2005), they divided students into three groups according to their mathematical ability. These are low ability group, medium ability group and high ability group. Also, the students were again divided into three groups with respect to their mathematical achievement which were low achievement group, medium achievement group and high achievement group. One of the students from low ability group said that if he understood everything in mathematics, it could be interesting for him. Thus, it can be said that understanding is very important for being interested in a subject and also being successful in it.

In the traditional schools, the teachers are expected to provide learning materials, to motivate their students and to take the responsibility of the learning process (Zimmerman, 2005). Actually, students can take their own learning responsibilities and they can regulate their own learning. The teacher can help them at that point by using some different teaching methods in teaching mathematics such as cooperative learning, discovery, laboratory approach, investigations, problem solving, simulations and exposition. In addition to these methods, in education, psychological views are also important and they complete each other with teaching methods. One of the important aspects of educational psychology is becoming active in the learning and interacting with peers and teachers (Patrick & Middleton, 2002). Moreover, becoming regulators of themselves is important for students. A number of psychologists and theorists have been working on describing the ways of it (Zimmerman & Martinez-Pons, 1990).

An example related with a student called Tracy was given by Zimmerman (2002). Tracy would have an important math exam two weeks later. She began to study for her exam while she was listening to music and she didn't have any studying goal for herself. She didn't plan her study time and she didn't have her own learning strategies. Even, she had finished her studying just before the exam. According to her, she had problems in learning mathematics because of her inherently poor mathematical ability. She didn't talk about it with her friends, teachers or family members and she didn't ask the missing parts in her knowledge to others. She thought that she had lots of things to learn in mathematics, but she had little intrinsic value for that. Thus, for students like Tracy, psychologists and theorists need to develop strategies about some key points such as goal orientation, time management, learning strategies, self-evaluation, self-attributions, seeking for help or information, self efficacy and intrinsic task interest.

In the present study, there are two specific focuses on mathematics achievement. These focuses are self-regulated learning components and motivational beliefs.

Self-regulated learning can be defined differently by the researchers, but the intersection points of these definitions are using metacognitive, motivational and behavioral strategies. According to Zimmerman (2005), self-regulation can be defined as planning self-generated thoughts, feelings and actions and adapting them into personal goals. In the educational systems, it is important to develop self-motivated and self-regulated students. Self-regulated learning has three main strategies. These strategies are: cognitive strategies, metacognitive self-regulation strategies and management strategies (Pintrich & DeGroot, 1990).

In cognitive strategies, there are four parts which are rehearsing, elaborating, organizing and critical thinking. The concept of goal can be considered as a special category of cognitive representation. The future goals of the people help us to understand what they are doing right now (Zimmerman, 2005).

In metacognitive self-regulation strategies, there are people's ideas about their self control of cognition. They have important places in people's choice of coping (Zimmerman, 2005).

In the management strategies, there are time and study environment, peer learning and help-seeking. According to Zimmerman and Martinez-Pons (1990, as cited in Chen, 2002), self-regulated learners restructure their physical environment in order to meet their needs. Also in the other result they have reached, they mentioned that high achieving students use environment management more than low achieving students. Time management involves scheduling, planning and managing study time. According to Zimmerman, Greenberg and Weinstein (1994, as cited in Chen, 2002), students who plan their time and manage their study become more self-regulated learners and this can improve their grades. Help-seeking includes social interaction and with that property it is different from other subtitles (Chen, 2002). In a study done among undergraduate students in Malaysia, it is concluded that strategies in managing resources such as time and study environment, peer learning and help-seeking are strong predictors for success for that group of students (Kosnin, 2007).

As a result, it can be said that self-regulated learning is important in learning. When the components of self-regulated learning are taken into consideration, students can be successful in mathematics.

Motivational beliefs are the second focus on mathematics achievement in the present study. In motivational beliefs, there are intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy and test anxiety. According to Zimmerman (1994, as cited in Spitzer, 2000), intrinsic goal orientation can predict students' academic achievement. Students who are oriented intrinsically choose more challenging activities, enjoy their classes more and have higher self-efficacy about their abilities. In the extrinsic goal orientation, students concern their grades, pleasing and besting others in the tasks with respect to Dweck and Leggett (1988). In task value, it is more quantitative approach to motivation. According to Bandura (1986, as cited in Schulz, 2005a), students' self-efficacy beliefs affect their learning behavior since self-beliefs are reflections of students' assessment of their own capacities. Self-efficacy beliefs affect the stress and anxiety level of students. While confident students are engaging the task with relaxation, unconfident students engage the task with fear and anxiety (Pajares, 2002). In self-efficacy, the students get efficacy information by comparing their performance with other people's performances. Also, it can be said that successes raise efficacy and failures lower it (Zimmerman, 2005). In the study of Zimmerman and Martinez-Pons (1990, as cited in Zimmerman, 2005), it is concluded that verbal and mathematical self-efficacy are related to self-regulated learning strategies among normally gifted students in grades 5, 8 and 11.

Consequently, it can be stated that motivational belief is crucial in learning. In other words, they support students' learning and thus being successful in the subjects.

There are many variables that affect students' achievement, ability and attitude in mathematics such as gender, parents, teachers, peers and schools (Ai, 2002). Also students' ethnicity, locality (urban, rural or regional), parental education, family income, reading materials at home and parental engagement in

the school can be the other effects of their achievement (Peterson & Llaudet, 2006).

According to Mills, Ablard and Stumpf (1993), gender difference in mathematics achievement is another area that can be investigated. Gender is one of the most popular investigation topics at different subjects in the educational literature. Boys seem to perform better than girls at mathematical skills such as algebraic rules, algorithms, number relationships and understanding of mathematical concepts (Manger & Gjestad, 1997). Also, according to a research done by Wigfield, Eccles and Pintrich (1996, as cited in Pajares, 2002), in the primary years, both boys and girls have equal confidence about their mathematics achievement, but when they become older, boys feel more confident than girls. According to the results of some researches, three main conclusions are emphasized. The first one is that there is a significant mean difference between girls and boys with respect to mathematics achievement. In the other result of related researches, it is mentioned that boys are more successful than girls in mathematics. According to the final result of these researches, girls are more successful than boys in mathematics. In the study of Drysdale and Milne (2004), there is no significant gender difference in mathematics achievement. Also in another research done by Fulk, Brigham and Lohman (1998), it is concluded that there is no gender difference in perception of self-regulation, self-efficacy and cognitive strategy use. Opposite to these research results, according to a study of Zimmerman and Martinez-Pons (1990), boys have significantly greater mathematics self-efficacy than girls. In the research of Ai (2002), a small significant gender difference is found between girls and boys in favor of girls in the field of mathematics achievement. In that study, the reason of previously mentioned result is emphasized as teacher and parent encouragement. For low girls, mathematics teachers' encouragement has a positive effect and parent encouragement has a negative effect on their mathematics achievement.

As a result, it can be said that the effects of gender difference on mathematics achievement can change. In some researches it is observed that there is no statistically significantly mean difference between girls and boys and in

some other researches gender can be an effect on mathematics achievement in favor of girls or in favor of boys.

Gender can be seen as the greatest factor, but according to Ai (2002) other factors related with people around students and their socioeconomic status must also be taken into consideration. Affective psychological factors such as mathematics attitude and social factors such as parents' and peers' encouragement are important factors in learning mathematics (Goldin, 2000). Also, these factors are important for students in deciding their futures. They try to answer how much mathematics they will need in the future during their decisions (Reyes, 1984). According to Marks, Cresswell and Ainley (2006), although socioeconomic factors are very important in education, there are still socioeconomic inequalities in many countries. They mentioned that there is educational differentiation which means school tracks, school types and curriculum tracking within schools and this differentiation causes a relation between socioeconomic background and student achievement. For example, rich families can enroll their students to expensive schools or they can afford tutoring, but poor families can only afford basic educational resources. In another view, they emphasize the connection among student, school and parent in education for both social and academic achievement. It is noticed that wealthy families have better connections with school and their students when compared to poor families. It is governments' business to make a balance among family incomes and making relations among parents, students and schools, but it is hard for governments to carry out this (Marks, Cresswell & Ainley, 2006).

Schools and teachers have an important role in education in order to provide it. Some international studies such as TIMSS and IEA emphasize that schools, curriculum and teacher instruction are important factors in mathematics achievement. In a research done among second grade of secondary education students, the analysis shows that socio economic status, initial cognitive abilities and achievement motivation are relevant predictors of mathematics education. Since mathematics is a subject that has to be learned at school, the type of the school becomes very important for achievement (Opdenakker et al., 2002). According to the PISA results investigated by Downes (2005), students at public

schools perform worse than students at private schools. Also according to PISA, school type is important since school demographics, class sizes and technological resources change with respect to school type. According to Marks (2006) in some researches which are done in European countries such as Belgium, Germany and Switzerland, it is observed that socioeconomic status is important in preferring schools.

School type difference is more important for mathematics than for reading. Reading is taught during the primary years, but mathematics is taught at different levels according to students' ability in accordance with their ages. Schools with students who have high socioeconomic standards are taught high level mathematics and this causes socioeconomic inequalities in favor of students from higher socioeconomic families in mathematics (Marks, Cresswell & Ainley, 2006).

Thus, it can be said that income and wealth of families are directly related to their students' achievement. High socioeconomic status families which are represented by income, education and occupation have opportunities in attending better schools (Schulz, 2005b). Also he interpreted the PISA study as there is a relationship between socioeconomic family background and student performance.

## 1.1 Significance of the Study

The significance of the study is that mathematics is becoming important in these ages, but increasing students' achievement in mathematics is a bit difficult. Many researches are studying on the ways of increasing students' mathematics achievement. For example, according to Peng (2002), students should be active during the learning process and they should understand the usefulness of mathematics in order to respect it; therefore they can be successful in it. Self-regulated learners are aware of their responsibilities, plan their works and exert effort to achieve their goals. Thus, self-regulation can be a way for mathematics achievement. Many researchers such as Zimmerman and Pintrich studied on the effects of self-regulated learning components and motivational

beliefs on mathematics achievement. According to them, there are some effects of these components and beliefs on students' mathematics achievement. Also, the importance of gender and school type is emphasized. Combining with school type, there are some effects of socio economic status, parental education, family income and family occupation. . In some studies such as Mills et al. (1993), it is mentioned that gender difference in mathematics achievement can be investigated. In addition to these Marks et al. (2006) mentioned the effects of school type differences and socioeconomic differences on mathematics achievement.

To sum up, it can be said that being successful in mathematics can be a bit difficult for some students. In order to increase their mathematics achievement, effects of some psychological variables such as intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, cognitive strategy use and self-regulation can be investigated. Also, gender and school type differences were mentioned in many researches in mathematics achievement; therefore they are other important points that have to be studied from the point of achievement in mathematics.

## 1.2 Research Problems of the Study

In the present research, the combined effects of both self-regulated learning components and motivational beliefs in mathematics achievement are studied in the first two largest cities of Turkey, Istanbul and Ankara. These are important points that have to be taken into consideration in mathematics achievement since their variables have important places in students' successes according to the results of many researches mentioned above. In addition to this, since the effects of gender and school type differences were mentioned in the researches for achievement, the effects of motivational beliefs and self-regulated learning components on mathematics achievement were investigated by controlling gender and school type. Also the mean scores of girls and boys were

compared with each other and the mean scores of public school and private school were compared with each other.

According to the purposes that mentioned above, the following research problems are prepared:

**P1.** How well can mathematics achievement be explained in terms of motivational beliefs, self-regulated learning components, gender and type of school?

**P1.1** What is the extent to which motivational beliefs, self-regulated learning components, gender and type of school could account for achievement in mathematics?

**P1.2** What is the extent to which motivational beliefs and self-regulated learning components could account mathematics achievement by controlling gender and type of school?

**P2.** What is the effect of gender and type of school on students' mathematics achievement, motivational beliefs and self-regulated learning components?

In other words, these research problems help to investigate how mathematics achievement can be explained in terms of motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy for learning and performance and test anxiety), self-regulated learning components (cognitive strategy use and self-regulation), gender and school types and to determine the differences between two gender (girls and boys) and two school types (public schools and private schools) with respect to the variables above in the subject domain of mathematics.

### 1.3 Definitions of Related Terms

In order to study on the effects of some psychological variables on mathematics achievement, some terms have to be defined separately. According to Pintrich, Smith, Garcia and McKeachie (1991), intrinsic goal orientation,

extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, rehearsal strategies, elaboration strategies, organisation strategies, critical thinking, metacognitive self-regulation, time and study environment, effort regulation, peer learning, help seeking, self-regulation, self-regulated learning and mathematics achievement are defined as follows:

**Intrinsic Goal Orientation (Intr):** Goal orientation refers to students' reasons, goals and orientations about interested in the learning task or the course. Intrinsic goal orientation is about the students' own degrees of participation for the course. In other words, it refers to they are in the course because of their own challenge, curiosity and mastery. Their participation in the task is an end all to itself, rather than a means to an end.

**Extrinsic Goal Orientation (Extr):** Extrinsic goal orientation explains the reasons of students' in studying on a task because of grades, rewards, evaluation by others and competition. According to the students, learning task is a means to an end.

**Task Value (Taskva):** Task value refers to students' ideas about the task such as how important the task is, how interesting the task is and how useful the task is. In other words, the task is evaluated by the students in terms of interest, importance and utility.

**Control and Learning Beliefs (Contro):** Control and learning belief refers to students' beliefs about reaching positive outcomes. They think that if they try hard, they will reach positive outcomes.

**Self-efficacy for Learning and Performance (Selfef):** Self-efficacy is about students' own ability to master a task. It includes accomplishing a task judgment and performing a task confidence.

**Test anxiety (Testan):** Cognitive component and emotionality component are two components of test anxiety. Cognitive component refers to students' negative thoughts and emotionality component refers to affective and physiological points of anxiety.

**Rehearsal Strategies (Rehear):** Rehearsal strategies involve naming items to be learned. It is best for activating the information in working memory. They are important for attention and encoding process, but they do not help students integrate the information with prior knowledge.

**Elaboration Strategies (Elab):** Elaboration strategies are important for storing the information in the long term memory. These strategies include paraphrasing, summarizing, creating analogies and generative note taking.

**Organisation Strategies (Organ):** Organisation strategies are important for selecting appropriate information and making connections among information. Clustering and selecting the main idea from the texts can be examples for organization strategies.

**Critical Thinking (Crit):** Critical thinking refers to the students' application of previous knowledge to the new information in order to solve problems and reach decisions.

**Metacognitive Self-Regulation (Meta):** Metacognition refers to awareness, knowledge and control of cognition. In MSLQ, control and self-regulation aspects are emphasized. There are three processes for these aspects which are planning, monitoring and regulating. Planning activities help to activate relevant aspects of prior knowledge. Goal setting and task analysis can be examples of planning activities. The second activity is monitoring. It helps students understand the material and integrate it with prior knowledge by the help of taking attention while someone is reading. The last activity is regulating. It

refers improvement performance of students by assisting in checking their behavior about a task.

**Time and Study Environment (Time):** Time and study environment refers to managing time of studying and the study environments. Scheduling and planning are important in time management. The students should set realistic goals and they should use their study time effectively. Also, study environment should be organized and quiet for doing a class work effectively.

**Effort Regulation (Effort):** Effort regulation is about students' ability to control their effort and to complete goals even there are difficulties.

**Peer Learning (Peer):** Peer learning refers to be in contact with the peers. It is important because it can help students achieve something which was hard to achieve by themselves.

**Help Seeking (Help):** Help seeking is about students supported by their peers and instructors. Their help can affect students' achievement positively.

**Self-Regulation (Sr):** In this study, self-regulation is comprised of effort regulation and metacognition.

**Self-Regulated Learning:** In this study, self-regulated learning comprised of self-regulation (effort regulation and metacognition) and cognitive strategy use (rehearsal strategies, elaboration strategies, organization strategies and critical thinking).

**Mathematics Achievement (Mach):** Mathematics achievement refers to students' scores on Mathematics Achievement Test (MAT).

To sum up, in the first chapter the significance of the present study, its purposes, research problems and definitions of related terms were explained. This

study is important in order to investigate the effects of self-regulated learning components and motivational beliefs on mathematics achievement. Also the effects of some psychological variables on mathematics achievement were investigated by means of controlling the gender and school type; furthermore the differences between girls and boys and the differences between private and public schools with respect to self-regulated learning components and motivational beliefs were examined in order to contribute the related subject's literature in a broader sense. Two main research problems were constructed for these aims. Finally, the definitions of related terms were explained for helping the understanding of the following chapters.

# CHAPTER 2

# THEORETICAL BACKGROUND OF THE PRESENT STUDY

In this chapter, the theoretical background of the present study is summarized. There are two main parts in this chapter. In the first part theoretical perspective of self-regulated learning and in the second part theoretical perspective of motivational beliefs in the present study are explained.

## 2.1 Theoretical Perspective of Self-Regulated Learning in the Present Study

Self-regulated learning is an important issue in educational research for the last two decades (Trigano, 2006). There is a variety of researchers work on self-regulated learning, but Barry J. Zimmerman is one of the leading theorists and his researches cross over 15 years. The results of his researches can be the primary references for self-regulated learning and its strategies (Hayman, 2005). Also, self-regulated learning researches were done in Europe. For example, the books about self regulated learning in German were begun to be published in late 1970s. In 1982, German Journal of Instructional Science published an issue about self-regulated learning. It was introduced by Weiner who is the leading researcher in the field of educational psychology. Also, in the same issue Mandl and Fischer discussed some points of self-regulated learning. In another European country, Netherlands, Monique Boekaerts has been carrying out a research program on self-regulated learning for more than a decade. In some of the other European countries, similar researches were done and the researches in Netherlands and Germany were developed (Steffens, 2006).

According to Pintrich, self regulated learning or self-regulation can be defined as an active, constructive progress where learners set their goals for their learning and then try to monitor, regulate and control their cognition, motivation and behavior guided and constrained by their goals and the environment (Schunk, 2005). According to Zimmerman, self-regulation refers to self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals (Zimmerman, 2005). He also mentioned that self regulation focuses on individuals as metacognitively, motivationally and behaviorally active participants in their own learning process (Meyer & Turner, 2002). Metacognition can be defined as the awareness of learners about their academic strengths and weaknesses and their knowledge in order to regulate their engagement in learning processes and outcomes (Zimmerman, 2005). As it is stated above, individuals are motivationally active participants in self regulation. In order to clarify how motivation is defined, it can be explained as the process where goal-directed activity is initiated and sustained (Pintrich & Schunk, 2002).

Self-regulation can not occur if any of the following conditions lack (Zimmerman, 2005):

- A self-monitoring function that provides and updates information related to its present state or its ongoing activity must be included.
- An organized system of self-representations must be included. These representations involve a self-system such as history, nature.
- Self-modification skills and strategies must be contained. These skills and strategies can be applied to the present or direct toward another activity.

Also, Zimmerman (2002) mentioned that self-regulation is not a mental ability or an academic performance skill. It is a self-directive process that learners transform their mental abilities into academic skills. Learning is viewed as an activity that students do for themselves. According to Bandura (1986, as cited in Zimmerman, 2005), the interaction of personal, behavioral and environmental processes can be seen as a social cognitive perspective in indicating self-regulation. Bandura's triadic theory of social cognition has helped Zimmerman in order to propose a formulation in explaining self-regulated academic learning. It

involves three classes which are the students' personal process, the students' behavior and the environment.

According to Pintrich, the model may be thought as a social-cognitive framework, although it cooperates elements from other theories. It includes theories based on Piaget's constructivist theory, Vygotsky's sociocultural theory, social learning theories and information-processing theories. Zimmerman and Schunk highlighted these different approaches by asking authors in their volumes to examine self-regulated learning from distinctive theoretical instances (Paris & Paris, 2001). From Vygotskian perspective, self-regulation includes the coordinated mental functions such as memory, analysis, synthesis, evaluation and planning. Also, Vygotsky developed a perspective on how the individuals achieve self-regulatory capacities through the use of signs (Schunk & Zimmerman, 1994). As a result of these, self-regulated learners are people, who set goals and sustain motivation. They are aware of what they know, what they believe and what some tactics and strategies are (Winne, 1995).

Many models were developed in the last two decades about self-regulated learning. The numbers of stages are different in each cycle, but generally there are three or four stages (Steffens, 2006). For example, Winne and Hadwin (1998, as cited in Steffens, 2006) proposed a model of four stages. These stages are:

(1) Defining the task.

(2) Goal setting and planning.

(3) Enacting study tactics and strategies.

(4) Metacognitively adapting studying for the future.

Zimmerman developed a model of self-regulated learning, too. In his model, each cycle has four steps. These steps in each cycle are (Steffens, 2006):

(1) Self-evaluation and monitoring.

(2) Goal setting and strategic planning.

(3) Strategy implementation and monitoring.

(4) Strategic outcome monitoring.

From a social cognitive perspective, Zimmerman defined three cyclical phases of self-regulation. These phases are: Forethought, performance / volitional control and self-reflection (Zimmerman, 2000).

- *Forethought:* Forethought phase refers to influential processes that go before in place of acts and set stages for it (Zimmerman, 2000). According to him this phase includes two main categories which are task analysis and self-motivation beliefs. The two forms of task analysis are goal setting and strategic planning. He defined goal setting as it refers to setting specific and challenging outcomes for learning or performance. Strategic planning was defined as it refers to having methods that are appropriate for the task and the setting to be mastered in a skill. According to Zimmerman (2000), the second category of forethought is self-motivation beliefs. There are four parts under self-motivation beliefs which are self-efficacy, outcome expectations, intrinsic interest/value and goal orientation. Self-efficacy refers to students' beliefs about their own capability to perform a task (Pintrich & De Groot, 1990). Outcome expectations refer to beliefs about the highest extend of performance (Zimmerman, 2000). Intrinsic interest/value and goal orientation essentially concerns students' reasons for doing a task (Zimmerman, 2000; Pintrich & De Groot, 1990).

- *Performance / Volitional Control:* In this phase, the chosen strategy is implemented and monitored by the student (Steffens, 2006). This phase is divided into two categories by Zimmerman. These are: Self-control and self-observation. Self-control helps the learners to focus on the task. It refers to regulatory processes like self-instruction, imagery, attention focusing and task strategies (Zimmerman, 2000). According to him, self-instruction involves describing how to progress as someone accomplishes a task. Imagery is forming of mental pictures (Sungur, 2004). Attention focusing is designed to improve one's concentration on a task. Task strategies assist learning by reducing a task into its essential parts and reorganizing them meaningfully (Zimmerman, 2000). He mentioned self-observation in the second category of this phase. It includes monitoring strategies like self-recording and self-experimentation. In self-recording, a person realizes something by himself/herself. After realizing that,

s/he can perform a self experiment to see that on another person (Zimmerman, 2000).

- *Self-reflection:* In self-reflection phase, the student tries to evaluate the outcome of his efforts (Steffens, 2006). There are two main categories in self-reflection phase. These are: Self-judgment and self-reaction. Self judgment includes self-evaluation and causal attribution (Zimmerman, 2000). According to him self-evaluation refers to comparing self-monitored information with a goal. Self-evaluative judgments are linked to causal attributions about the results. The forms of the second category mentioned above by Zimmerman are self-satisfaction /affect and adaptive / defensive. He defined self-satisfaction as it involves perceptions of satisfaction or dissatisfaction that affect one's performance. Adaptive inferences are conclusions about how one needs to change his/her self-regulatory approach with respect to Zimmerman.

In the following table, three phases and their categories of Zimmerman are given.

Table 2.1 Three Phases and the Categories of Zimmerman

| FORETHOUGHT | PERFORMANCE/ VOLITIONAL CONTROL | SELF-REFLECTION |
|---|---|---|
| Task analysis<br>- Goal setting<br>- Strategic planning | Self-control<br>- Self-instruction<br>- Imagery<br>- Attention focusing<br>- Task strategies | Self-judgment<br>- Self-evaluation<br>- Causal attribution |
| Self-motivation beliefs<br>- Self-efficacy<br>- Outcome expectations<br>- Intrinsic interest/value<br>- Goal orientation | Self-observation<br>- Self-recording<br>- Self-experimentation | Self-reaction<br>- Self-satisfaction/ affect<br>- Adaptive/ defensive |

In Pintrich's model of self-regulation, there are four phases. These phases are summarized in the following table (Schunk, 2005).

Table 2.2 Four Phases of Self-Regulation According to Pintrich

| PHASES OF SELF-REGULATION | AREAS FOR SELF-REGULATION | INFORMATION |
|---|---|---|
| Forethought, planning, activation | Cognition | Cognitions include goals, prior content knowledge and metacognitive knowledge. |
| Monitoring | Motivation | Attention and awareness of one's actions and their outcomes. |
| Control | Behavior | Learners attempt to control their cognitions, motivation, behaviors and contextual factors based on their monitoring with the goal to enhance learning. |
| Reaction, reflection | Context | Learners' reactions and reflections include judgments, attributions and self-evaluations of performance. |

Pintrich's model shares some assumptions that are common to other self-regulation models. Learners are active participants in learning, learners have some choices for control over key activities, learners have a goal against which

they can assess progress and self-regulatory processes mediate the relation between personal factors and performance outcomes (Schunk, 2005).

Although recent research studies show that self-regulatory processes are teachable and cause increase in student motivation and achievement, few teachers effectively prepare their students to learn on their own (Schunk & Zimmerman, 1998). It is possible to develop self-regulatory competence by personal discovery, but this path is often frustrating and limited in its effectiveness. Another skill which is observational level occurs when learners induce the major features of the skill from watching a model. The following table explains the developmental levels of this skill (Zimmerman, 2000).

Table 2.3 Developmental Levels of Observational Level

| LEVEL | NAME | DESCRIPTION |
|---|---|---|
| 1 | Observation | Vicarious induction of a skill from a proficient model. |
| 2 | Emulation | Imitative performance of the general pattern or style of a model's skill with social assistance. |
| 3 | Self-control | Independent display of the model's skill under structured conditions. |
| 4 | Self-regulation | Adaptive use of skill across changing personal and environmental conditions. |

The teachers' roles in developing self-regulated students are important. They can shift responsibility for the learning process by helping their students develop self regulatory skills. They can do that by asking them to self-monitor, assisting them to analyze their own data either individually or in small groups and helping them set goals, choose strategies in light of self-monitored outcomes. The teachers can encourage their students to self-monitor, so they may refine their

self-regulatory strategies (Zimmerman, Bonner & Kovach, 1996). Also, self-regulated learning is more likely to occur when teachers create classroom environments in which students have opportunities to seek for challenges, to reflect on their progress and to take responsibility and pride in their accomplishments. Teachers can design open-ended instructional activities and scaffold assistance for student inquiry. They can minimize objective tests such as multiple-choice tests or true/false tests, competitive test scores and public comparisons of performance which detract from students' sense of efficacy and mastery. Projects, portfolios and performance assessments can motivate students, provide opportunities for self-regulated learning and enhance creative expressions (Paris & Paris, 2001). Thus, the main goal of the teachers should be transforming their classes into academies where the students can become smart learners.

In the present study, self-regulated learning includes three components. These are: metacognitive strategies for learning, monitoring and modifying cognition, management and control of effort and cognitive strategies for students to learn, remember and understand the material. In the study of Pintrich and De Groot (1990), there are three motivational components: value components, expectancy components and affective components. Value components include students' goals and beliefs about the task. Intrinsic goal orientation, extrinsic goal orientation and task value are in this component. Value components generally give information about the reason of doing a task. Expectancy components include students' beliefs about their ability to perform a task. Control and learning beliefs and self-efficacy for learning and performance are in expectancy component. These components generally give information about the students' ability to do a task. Affective components include students' emotional reactions. Test anxiety is the only part of this component. This component is about students' feelings about the task.

In summary, self-regulated learning is one of the most popular educational research fields in the last years. Many researches such as Zimmerman and Pintrich study about self-regulation. They developed models of it. In the model of Zimmerman there are three phases: forethought, performance/volitional control and self-reflection whereas in the model of Pintrich there are four phases:

forethought, planning and activation, monitoring, control and reaction and reflection. In self-regulated learning, teachers have important roles. They should consider the researchers' phases in order to make their learners be self-regulated. According to the model of the present study, there are three components for self-regulated learning that are metacognitive strategies for learning, monitoring and modifying cognition, management and control of effort and cognitive strategies for students to learn, remember and understand the material. Also, there are three motivational components that are value components, expectancy components and affective components.

## 2.2 Theoretical Perspective of Motivational Beliefs in the Present Study

Motivation is an internal state that arouses, directs and maintains behavior (Hoy, 2001). Choices, time to start, intensity level of involvement, causes to persist and individual thinking and feelings are questioned by motivation researchers. According to her a person can motivate himself/herself intrinsically or extrinsically. In intrinsic motivation, motivation is associated with activities which are people's own reward. In extrinsic motivation, external factors such as rewards and punishment help people create motivation.

Hoy (2001) mentioned that motivation is a complicated subject that can be included in many theories. In behavioral approaches to motivation, reward in the classroom is very important. Reward can be defined as an attractive object or event as a consequence of a behavior. In the humanistic approach to motivation, encouraging people's inner resources is important. These inner resources can be sense of competence, self-esteem, autonomy and self-actualization. Also in humanistic perspective, personal freedom, personal choices and self-determination are emphasized. In cognitive approaches to motivation, attribution theory is emphasized. In this theory, the effects of individual's explanations, justifications and excuses about self or others on motivation are included (Hoy, 2001). According to Weiner (1992, as cited in Hoy, 2001), in attribution theory there are three dimensions on attributed causes of success or failure. These are locus, stability and controllability. As Hoy was stated locus can be defined as a

location of the cause internal or external to the person, stability is about whether the cause can stay the same or change and controllability is about whether the person can control the cause or not. He mentioned that the components of motivation in attribution are ability, effort, luck, task difficulty, mood or illness and help from others. When these attributions are investigated with respect to dimensions, ability is internal, stable and uncontrollable, effort is internal, unstable and controllable, luck is external, unstable and uncontrollable, task difficulty is external, unstable and uncontrollable, mood or illness is internal, unstable, uncontrollable, help from others is external, unstable and uncontrollable. In sociocultural conceptions of motivation, participation in communities is emphasized. Goal orientation is an important part in motivation. It can be defined as patterns of beliefs about goals, outcome or attainment to accomplish, related to achievement (Hoy, 2001).

In summary, motivation can be defined as an internal state and can be divided into two parts: intrinsic motivation and extrinsic motivation. Motivation is a complex subject and it is studied from many perspectives such as behavioral approaches, humanistic approaches, cognitive approaches and sociocultural conceptions. In these approaches, some terms such as reward, self-esteem, autonomy, self-actualization, personal choices, self-determination, justifications, locus, stability, controllability, effort, luck, task difficulty and goal orientations are emphasized.

Consequently, in the second chapter some theories related to self-regulated learning and motivational beliefs were explained. In self-regulation both Zimmerman's and Pintrich's models were mentioned. Also the relationship among self-regulation, Piaget's constructivist theory, Vygotsky's sociocultural theory, social learning theories and information-processing theories were discussed. In addition to these, motivation and motivational beliefs were explained. Information about humanistic approach, cognitive approach, attribution theory and sociocultural conceptions were given from the point of motivation.

# CHAPTER 3

# REVIEW OF LITERATURE

In this chapter, the literature related with the present study is reviewed. According to the aims of the present study, this chapter can be divided into four subtitles. These are: Studies on self-regulated learning and its components in academic achievement, studies on motivational beliefs in academic achievement, gender differences related to self-regulated learning components and motivational beliefs and finally school types related to self-regulated learning components and motivational beliefs.

## 3.1 Studies on Self-Regulated Learning and Its Components in Academic Achievement

Mathematics is one of the most difficult courses according to many students. According to them, it is very hard to understand and to learn the meanings behind it besides applying it on their lives. Even, many students think that it is an unnecessary course although they always use it in their daily lives. According to McLeod (1992, as cited in Schreiber, 2002) affective background factors, such as attitudes and beliefs, have an important role in mathematics achievement. When a student has a better attitude toward a subject, the achievement and the performance level will be higher. Also enjoyment is important in learning mathematics. When students study mathematics with enjoyment, they achieve high scores (Schreiber, 2002). Achievement and effort are strongly related with each other (Pape & Smith, 2002).

As stated in Pape and Smith (2002), they made an interview with a small group of students who were hard-working, but unsuccessful in mathematics lessons. They made a research about the students' efforts in completing their homework, practicing problems and spending time on study. They concluded that these unsuccessful mathematics students were mostly doing their homework, attending mathematics classes and doing additional work in preparation for exams. Thus, they decided to make a research on what students were doing during their studying sessions instead of how much the students were studying mathematics. In other words, their question took the form of being if the students know how to study mathematics, where and when they learned it. Also, they made a connection from these questions into whether they can be taught how to monitor and regulate their mathematics learning or not. In the spring of 1996, an investigation was done on 23 students in order to determine their preferred approaches about studying mathematics. Student journal entries, researcher field notes and focus group interviews were examined for evidence of their approaches. They reached the following results by using the data from this investigation:

- Students often studied "hard" problems when preparing for exams.
- Monitoring understanding was difficult for developmental mathematics students.
- Students hesitate to change their studying approaches although their current strategies were ineffective.
- Mathematics instructors are often unaware of their students' deficiencies with respect to studying.
- Students need more practice by using effective study strategies.

According to this study, the results showed that mathematics education and self-regulated learning theory are united. In 1998, the researchers combined theory and practice in a 10 week experiment done with 19 college students. The students learned to take good notes during the lecture, read a mathematics text and explore available resources. They also engaged in setting goals, monitoring progress toward goals and evaluate plans of action. As it can be noticed, these are

all phases of self-regulated learning. Test preparation and test-taking strategies were discussed and examined throughout the term and the students learned to analyze and evaluate their examination errors. During the experiment, the students began to take responsibility for their own successes and failures. They also began to attribute course-related outcomes to actions, because they were aware of variety of mathematics-specific learning strategies which can affect their performance. Also, when they got a poor mark, they were capable of analyzing and modifying their approaches to studying and learning. According to Hagen and Weinstein (1995, as cited in Pape & Smith, 2002), when students take their own responsibility for their own learning, they attribute their success to their own efforts and therefore they begin to spend higher efforts for their learning. At the beginning of the study, the students were not able to say that they knew how to study mathematics, but at the end of the study, they stated that they knew the ways of studying mathematics. As a result of that study, it was observed that the components of self-regulated learning affect the mathematics education. In the research of Pape and Smith (2002), the results can be explained with respect to the phases of self-regulation. For example, the participants set goals and describe plans. Also, they gain high sense of self-efficacy. As an example to the second phase which is the performance phase, it can be said that the participants are engaged in a variety of different learning strategies and self-monitoring is difficult for all of them. In the self-reflective phase, the participants use the knowledge which they have gained during the study to determine new goals.

In a research done by Sundre and Kitsantas (2003), the purpose was to examine the power of self-regulated strategies and test-taking motivation on achievement performances under consequential and non-consequential test conditions. There were sixty two students in the sample. They were asked two parallel classroom tests: one that counted towards their class grade (consequential) and the one that did not (non-consequential). Each test consisted of a multiple-choice section and an essay section. According to the hypothesis of the study, power of self-regulated strategies would be predicted as both multiple-choice and essay performances in consequential and non-consequential contexts. As a result of the study, it was observed that power of self-regulation strategy was

significantly predicted as both multiple-choice conditions and essay type performances; however it was only predicted as consequential essay performance. In conclusion, it can be said that the social cognitive self-regulation perspective and expectancy–value motivation theory are supported by the findings of this study.

One of the ways of developing self-regulatory skills is watching a model. Teachers, parents, adults or peers can be a model for the students. They are important sources for teaching self-regulatory skills and for building self-efficacy. The positive effects of modeling can be noticed in one of the studies of Schunk. His study is about students' mathematical achievement. The sample was divided into two main groups. The first group was received by using cognitive modeling from an adult model and the second group was received by using didactic instruction which means that same instruction and materials without cognitive modeling. Both treatments enhanced achievement and self-efficacy, but gaining in the first group was more than the second group. As a result, it can be said that modeling which is a way of developing self-regulatory skills helps students focus on the requisite operations. Also it provides a concrete set of observable operations connected to the abstract principles (Schunk & Zimmerman, 1998).

In brief, it can be said that mathematics is thought as a difficult subject. According to the researches, many students do not know how to study it. Although they know that their studying strategies are ineffective, they hesitate to change it. At that point, teachers should help their students. Pape and Smith (2002) studied on combining mathematics education and self-regulated learning theory. Also, Sundre and Kitsantas (2003) studied on self-regulated strategies and achievement performances. All these researches show that self-regulated learning can positively affect students' mathematics achievement.

### 3.2 Studies on Motivational Beliefs in Academic Achievement

According to the study of Tussey (2002), there was a three-way interaction among personal mastery goals, task values and expectancy for success.

When a student had high expectancy for success, but had low personal mastery, the relationship between task value and anxiety was positive. In other words, it was observed that higher task values caused higher anxiety levels. On the other hand, when a student has high personal mastery and high expectancy for success, his/her anxiety level decreased, but task value increased.

In the study of Wolters and Rosenthal (2001), their aim was to investigate the relationship between four motivational beliefs and the students' five motivational regulation strategies. The four motivational beliefs were task value, self-efficacy, learning goal orientation and performance goal orientation. The five motivational regulation strategies were self-consequating, environmental control, interest enhancement, mastery self-talk and performance self-talk. The study was done with 114 eighth grade students in the algebra classes. One instrument was used which was a 7-point Likert-type scale with 145 items. There were two parts in the instrument. In the first part, there were items about students' task value, learning goal orientation, performance goal orientation, and self-efficacy. In the second part, there were items about students' use of five motivational regulation strategies which were self-consequating, environmental control, performance self-talk, mastery self-talk, and interest enhancement. According to the results of the study, firstly, task value, learning goal orientation and performance goal orientation were the significant predictors of self-consequating, secondly, only learning goal orientation was a significant individual predictor of environmental control, thirdly, only performance goal orientation was a significant predictor of performance self-talk, fourthly, all four motivational beliefs were significant predictors of mastery self-talk and finally, task value, learning goal orientation, and performance goal orientation were significant predictors of interest enhancement.

In the study of Schulz (2005a), the PISA 2003 data were used in order to analyze relationships among mathematics self-efficacy, mathematics self-concept, mathematics anxiety, student background and students' families' socioeconomic status. In the study of PISA, nearly 4500 students were chosen from 30 OECD countries and 10 non-OECD countries. At the end of the study, it was concluded that mathematics self-efficacy was negatively correlated with mathematics

anxiety and it was positively correlated with self concept. Also self concept and mathematics anxiety had negative correlations with each other. From the point of gender, it was concluded that females had higher levels of mathematics anxiety than males. Turkey was also one of the countries that the study was applied. According to the correlations between Economic, Social and Cultural Status (ESCS) and mathematics self beliefs (self-efficacy, self-concept and anxiety) and literacy in that study, mathematics self-efficacy had a stronger relationship with socio-economic background than self-concept and anxiety in Turkey (self-efficacy .31, self-concept .18, anxiety -.18). Also mathematics literacy had stronger correlations with socio-economic background than mathematics self-efficacy, self-concept and anxiety in Turkey (self-efficacy .31, self-concept .18, anxiety -.18, literacy .47) (Schulz, 2005a).

In summary, some studies were done about motivational beliefs in achievement. According to the results of these studies, task value increased with high expectations for success and high personal mastery. Also, it was clarified that anxiety level decreased by means of them. In another research done by Wolters and Rosenthal (2001), some relationships were observed between four motivational beliefs (task value, self-efficacy, learning goal orientation and performance goal orientation) and five motivational regulation strategies (self-consequating, environmental control, interest enhancement, mastery self-talk and performance self-talk). Finally, according to Schulz (2005a), the results of PISA 2003 indicated that there were high correlations between self-efficacy, self-concept, anxiety, literacy and socioeconomic background.

### 3.3 Studies on Gender Differences Related to Self-Regulated Learning Components and Motivational Beliefs

In the study of Drysdale and Milne (2004), they investigated the relationship between self-concept and achievement in mathematics and English among middle school students at ages between 12 and 15 years. 63 male and 61 female students are the participants of the study. They completed three subscales of the Self-Description Questionnaire II. According to the results of their study,

females displayed lower levels of mathematical self-concept than males, but there is no statistically significant gender difference in mathematics achievement. In other words, they concluded that there is no statistically significant relationship between gender and mathematics achievement.

In another study, the researchers used Motivated Strategies for Learning Questionnaire (MSLQ) which was also used in the present study. According to that study done by Fulk, Brigham and Lohman (1998), it was concluded that there was no gender difference among the participants of that study in the perception of self-regulation, self-efficacy and cognitive strategy use.

According to the study of Manger and Gjestad (1997), one of the results was that there was a significant effect of gender in favor of boys in mathematical achievement at the Norwegian third grade primary school level students. This study was done with 440 girls and 480 boys at Norway among third grade students.

In a study of Zimmerman and Martinez-Pons (1990), boys have significantly greater verbal self-efficacy than girls and similar mathematics self-efficacy. Generally, it is believed that boys have greater mathematics ability than girls and girls have greater verbal ability than boys. But in some researches, this result is rejected (Ruban, McCoach & Reis, 2002).

In the research of Ai (2002), a small significant gender difference was found between girls and boys in favor of girls in mathematics achievement. Especially girls who started low on mathematics grew faster than low boys and in this growing one of the main reasons was school variety.

In a study done by Tussey (2002), the relationship between motivational variables and anxiety was investigated. The sample of the study included 50 male and 53 female students from post secondary grade. They were given two surveys. The first one was a 44-item survey which was used to measure their motivational variables. The second one was a 20-item survey for measuring their level of anxiety. One of the results of the study showed that there was a significant gender difference for the variables of anxiety and task values in favor of females. In other words, it appeared that females had higher levels of anxiety and task value than males.

To sum up, various researches were done in order to investigate the relationship between gender and mathematics achievement. In the research of Drysdale and Milne (2004), they concluded that there was no relationship between gender and mathematics achievement. Similar to that research, Fulk, Brigham and Lohman (1998) concluded that there was no relationship between gender and the participants' self-regulation, self-efficacy and cognitive strategy use. On the other hand, according to the study of Manger and Gjestad (1997), males have significantly higher achievement than females. Similar to the result of of Manger and Gjestad (1997), Ai (2002) and Tussey (2002) found significant gender difference between girls and boys which was in favor of girls.

### 3.4 Studies on School Types Related to Self-Regulated Learning Components and Motivational Beliefs

The differences between schools can be noticed in some European countries such as Belgium, Germany and Switzerland, because schools in wealthy areas tend to have better outcomes than schools in poorer areas. Between and within school differences can be noticed in many subjects and especially in mathematics and science since these subjects require materials and skills. According to the results of this search, socio economic status is one of the effects of between and within school differences and this result is directly proportional to differences in school types (Marks, 2006).

. Peterson and Llaudet (2006) gave information about a study of National Center for Education Statistics (NCES). According to that, the performances of students at private schools were higher than the performances of students at public schools, but they supported that NCES results were too breakable to accept their conclusions.

As a consequence, type of school difference is a popular focus of concern. According to many researches, private schools are better than public schools, but when socioeconomic factors are taken into consideration, the difference between two types of schools can minimize or not exist.

For the summary of the third chapter, it can be seen that many studies were done related with the effects of self-regulated learning and its components, motivational beliefs, gender and school type on mathematics achievement. In these researches, some different results were reached. This can show that since the variables are psychological and gender and school type have some outside effects, each study can have different conclusions.

# CHAPTER 4

# METHOD

This chapter includes research design, main and sub-problems, variables, subjects, instruments, procedure, analysis of data, assumptions and limitations of the present study.

## 4.1 Research Design of the Study

The purposes of the present study are: (1) to further understanding of the effects of motivational beliefs, self-regulated learning components, gender and school types on mathematics achievement, and (2) to investigate the differences between girls and boys in both private and public schools, with respect to psychological variables. This study is both a correlational and a causal-comparative study according to the definitions of these two studies done by Fraenkel and Wallen (2000). They declared that the correlational research and causal-comparative research are examples for associational research which is defined as a relationship study among two or more variables. Also they mentioned that in correlational researches, there is no manipulation of variables. In addition to this, it describes an existing relationship and the degree to which two or more variables are related. There are two purposes of correlational research mentioned by Fraenkel and Wallen (2000). The first purpose is about explaining important human behaviors and the second purpose is about predicting likely outcomes. As a result, it can be said that the first research problem of the present study is a correlational research. Furthermore, in causal-comparative research, the aim is determining the cause or results of differences that already exist between groups

(Fraenkel & Wallen, 2000). They mentioned that at first the difference is created between groups and then their performances are compared with each other. The second research problem of the present study is related with causal-comparative research. As a result, it can be said that the present study is correlational and causal-comparative study.

The Motivational Strategies for Learning Questionnaire (MSLQ) and the Mathematics Achievement Test (MAT) were administered in the present study. MSLQ is a self-report instrument designed to measure students' motivational beliefs and strategy use. MSLQ and MAT were administered to 577 seventh grade students in Ankara and Istanbul, the first two largest cities of Turkey.

## 4.2 Main and Sub-Problems of the Study

In the following problems and the hypotheses, motivational beliefs consist of intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety. Self-regulated learning components are cognitive strategy use and self-regulation.

The problems of the study are like the following:

**P1.** How well can mathematics achievement be explained in terms of motivational beliefs, self-regulated learning components, gender and type of school?

**P1.1** What is the extent to which motivational beliefs, self-regulated learning components, gender and type of school could account for achievement in mathematics?

**P1.2** What is the extent to which motivational beliefs and self-regulated learning components could account mathematics achievement by controlling gender and type of school?

**P2.** What is the effect of gender and type of school on students' mathematics achievement, motivational beliefs and self-regulated learning components?

In order to examine the first sub-problem of the first problem, the following hypothesis is stated.

**H1.1** The eight variables, gender and school type together do not explain a significant amount of variance in students' mathematics achievement.

In order to examine the second sub-problem of the first problem, the following four hypotheses are stated.

**H1.2.1** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at public schools.

**H1.2.2** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at private schools.

**H1.2.3** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at public schools.

**H1.2.4** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at private schools.

In order to examine the second problem, the following three hypotheses are stated.

**H2.1.** There is no statistically significant interaction between gender and type of school with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

**H2.2** There is no statistically significant mean difference between girls and boys with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

**H2.3** There is no statistically significant mean difference between public and private schools with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

The hypotheses are stated in the null form. The hypotheses of the first problem tested at a significance level of 0.05 and the hypotheses of the second problem tested at a significance level of 0.025. The eight variables mentioned in the hypotheses above are intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, cognitive strategy use and self-regulation.

### 4.3 Variables

The variables of the present study will be considered into two parts. The first part includes the variables of the first problem – "P1. How well can mathematics achievement be explained in terms of motivational beliefs, self-regulated learning components, gender and type of school?"

In this part of the study, there are totally ten predictors: (1) intrinsic goal orientation, (2) extrinsic goal orientation, (3) task value, (4) control and learning beliefs, (5) self-efficacy for learning and performance, (6) test anxiety, (7) cognitive strategy use, (8) self-regulation, (9) gender and (10) school type. The first six predictors are in the motivational beliefs and seventh and eighth predictors are in the self-regulated learning components.

In the second part of the study, there are dependent and independent variables – P2. "What is the effect of gender and type of school on students' mathematics achievement, motivational beliefs and self-regulated learning components?"

The dependent variables are the same as the first eight predictors used in the first part of the study. These are: (1) intrinsic goal orientation, (2) extrinsic goal orientation, (3) task value, (4) control and learning beliefs, (5) self-efficacy for learning and performance, (6) test anxiety, (7) cognitive strategy use, and (8) self-regulation. Type of school and gender are the independent variables for this part of the study.

### 4.4 Subjects of the Study

The subjects of the study are 577 seventh grade students (303 girls and 274 boys) enrolled in twenty-five classrooms in nine primary schools from two types (public and private schools) in Istanbul and Ankara –the first two largest cities in Turkey.

In Table 4.1 the distribution of subjects in the present study is given.

Table 4.1 The Distribution of the Subjects

| | | SCHOOL TYPE | | TOTAL |
|---|---|---|---|---|
| | | PRIVATE | PUBLIC | |
| GENDER | BOYS | 165 | 109 | 274 |
| | GIRLS | 170 | 133 | 303 |
| TOTAL | | 335 | 242 | 577 |

The subjects have been selected from both private schools and public schools. It is decided to conduct the study at two types of schools, because it is thought that students being educated at different types of schools will give the chance of comparing these schools. According to Marks, Cresswell and Ainley (2006), socioeconomic status of families have important places in students' achievement since they affect the choices of school type. In Turkey, rich families choose private schools for their children and poor families can only account for public schools. In many researches, the opportunities of these two types of schools are compared. For example, in the national exams of Turkey, it is

observed that private schools are more successful then public schools. The results of these can be related to opportunities in private schools such as materials, lecture hours or tutoring. As a result, in the present study the students at these two types of schools are compared with each other whether there are differences or not.

The study was carried out during the spring semester of 2006-2007 academic year.

### 4.5 Measuring Instruments

In the present study, Motivated Strategies for Learning Questionnaire (MSLQ) and Mathematics Achievement Test (MAT) measuring instruments were used.

#### 4.5.1 Motivated Strategies for Learning Questionnaire (MSLQ)

This questionnaire was developed by Pintrich, Smith, Garcia and McKeachie (1991). The questionnaire includes fifteen scales which are intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time and study environment management, effort regulation, peer learning and help-seeking, but the questionnaire used in the present study consists of twelve scales. The three scales -time and study environment management, peer learning and help-seeking- weren't used in this study. MSLQ was originally developed in English and the items were translated into Turkish by Hendricks, Ekici and Bulut in 2000. MSLQ includes 81 items, but in this study all items were not used. For the pilot study 57 items were chosen from 81 items and for the main study 3 more items were added to 57 items. So the total number of items became 60 (see Appendix A). In the present study, some sentences from the Turkish version of MSLQ were clarified in order to make them more understandable by seventh grade students.

MSLQ is designed in two main scales which are motivational scales and learning strategies scale. In motivational scales, there are three main components. The first component is value and it is consisted of intrinsic goal orientation, extrinsic goal orientation and task value. The second component is expectancy and it is consisted of control and learning beliefs and self-efficacy for learning and performance. The last component is affective and it is consisted of only test anxiety. In learning strategies scale, there are two main strategies. The first strategy is cognitive and metacognitive strategies and it is consisted of rehearsal, elaboration, organisation, critical thinking and metacognitive self-regulation. The other strategy is resource management strategies and it is consisted of time and study environment management, effort regulation, peer learning and help-seeking. In the following sections, the pilot study and the main study will be explained.

#### 4.5.1.1 The Results of Item Analyses of MSLQ in the Pilot Study

In the pilot study of this present study, 57 items were chosen from 81 items of the original MSLQ. It was scored on a 5-point Likert scale. "I strongly disagree", "I disagree", "Uncertain", "I agree" and "I strongly agree" were used. In the coding procedure, Pintrich, Smith, Garcia and McKeachie (1991) performed the following procedure: 1. If the items supports the scale, it is considered as positive; 2. If not, it is taken into consideration as negative and it is reversed. The reversed items were coded starting from Strongly Disagree to Strongly Agree as 5 to as 1. The same procedure was followed in the present study. For example, the item -"During the examination I feel uncomfortable and uneasy" are two examples for test anxiety"- was not reversed item. Thus, it was coded starting from Strongly Disagree to Strongly Agree as 1 to as 5.

In the motivation scales part, there were 23 items that assessed students' value, expectancy and affective components. In the learning strategies scale, there were 34 items that assessed students' cognitive and metacognitive strategies and resource management strategies. By assessing them, learning strategies scales divided into five groups which are cognitive strategy use, self-regulation, time and study environment management, peer learning and help-seeking. Cognitive

strategy use includes rehearsal, elaboration, organization and critical thinking. Self-regulation includes metacognitive self-regulation and effort regulation. The other strategies are taken into consideration individually.

This questionnaire was administered to 120 seventh grade students in Istanbul. Before administering this questionnaire, it was checked by one Turkish teacher, two mathematics teachers and one mathematics education researcher. The Turkish teacher investigated the items of the questionnaire with respect to Turkish writing mistakes and clarity. Also, mathematics teachers checked out whether they were understandable for the students or not and whether they were appropriate for the level of seventh grade students.

Intrinsic goal orientation (Intr) was measured with three positive items. "In mathematics, I prefer to choose subjects that arouse my curiosity even they were hard to learn" and "I choose my assignments from mathematics to learn something, not for good grades" are two example items from intrinsic goal orientation. The reliability of the scale was 0.60.

Extrinsic goal orientation (Extr) was measured with four positive items. "The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade" and "I want to do well in this class because it is important to show my ability to my family, friends, employer, or others." are two examples for extrinsic goal orientation. The reliability of the scale was 0.62.

Task value (Taskva) was measured with four positive items. "I think I will be able to use the things that I learned in this course in the other courses" and "I like the subjects of this course" are two example items for task value. The reliability of the scale was 0.60.

Control and learning beliefs (Contro) was measured with four positive items. "It is my own fault if I don't learn the material in this course" and "If I don't understand the subjects in mathematics, the reason is not trying hard enough" are two examples for control and learning beliefs. The reliability of the scale was 0.37.

Self-efficacy for learning and performance (Selfef) was measured with four positive items. "I believe I will get an excellent grade from mathematics" and

“I am good at mathematics” are two examples of self-efficacy for learning and performance. The reliability of the scale was 0.72.

Test anxiety (Testan) was measured with four positive items. “During the mathematics examinations I think how poorly I am doing compared to my friends” and “During the examination I feel uncomfortable and uneasy” are two examples for test anxiety. The reliability of the scale was 0.59.

The cognitive strategy use scale (Csu) has four subscales. These are: Rehearsal, Elaboration, Organisation and Critical thinking. Rehearsal contained three positive items, elaboration contained four positive items, organization contained three positive items and finally critical thinking contained three positive items. Totally, cognitive strategy use scale consisted of thirteen positive items. “While studying mathematics, I practice by saying them with a high voice” is an example for rehearsal, “While studying mathematics, I try to connect the new information with the previous ones” is an example for elaboration, “While studying mathematics, I study on my course notes and make a list of important concepts” is an example for organization and finally “I try to develop my own ideas about the subjects of the mathematics course” is an example for critical thinking. The reliability of rehearsal scale for this study was 0.55. The reliability of elaboration scale for this study was 0.55. The reliability of organization scale for this study was 0.50. The reliability of critical thinking scale for this study was 0.57. Totally, the reliability of cognitive strategy use scale was 0.80.

The self-regulation (Sr) has two sub-scales. These are: Metacognitive self-regulation and effort regulation. Metacognitive self-regulation contained six items, one of them is negative and the other five items are positive. Effort regulation contained three items, one of them is negative item and the other two items are positive. Totally, self-regulation consisted of nine items. Two of them are negative and seven of them are positive items. “I am asking questions to myself in order to be sure about my understanding of the subjects in mathematics” and “While studying mathematics, I am trying to find out concepts that I don’t understand well” are two examples for metacognitive self-regulation. “Although I don’t like the things that we do in mathematics, I am studying a lot to be successful” is an example for effort regulation. The reliability of metacognitive

self-regulation scale for this study was 0.67 and the reliability of effort regulation scale for this study was 0.36. Totally, the reliability of self-regulation scale for this study was 0.74.

Time and study environment management (Time) was measured with six items. Half of these items are negative items. “Generally I study where I can pay attention to the subject” and “Because of my other activities, I notice that I don’t spend a lot of time for studying mathematics” are two examples for time and study environment management. The reliability of the scale was 0.55.

Peer learning (Peer) was measured with three positive items. “While studying mathematics, I try to explain the subjects to one of my friends” is an example for peer learning. The reliability of the scale was 0.46.

Help seeking (Help) was measured with three items. One of these three items is negative item and the other two items are positive items. “I ask the instructor to explain the concepts that I don’t understand well” is an example for help seeking. The reliability of the scale was -0.14.

Totally, in the pilot study, there were 51 positive and 6 negative items.

Table 4.2 demonstrates the number of items and reliability coefficients of the subscales of the Motivated Strategies for Learning Questionnaire for boys and girls in the pilot study.

Table 4.2 Reliability Coefficients for Boys and Girls in the Pilot Study

| Scales | Items | alpha for boys | alpha for girls | alpha total |
|---|---|---|---|---|
| Intrinsic goal orientation | 3 | 0.61 | 0.59 | 0.60 |
| Extrinsic goal orientation | 4 | 0.64 | 0.49 | 0.62 |
| Task value | 4 | 0.54 | 0.66 | 0.60 |
| Control and learning beliefs | 4 | 0.31 | 0.41 | 0.37 |
| Self-efficacy | 4 | 0.63 | 0.78 | 0.72 |
| Test anxiety | 4 | 0.56 | 0.62 | 0.59 |
| Cognitive strategy use | 13 | 0.83 | 0.78 | 0.80 |
| Self-regulation | 9 | 0.69 | 0.76 | 0.74 |
| Time and study environment management | 6 | 0.37 | 0.64 | 0.55 |
| Peer learning | 3 | 0.36 | 0.54 | 0.46 |
| Help seeking | 3 | -0.17 | -0.03 | -0.14 |

In Table 4.2, the reliability coefficients for boys and girls and the total alpha values are given. Although some reliability coefficients are low, many scales have high reliabilities.

#### 4.5.1.2 The Results of Item Analyses of MSLQ in the Present Study

In this section, results of item analyses of MSLQ in the present study will be explained. The section will be divided into three sub-sections. The first one will include confirmatory factor analyses of scales, the second one will include exploratory factor analyses of scales and the last section will include reliabilities of scales.

##### 4.5.1.2.1 Confirmatory Factor Analyses of Scales in the Present Study

In the present study, confirmatory factor analysis was done in order to observe relationships among indicators for each factor. Table 4.3 was prepared for the results of confirmatory factor analysis for motivational beliefs.

Table 4.3 The Results of Confirmatory Factor Analysis for Motivational Beliefs

| Factor | Indicator | Λ | S.Λ | SE | t | RMSEA | SRMR | GFI | AGFI | $\chi^2$ (p) |
|---|---|---|---|---|---|---|---|---|---|---|
| Intr | i13 | 0.61 | 0.37 | 0.083 | 7.30 | 0.000 | | | | 0.00 |
| | i18 | 1.35 | 0.76 | 0.13 | 10.64 | | | | | (1.00) |
| | i19 | 1.26 | 0.64 | 0.13 | 9.95 | | | | | |
| Extr | i6 | 0.97 | 0.56 | 0.080 | 12.11 | 0.059 | 0.020 | 0.99 | 0.97 | 5.99 |
| | i9 | 1.15 | 0.60 | 0.089 | 12.94 | | | | | (0.05) |
| | i11 | 1.57 | 0.68 | 0.11 | 14.75 | | | | | |
| | i23 | 1.07 | 0.62 | 0.080 | 13.39 | | | | | |
| Taskva | i3 | 0.84 | 0.39 | 0.099 | 8.52 | 0.120 | 0.0084 | 0.99 | 0.92 | 8.50 |
| | i8 | 1.18 | 0.60 | 0.086 | 13.77 | | | | | (0.0001) |
| | i14 | 1.12 | 0.74 | 0.064 | 17.30 | | | | | |
| | i21 | 2.36 | 0.78 | 0.13 | 18.22 | | | | | |
| Contro | i1 | 0.76 | 0.38 | 0.10 | 7.57 | 0.071 | 0.014 | 1.00 | 0.97 | 3.93 |
| | i7 | 0.94 | 0.62 | 0.083 | 11.26 | | | | | (0.047) |
| | i15 | 0.98 | 0.41 | 0.12 | 8.39 | | | | | |
| | i20 | 1.39 | 0.78 | 0.11 | 12.75 | | | | | |
| Selfef | i4 | 1.25 | 0.77 | 0.063 | 19.80 | 0.061 | 0.017 | 0.99 | 0.97 | 6.07 |
| | i5 | 0.78 | 0.64 | 0.050 | 15.61 | | | | | (0.048) |
| | i10 | 1.11 | 0.68 | 0.066 | 16.77 | | | | | |
| | i17 | 0.91 | 0.79 | 0.045 | 20.15 | | | | | |
| Testan | i2 | 0.65 | 0.38 | 0.079 | 8.18 | 0.113 | 0.0021 | 0.99 | 0.93 | 16.65 |
| | i12 | 1.31 | 0.57 | 0.11 | 12.33 | | | | | (0.0002) |
| | i16 | 1.49 | 0.71 | 0.087 | 17.10 | | | | | |
| | i22 | 1.76 | 0.67 | 0.11 | 16.33 | | | | | |

Table 4.3 gives information about some values for confirmatory factor analysis belongs to motivational beliefs. According to Schumacker and Lomax (1996), RMSEA and SRMR values should be smaller than 0.05, GFI and AGFI values should be greater than 0.90 for a good fit. Also p values of $\chi^2$ should be greater than 0.05. From Table 4.3, it can be noticed that except for intrinsic goal orientation, RMSEA values for all factors are a bit greater than 0.05. However, SRMR values for all factors are smaller than 0.05, GFI and AGFI values for all factors are greater than 0.90 except for intrinsic goal orientation as they were expected for reflecting a good model fit. According to Pintrich et al. (1991), goodness of fit indices are reasonable values since course characteristics, student characteristics and teacher requests can affect motivational attitudes. Thus,

indicators for intrinsic goal orientation were acceptable because of its RMSEA value and p value of $\chi^2$. Also according to Schumacker and Lomax (1996), $\chi^2$ can equal to 0 for a perfect model fit. Furthermore, indicators for other factors were acceptable because of their SRMR, GFI and AGFI values.

Table 4.4 gives information about the results of confirmatory factor analysis for self-regulated learning components.

Table 4.4 The Results of Confirmatory Factor Analysis for Self-Regulated Learning Components

| Factor | Indicator | Λ | S.Λ | SE | t | RMSEA | SRMR | GFI | AGFI | $\chi^2$ (p) |
|---|---|---|---|---|---|---|---|---|---|---|
| csu | i30 | 0.60 | 0.40 | 0.064 | 9.40 | 0.067 | 0.043 | 0.94 | 0.91 | 274.02 |
| | i41 | 1.03 | 0.63 | 0.064 | 16.10 | | | | | (0.00) |
| | i51 | 0.92 | 0.64 | 0.056 | 16.46 | | | | | |
| | i43 | 1.04 | 0.67 | 0.060 | 17.31 | | | | | |
| | i48 | 0.95 | 0.62 | 0.061 | 15.55 | | | | | |
| | i50 | 1.07 | 0.63 | 0.067 | 16.00 | | | | | |
| | i52 | 0.83 | 0.60 | 0.055 | 15.06 | | | | | |
| | i24 | 0.90 | 0.54 | 0.068 | 13.27 | | | | | |
| | i34 | 0.81 | 0.56 | 0.059 | 13.72 | | | | | |
| | i49 | 1.05 | 0.71 | 0.056 | 18.66 | | | | | |
| | i39 | 0.87 | 0.59 | 0.059 | 14.80 | | | | | |
| | i31 | 0.79 | 0.46 | 0.068 | 11.54 | | | | | |
| | i37 | 0.90 | 0.60 | 0.059 | 15.14 | | | | | |
| | i46 | 0.62 | 0.44 | 0.059 | 10.42 | | | | | |
| sr | i29 | 0.39 | 0.26 | 0.067 | 5.81 | 0.071 | 0.046 | 0.96 | 0.93 | 272.83 |
| | i38 | 1.03 | 0.55 | 0.078 | 13.15 | | | | | (0.00) |
| | i47 | 0.16 | 0.12 | 0.058 | 2.67 | | | | | |
| | i55 | 0.95 | 0.63 | 0.061 | 15.45 | | | | | |
| | i25 | 0.22 | 0.17 | 0.060 | 3.75 | | | | | |
| | i28 | 0.93 | 0.61 | 0.062 | 14.97 | | | | | |
| | i33 | 1.30 | 0.67 | 0.077 | 16.84 | | | | | |
| | i44 | 1.67 | 0.70 | 0.093 | 17.86 | | | | | |
| | i57 | 1.57 | 0.63 | 0.092 | 17.09 | | | | | |
| | i59 | 1.05 | 0.65 | 0.065 | 16.21 | | | | | |

As seen from Table 4.4, both cognitive strategy use and self-regulation have greater RMSEA values than 0.05. For a perfect fit, this value should be

smaller than 0.05 (Schumacker & Lomax, 1996). However, their SRMR, GFI and AGFI values are acceptable for a perfect fit. According to Schumacker and Lomax (1996), SRMR values should be smaller than 0.05, GFI and AGFI values should greater than 0.90 for a perfect fit. As seen from Table 4.4, both two factors have appropriate SRMR, GFI and AGFI values for a perfect fit.

#### 4.5.1.2.2 Exploratory Factor Analysis of Scales in the Present Study

In the present study one of the aims was to investigate how mathematics achievement can be explained in terms of motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy for learning and performance and test anxiety), self-regulated learning components (cognitive strategy use and self-regulation), gender and school types. In order to determine the motivational beliefs' and self-regulated learning components' dimensions, MSLQ was used. This scale was developed by Pintrich, Smith, Garcia and McKeachie (1991). Some dimensions are intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy for learning and performance and test anxiety. The others were determined by Ozturk (2003). Consequently, each dimension was taken into account as a unidimensional and tested by Exploratory Factor Analysis.

For exploratory factor analysis, assumptions were tested for all scales. The assumption includes four parts which are sample size, factorability of the correlation matrix, linearity and outliers among cases as given by Pallant (2001).

In intrinsic goal orientation, firstly the assumptions were tested. According to sample size assumption, the sample size should be greater than 150. Since there are 577 data in the present study, this assumption is satisfied. The second assumption is related to factorability of the correlation matrix. According to this assumption, some correlations should be equal to or greater than 0.3 in the correlation matrix. For intrinsic goal orientation, there are some correlations greater than 0.3, therefore this part of assumption is satisfied. Also, the Bartlett's test of sphericity should be smaller than 0.05 and the Kaiser-Meyer-Olkin value should be equal to or greater than 0.6. In the factor analysis of intrinsic goal

orientation, the Bartlett's test of sphericity is 0.000 and it shows that this part is also satisfied. The Kaiser-Meyer-Olkin value is 0.58. This part of assumption is not exactly satisfied, but the difference is very small. The next assumption is about linearity. According to Tabachnick and Fidell (1996, as cited in Pallant, 2001), if there is no evidence of curvilinear relationship and there is an adequate sample size, the assumption is satisfied. Since there is no evidence for curvilinear relationship and the sample size is adequate, it can be said that this assumption is satisfied. The last assumption is related to outliers among cases. This assumption is satisfied since the data was checked against to outliers.

In intrinsic goal orientation, there are three items and all of them are positive items. According to the initial principal factor solution with iterations, the eigenvalue is 1.597. This factor is accounted for 53.24 % of the total variation in the intrinsic goal orientation scores. There is one factor in the scale. The factor loadings of these items are given in Table 4.5.

Table 4.5 Factor Loadings of Intrinsic Goal Orientation Items

| Items | Factor Loadings |
|---|---|
| 18 | 0.800 |
| 19 | 0.778 |
| 13 | 0.593 |

As seen in Table 4.5, the factor loadings of intrinsic goal orientation items range between 0.593 and 0.800.

In extrinsic goal orientation, the assumptions were tested at the beginning of the factor analysis. The first assumption is satisfied since the sample size is more than 150. The factorability assumption is also satisfied, because there are some correlations greater than 0.3 in correlation matrix, the Bartlett's test of sphericity is equal to 0.00 (should be smaller than 0.05) and The Kaiser-Meyer-Olkin value is 0.725 (should be equal to or greater than 0.06). The third assumption is linearity. According to Tabachnick and Fidell (1996, as cited in

Pallant, 2001), if there is no evidence of curvilinear relationship and there is an adequate sample size, the assumption is satisfied. Since there is no evidence for curvilinear relationship and the sample size is adequate, it can be said that this assumption is satisfied. The last assumption is also satisfied when the data was checked for outliers.

In extrinsic goal orientation, there are four items and all of them are positive items. According to the initial principal factor solution with iterations, the eigenvalue is 1.984. This factor is accounted for 49.61 % of the total variation in the extrinsic goal orientation scores. There is one factor in the scale. The factor loadings of these items are given in Table 4.6.

Table 4.6 Factor Loadings of Extrinsic Goal Orientation Items

| Items | Factor Loadings |
|---|---|
| 11 | 0.757 |
| 9 | 0.700 |
| 23 | 0.690 |
| 6 | 0.668 |

From Table 4.6, it can be seen that the factor loadings of extrinsic goal orientation items range between 0.668 and 0.757.

In task value, the assumptions were also checked. The sample size assumption is satisfied because of the same reason of the first two scales. The second assumption is related to factorability of the correlation matrix. There are some correlations equal to or greater than 0.3 in the correlation matrix. The Bartlett's test of sphericity is 0.00 which is statistically significant. Also the Kaiser-Meyer-Olkin value is 0.700 (should be equal to or greater than 0.06). Thus, this assumption is satisfied. Next assumption is about linearity. According to Tabachnick and Fidell (1996, as cited in Pallant, 2001), if there is no evidence of curvilinear relationship and there is an adequate sample size, the assumption is satisfied. Since there is no evidence for curvilinear relationship and the sample

size is adequate, it can be said that this assumption is satisfied. The last assumption is also satisfied when the data was checked for outliers.

In task value, there are four items and these items are positive. According to the initial principal factor solution with iterations, the eigenvalue is 2.078. This factor is accounted for 51.95 % of the total variation in the task value scores. There is one factor in the scale. The factor loadings of these four items are given in Table 4.7.

Table 4.7 Factor Loadings of Task Value Items

| Items | Factor Loadings |
|---|---|
| 21 | 0.796 |
| 14 | 0.774 |
| 8 | 0.739 |
| 3 | 0.547 |

By the help of Table 4.7, it can be noticed that the factor loadings of task value items range between 0.547 and 0.796.

In control and learning beliefs, the assumptions were tested. The first assumption which is sample size is satisfied since there are 577 data. Next assumption is factorability of the correlation matrix. This assumption is satisfied since there are some correlations equal to or greater than 0.3 in the correlation matrix, the Bartlett's test of sphericity is 0.00 and the Kaiser-Meyer-Olkin value is 0.627. According to Pallant (2001), these values mentioned as statistically significant. The third assumption is linearity. This assumption is satisfied since there is no evidence for curvilinear relationship and the sample size is adequate. The final assumption is about outliers. This assumption is also satisfied as a result of data checking.

In control and learning beliefs, there are four positive items. According to the initial principal factor solution with iterations, the eigenvalue is 1.926. This factor is accounted for 48.16 % of the total variation in the control and learning

beliefs scores. There is one factor in the scale. The factor loadings of these four items are given in Table 4.8.

Table 4.8 Factor Loadings of Control and Learning Beliefs Items

| Items | Factor Loadings |
|---|---|
| 20 | 0.713 |
| 15 | 0.710 |
| 1 | 0.696 |
| 7 | 0.656 |

As seen in Table 4.8, the factor loadings of control and learning beliefs items range between 0.656 and 0.713.

In self-efficacy for learning and performance, the assumptions were tested at the beginning. The sample size assumption is satisfied since there 577 data. Factorability assumption is satisfied since there are some correlations equal to or greater than 0.3 in the correlation matrix, the Bartlett's test of sphericity is 0.00 and the Kaiser-Meyer-Olkin value is 0.774. The Bartlett's test of sphericity should be smaller than 0.05 and the Kaiser-Meyer-Olkin value should be equal to or greater than 0.6. The third assumption is linearity. This assumption is satisfied since there is no evidence for curvilinear relationship and the sample size is adequate. The final assumption is about outliers. This assumption is also satisfied as a result of data checking.

In self-efficacy for learning and performance, there are four positive items. According to the initial principal factor solution with iterations, the eigenvalue is 2.378. This factor is accounted for 59.45 % of the total variation in the self-efficacy scores. There is one factor in the scale. The factor loadings of these four items are given in the following table.

Table 4.9 Factor Loadings of Self-Efficacy

| Items | Factor Loadings |
|---|---|
| 17 | 0.808 |
| 4 | 0.801 |
| 10 | 0.743 |
| 5 | 0.729 |

As it can be seen from Table 4.9, the factor loadings of self-efficacy items range between 0.729 and 0.808.

In test anxiety, when the assumptions were tested, it was observed that all the assumptions were satisfied. The first assumption is sample size and satisfied since there are 577 data. The second assumption is linearity and satisfied since there are some correlations equal to or greater than 0.3 in correlation matrix, the Bartlett's test of sphericity is 0.00 and the Kaiser-Meyer-Olkin value is 0.692. The Bartlett's test of sphericity should be smaller than 0.05 and the Kaiser-Meyer-Olkin value should be equal to or greater than 0.6. The third assumption is linearity. This assumption is satisfied since there is no evidence for curvilinear relationship and the sample size is adequate. The final assumption is outliers and satisfied as a result of data checking.

In test anxiety, there are four items and all of them are positive. According to the initial principal factor solution with iterations, the eigenvalue is 2.017. This factor is accounted for 50.44 % of the total variation in test anxiety scores. There is one factor in the scale. The factor loadings of items in the test anxiety are given in Table 4.10.

Table 4.10 Factor Loadings of Test Anxiety

| Items | Factor Loadings |
|---|---|
| 16 | 0.783 |
| 22 | 0.767 |
| 12 | 0.703 |
| 2 | 0.566 |

From Table 4.10, it can be seen that the factor loadings of test anxiety range between 0.566 and 0.783.

In cognitive strategy use, the assumptions were checked at the beginning. Sample size assumption is satisfied since there are 577 data. Factorability assumption is satisfied since there are some correlations equal to or greater than 0.3 in the correlation matrix, the Bartlett's test of sphericity is 0.00 and the Kaiser-Meyer-Olkin value is 0.925. The Bartlett's test of sphericity should be smaller than 0.05 and the Kaiser-Meyer-Olkin value should be equal to or greater than 0.6. The third assumption is linearity. This assumption is satisfied since there is no evidence for curvilinear relationship and the sample size is adequate. The final assumption is outliers and satisfied as a result of data checking.

Cognitive strategy use includes rehearsal, elaboration, organization and critical thinking. In cognitive strategy use, totally there are fourteen items and all of them are positive. According to the initial principal factor solution with iterations, the eigenvalue is 5.036. This factor is accounted for 35.97 % of the total variation in cognitive strategy use scores. There is one factor in the scale. The factor loadings of the items are given in Table 4.11.

Table 4.11 Factor Loadings of Cognitive Strategy Use

| Items | Factor Loadings |
|---|---|
| 49 | 0.706 |
| 43 | 0.677 |
| 51 | 0.654 |
| 50 | 0.643 |
| 41 | 0.642 |
| 48 | 0.620 |
| 37 | 0.619 |
| 52 | 0.604 |
| 39 | 0.603 |
| 34 | 0.594 |
| 24 | 0.578 |
| 31 | 0.503 |
| 46 | 0.461 |
| 30 | 0.423 |

According to Table 4.11, the factor loadings of cognitive strategy use range between 0.423 and 0.706.

In self regulation, when the assumptions were tested, it was observed that all the assumptions were satisfied. The first assumption is sample size and satisfied since there are 577 data. The second assumption is linearity and satisfied since there are some correlations equal to or greater than 0.3 in the correlation matrix, the Bartlett's test of sphericity is 0.00 and the Kaiser-Meyer-Olkin value is 0.840. The Bartlett's test of sphericity should be smaller than 0.05 and the Kaiser-Meyer-Olkin value should be equal to or greater than 0.6. The third assumption is linearity. This assumption is satisfied since there is no evidence for curvilinear relationship and the sample size is adequate. The final assumption is outliers and satisfied as a result of data checking.

Self regulation consists of metacognitive self regulation and effort regulation. In self regulation, there are ten items. Seven of them are positive items and three of them are negative items. According to the initial principal factor

solution with iterations, the eigenvalue is 3.357. This factor is accounted for 33.57 % of the total variation in self regulation scores. There is one factor in the scale. The factor loadings of the items are given in Table 4.12.

Table 4.12 Factor Loadings of Self Regulation

| Items | Factor Loadings |
|---|---|
| 44 | 0.708 |
| 33 | 0.708 |
| 55 | 0.689 |
| 57 | 0.678 |
| 59 | 0.676 |
| 28 | 0.628 |
| 38 | 0.586 |
| 29 | 0.346 |
| 25 | 0.251 |
| 47 | 0.208 |

As seen in Table 4.12, the factor loadings of self regulation range between 0.208 and 0.708.

#### 4.5.1.2.3 Reliabilities of Scales in the Present Study

In the present study, MSLQ was implemented to 577 seventh grade students from private and public schools. Before implementing the questionnaire, one Turkish teacher, two mathematics teachers and one mathematics education researcher investigated the questionnaire again. The number of items in MSLQ was increased to 60 from 57. One more item was added for each of organisation, effort regulation and help seeking scales. “While studying mathematics, I notice the main points of the subject that I studied” positive item was added to the organization, “If studying mathematics became hard for me, I prefer whether stop studying or studying the simple parts only” negative item was added to the effort

regulation and finally "I try to determine my friends from classroom to ask question when I needed" positive item was added to help seeking. 7 items of these 60 items were negative items and 53 items of these 60 items were positive items. The reliabilities of control and learning beliefs, peer learning and help seeking were low at the pilot study, but they became higher in the present study. Although the reliability of control and learning belief was 0.37 in the pilot study, it became 0.63 in the present study. Also, the reliability of peer learning increased to 0.64 from 0.46. Finally, in the help seeking, the reliability became 0.26. Although it was not very high, there was an increase from the reliability of the pilot study which was -0.14.

Table 4.13 demonstrates the number of items and the total reliability coefficients of the subscales of the Motivated Strategies for Learning Questionnaire in the present study.

Table 4.13 Reliability Coefficients on the Motivated Strategies for Learning Questionnaire in the Present Study

| Scales | Items | Total alpha |
|---|---|---|
| Intrinsic goal orientation | 3 | 0.55 |
| Extrinsic goal orientation | 4 | 0.65 |
| Task value | 4 | 0.68 |
| Control and learning beliefs | 4 | 0.63 |
| Self-efficacy | 4 | 0.77 |
| Test anxiety | 4 | 0.66 |
| Cognitive strategy use | 14 | 0.85 |
| Self-regulation | 10 | 0.75 |
| Time and study environment management | 6 | 0.47 |
| Peer learning | 3 | 0.64 |
| Help seeking | 4 | 0.26 |

Time and study environment management, peer learning and help seeking subscales were not taken into consideration in the present study since the study of Ozturk (2003) supports this idea. Also their reliability coefficients are another factor in dropping them out. Thus, the number of subscales for this study

was eight. These eight subscales were intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, cognitive strategy use (rehearsal, elaboration, organization, critical thinking) and self-regulation (metacognitive self-regulation, effort regulation). In the present study, three items out of ten items of self-regulation, three items out of six items of time and study environment management and one item out of four items of help seeking were negative items. All the other items in the questionnaire were positive items.

The total reliability of MSLQ according to 60 items is 0.91 in the present study. The reliability of boys at private schools is 0.90, the reliability of boys at public schools is 0.90, the reliability of girls at private schools is 0.89 and finally the reliability of girls at public schools is 0.93.

### 4.5.2 Mathematics Achievement Test (MAT)

Mathematics Achievement Test (MAT) was developed by the researcher. It was used to determine students' achievement and to assess their degrees about mathematics course objectives. The questions in the test were determined according to the curriculum program published by the Ministry of Education of Turkey. Objectives were written as defining in the Bloom's Taxonomy. At first, 30 questions were planned to ask to the students. A table of specification was prepared according to these questions. These 30 questions were investigated by a mathematics education researcher, a high school mathematics teacher and a primary school mathematics teacher. Also a Turkish teacher investigated the test from the point of Turkish grammar and writing. According to their comments, the questions were revised. So, the number of questions in the test decreased to 25.

In the pilot study, 25 questions were asked to 120 seventh grade students in Istanbul. After the application of the test, item analysis of the data was conducted by using ITEMAN program. The ITEMAN program gave information about item discrimination power as a biserial coefficient and item difficulty power as a percentage of correct answers. According to the criterion for item

discrimination power, the coefficient should be greater than or equal to 0.2. According to the second criterion, which was item difficulty power, the coefficient should be between 0.2 and 0.8. According to these criteria, the items' discrimination powers and item difficulty power for each item were analyzed. There was no any problem in thirteen questions with respect to these two criteria. The values in three questions were below 0.2 for both these two criteria. Thus, these three questions and two more questions were dropped out of the test. Thus the number of questions became 20 in the present study. The values for item discrimination and item difficulty power were a bit greater than 0.2, therefore eleven questions out of twenty questions were revised and they were made a bit simpler. As a result, 20 questions were asked to the students in the present study (see Appendix B). The subjects of these twenty questions in mathematics achievement test were integers, rational numbers, very big and small numbers, equations, coordinate system, problem solving by using equations, symmetry, inequalities, rate and ratio, percentage problems, profit and loss problems, angles on line and angles on triangles. These twenty questions were also investigated by the same mathematics education researcher and by the same mathematics teachers and table of specification was checked over again for the test with 20 questions (see Appendix C). These are all done for the validity of the test. The reliability of these twenty questions applied in the present study was 0.84.

### 4.6 Procedure

Review of the literature was the first step done at the beginning of the study. According to the components of the research question, the study was begun. Data collection instrument, MSLQ, was selected from the literature. Its Turkish translation was used in the study, but the number of items was decreased to 57 from 81 items for the pilot study. Then three more items were added to the pilot study of this study. Thus, the total number of items became 60 for the present study.

The pilot study of this present study was conducted in Istanbul with 120 seventh grade students in the spring semester of 2006-2007 academic year. Before

the real testing situation, it was decided to conduct it both in Istanbul and Ankara, the first two largest cities of Turkey. According to this decision the necessary permissions were taken. Thus, the real testing was conducted in the spring semester of 2006-2007 academic year.

The Motivated Strategies for Learning Questionnaire was administered at any hour in each school. The important point at this application was, filling out the questionnaire at the same time with the whole seventh grades at every school. Before filling out, the teachers gave necessary information to the students. They emphasized that filling out all the items in the questionnaire was very important for the study. Also, they explained that the students should fill it according to their own ideas and feelings about mathematics course. When the Mathematics Achievement Test was also administered at the same time with the all seventh grades at every school, most of the time, the lesson was mathematics for at least one class.

### 4.7 Analyses of Data

In the present study, data analyses began by coding data. The data collected from the subjects were transferred to the computer environment with MS Excel, SPSS package program and ITEMAN program. Then the reliability analyses were reported as an evidence for internal consistency of the scales. Also descriptive statistics such as mean and standard deviation were calculated. Linear Stepwise Regression and Multivariate Analyses of Variance (MANOVA) were used in this study. Linear Stepwise Regression analyses was used in order to asses how well mathematics achievement can be explained in terms of motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety), self-regulated learning components (cognitive strategy use, self-regulation), gender and school type. The relationships between the measures of the study were presented by using Pearson Product Moment Coefficient. After using regression, MANOVA was conducted. It was used in order to examine mean differences in

gender and school type. For the probability of doing Type I error, 0.025 alpha was set.

### 4.8 Assumptions and Limitations

The followings are the assumptions of the study:

- The instrument used in this study is a self-report; therefore the main assumption for this questionnaire is the students' sincerity. It is assumed that they filled the questionnaire accurately and sincerely.
- It is assumed that the questions in the mathematics achievement test were solved by the participants with high patience. They did not just circle a choice in the question, they also solve them.
- It is assumed that the questionnaire and the achievement tests are administered under standard conditions.

The followings are the limitations of the study:

- By accepting the dimensions of MSLQ mentioned in the literature by Pintrich et al. (1991) and Ozturk (2003), exploratory factor analysis was done as unidimentional.
- Since the questionnaire filled by the participants is a self report test, it can be a subject to bias.
- Since the present study is conducted with students from nine different schools and two different cities, the results are valid for students who have same characteristics.

# CHAPTER 5

# RESULTS

In this chapter, the results of the study will be explained. These results include statistical evidences for the claims of the present study. There are three sections in this chapter. These are: descriptive statistics, inferential statistics and conclusions of the study.

## 5.1 Descriptive Statistics

Table 5.1 shows the means and the standard deviations of the variables ((1) intrinsic goal orientation, (2) extrinsic goal orientation, (3) task value, (4) control and learning beliefs, (5) self-efficacy for learning and performance, (6) test anxiety, (7) cognitive strategy use, (8) self-regulation and (9) mathematics achievement) as a function of gender and school types on the position of 5-point Likert-type scale. The subscale scores of MSLQ for the whole subjects were divided by the number of items on the subscale to represent their position on the 5-point Likert-type scale.

Table 5.1 gives information about descriptive statistics of MSLQ and mathematics achievement.

Table 5.1 Descriptive Statistics of MSLQ Subscale Scores and Mathematics Achievement

| Measuring instruments | Predictors | Mean | Std. Deviation |
|---|---|---|---|
| Motivational subscales | Intrinsic goal orientation | 3.61 | 0.86 |
| | Extrinsic goal orientation | 4.13 | 0.77 |
| | Task value | 3.77 | 0.80 |
| | Control and learning beliefs | 3.81 | 0.78 |
| | Self-efficacy | 3.46 | 0.83 |
| | Test anxiety | 3.23 | 0.97 |
| Self-regulated learning subscales | Cognitive strategy use | 3.28 | 0.71 |
| | Self-regulation | 3.45 | 0.67 |
| Achievement | Mathematics Achievement | 12.84 | 4.71 |

Table 5.1 demonstrates the mean scores of motivational subscales ranging from 3.23 to 4.13. As a result, it can be said that the students tend to reflect an "undecided" perspective from the point of self-efficacy and test anxiety. Also, they tend to reflect an "agree" perspective from the point of intrinsic goal orientation, extrinsic goal orientation, task value and control and learning beliefs. Secondly, the mean score of cognitive strategy use shows that students are likely to reflect "undecided" perspective. From the point of self-regulation, students nearly tend to reflect an "agree" perspective. The mean score of mathematics achievement of all subjects is 12.84 out of 20.

Table 5.2 demonstrates the mean scores of motivational subscales range, self-regulated learning subscales range and mathematics achievement for boys and girls at public schools.

Table 5.2 Boys and Girls at Public Schools' Descriptive Statistics of MSLQ Subscale Scores and Mathematics Achievement

| Predictors | $M_{boys}$ | $SD_{boys}$ | $M_{girls}$ | $SD_{girls}$ |
|---|---|---|---|---|
| Intrinsic goal orientation | 3.70 | 0.79 | 4.02 | 0.75 |
| Extrinsic goal orientation | 4.16 | 0.73 | 4.23 | 0.77 |
| Task value | 3.67 | 0.75 | 3.87 | 0.73 |
| Control and learning beliefs | 3.80 | 0.80 | 4.02 | 0.75 |
| Self-efficacy | 3.34 | 0.81 | 3.42 | 0.78 |
| Test anxiety | 3.49 | 0.74 | 3.51 | 0.86 |
| Cognitive strategy use | 3.35 | 0.65 | 3.57 | 0.64 |
| Self-regulation | 3.32 | 0.59 | 3.68 | 0.67 |
| Mathematics Achievement | 8.86 | 3.31 | 9.52 | 3.96 |

According to Table 5.2, the mean scores of girls are higher than the mean scores of boys at all subscales. As a result, it can be said that both boys and girls at public schools tend to reflect an "undecided" perspective from the point of self-efficacy, however they are likely to reflect an "agree" perspective from the point of intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs and test anxiety. As a second result, although boys tend to reflect an "undecided" perspective, girls tend to reflect an "agree" perspective from the point of cognitive strategy use and self-regulation. Girls at public schools have a higher point from the boys at public schools about mathematics achievement. The mean score of girls is 9.52 whereas the mean score of boys is 8.86 out of 20.

Table 5.3 demonstrates the mean scores of motivational subscales range, self-regulated learning subscales range and mathematics achievement for boys and girls at private schools.

Table 5.3 Boys and Girls at Private Schools' Descriptive Statistics of MSLQ Subscale Scores and Mathematics Achievement

| Predictors | $M_{boys}$ | $SD_{boys}$ | $M_{girls}$ | $SD_{girls}$ |
|---|---|---|---|---|
| Intrinsic goal orientation | 3.28 | 0.90 | 3.56 | 0.80 |
| Extrinsic goal orientation | 3.97 | 0.84 | 4.20 | 0.69 |
| Task value | 3.63 | 0.87 | 3.73 | 0.80 |
| Control and learning beliefs | 3.57 | 0.87 | 3.89 | 0.64 |
| Self-efficacy | 3.57 | 0.91 | 3.47 | 0.81 |
| Test anxiety | 2.96 | 1.03 | 3.09 | 1.04 |
| Cognitive strategy use | 3.01 | 0.77 | 3.28 | 0.66 |
| Self-regulation | 3.26 | 0.64 | 3.52 | 0.69 |
| Mathematics Achievement | 15.45 | 3.48 | 15.46 | 3.49 |

As seen in Table 5.3, the mean scores of girls are higher than the mean scores of boys at all subscales except for self efficacy. Consequently, it can be said that boys at private schools tend to reflect an "undecided" perspective from the point of intrinsic goal orientation and test anxiety; however girls at private schools tend to reflect an "undecided" perspective only from the point of test anxiety. From the point of self efficacy, they nearly tend to reflect an "agree" perspective. Also, boys at private schools are likely to reflect an "agree" perspective from the point of extrinsic goal orientation, task value, control and learning beliefs and self efficacy, however girls at private schools tend to reflect an "agree" perspective from the point of intrinsic goal orientation, extrinsic goal orientation, task value and control and learning beliefs. As a second consequence, boys at private schools tend to reflect an "undecided" perspective from the point of self regulated learning subscales. Being different from boys at private schools, girls at private school tend to reflect an "agree" perspective from the point of self-regulation. The mean score of mathematics achievement for boys is nearly the same as the girls. The boys' mean score is 15.45 where the girls' mean score is 15.46 out of 20.

## 5.2 Inferential Statistics

In this section, the problems of the present study will be examined by the means of their associated hypotheses.

### 5.2.1 Result of Testing the First Problem

The first problem stated in the method chapter is: "P.1 How well can mathematics achievement be explained in terms of motivational beliefs, self-regulated learning components, gender and type of school?

There are two sub-problems of this problem. In this part, these sub-problems will be examined by means of their associated hypotheses. These hypotheses are in the null form and they are tested at a significance level of 0.05.

#### 5.2.1.1 Results of Testing of the Hypothesis of the First Sub-Problem

The first sub-problem of the first problem is: "P.1.1 What is the extent to which motivational beliefs, self-regulated learning components, gender and type of school could account for achievement in mathematics?"

For this sub-problem, the hypothesis is stated like that: "H1.1 The eight variables, gender and school type together do not explain a significant amount of variance in students' mathematics achievement." The eight variables mentioned in the hypothesis are intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance, test anxiety, cognitive strategy use and self-regulation.

Before testing H1.1 by using Linear Stepwise Regression, its assumptions were tested.

The first assumption is sample size. According to Tabachnick and Fidell (1996, as cited in Pallant. 2001) the sample size must be greater than 50+8m where m is equal to number of independent variables (N>50+8m). There are 10 independent variables; therefore the sample size of this study should be greater

than 130. Since the sample size of the present study is 577, the sample size assumption is satisfied.

The second assumption is multicollinearity. The interrelationships among variables were examined before testing the hypothesis of the first sub-problem. In order to examine these interrelationships, again Pearson product moment correlations were conducted. Table 5.4 demonstrates that the predictor variables do not have high correlations among each other. In other words, the multicollinearity assumption is satisfied.

Table 5.4 Pearson Product Moment Correlations among the Measures for all Subjects of the Study

| Variable | Extr | Taskva | Contro | Selfef | Testan | Csu | Sr | Stype | Gender | Mach |
|---|---|---|---|---|---|---|---|---|---|---|
| Intr | 0.33 | 0.55 | 0.44 | 0.29 | 0.09 | 0.58 | 0.51 | 0.26 | 0.18 | -0.17 |
| Extr | | 0.40 | 0.52 | 0.19 | 0.29 | 0.32 | 0.30 | 0.08 | 0.11 | -0.02 |
| Taskva | | | 0.50 | 0.62 | -0.07 | 0.55 | 0.58 | 0.06 | 0.09 | 0.10 |
| Contro | | | | 0.31 | 0.15 | 0.37 | 0.37 | 0.12 | 0.18 | -0.03 |
| Selfef | | | | | -0.35 | 0.33 | 0.43 | -0.08 | -0.02 | 0.24 |
| Testan | | | | | | 0.16 | -0.08 | 0.24 | 0.05 | -0.25 |
| Csu | | | | | | | 0.69 | 0.22 | 0.18 | -0.11 |
| Sr | | | | | | | | 0.10 | 0.23 | 0.04 |
| Stype | | | | | | | | | 0.04 | -0.65 |
| Gender | | | | | | | | | | 0.00 |

Another assumption is related to singularity. This assumption is satisfied, because all independent variables are not combinations of other independent variables.

Next assumption is outliers. The mean is 12.84 and the 5 % trimmed mean is 12.93. Since the difference between these two values is low, there is no outlier. In other words, outlier assumption is satisfied.

Another assumption is normality. In order to test the normality, Kolmogorov-Smirnov statistics is used. The significance value is found as 0.000. It reveals that there is a violation of the assumption of normality, but this is quite common in larger samples (Pallant, 2001 p. 59). In order to test the normality, the

normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots it is observed that each score is plotted against the expected value from the normal distribution. According to Pallant (2001), if a reasonably straight line is obtained, it suggests a normal distribution. The scores of the achievement test appear to be reasonably normally distributed in the present study.

The last assumption is linearity. In linearity, the residuals should have a straight line relationship with dependent variable score (Pallant, 2001). In the present study, the normal p-p plot of regression standardized residual shows that residuals have a straight line relation with dependent variable. Thus, the linearity assumption is satisfied.

The stated hypothesis (H1.1) is examined by using Linear Stepwise Regression at a significance level of 0.05.

In the Table 5.5, linear stepwise regression analysis results of three predictive variables on mathematics achievement are given.

Table 5.5 Linear Stepwise Regression Analysis Results for Combined Effect of Three Predictive Variables on Mathematics Achievement

| Regression Statistics | | | | | |
|---|---|---|---|---|---|
| Multiple R | 0.683 | | | | |
| R Square | 0.466 | | | | |
| Adjusted R Square | 0.464 | | | | |
| Standard Error | 3.450 | | | | |
| | df | SS | MS | F | Sig.F |
| Regression | 3 | 5961.001 | 1987.000 | 166.886 | 0.000 |
| Residual | 573 | 6822.330 | 11.906 | | |
| Total | 576 | 12783.331 | | | |

Table 5.5 indicates that the three variables together (school type, self efficacy and intrinsic goal orientation) explained a significant amount of variance

in students' mathematics achievement, $R^2$=0.466, adjusted $R^2$=0.464, F(3,576)=166.886, p=0.000. Thus, 46.6 % of the variances are explained by these variables together.

Table 5.6 is related with three significant predictor variables. According to it, school type, self efficacy and intrinsic goal orientation individually explain a significant amount of variance in mathematics achievement ($p<0.05$).

Table 5.6 Linear Stepwise Regression Analysis Results for Individual Effects of Three Significant Predictor Variables on Mathematics Achievement

| Variables | Standardized Coefficients | Standard Error | t Ratio | p-value |
|---|---|---|---|---|
| School Type | -0.619 | 0.306 | -19.280 | 0.000 |
| Self-efficacy | 0.211 | 0.046 | 6.522 | 0.000 |
| Intrinsic goal orientation | -0.067 | 0.061 | -1.996 | 0.046 |

By the help of Table 5.6, a linear stepwise regression equation can be written in order to estimate students' mathematics achievement from three significant predictors. The regression equation with these three predictors is significantly related to mathematics achievement.

The equation is:

$Y= -0.619 X_1 + 0.211 X_2 - 0.067 X_3$

In this equation, Y represents the predicted mathematics achievement, $X_1$ represents school type, $X_2$ represents self-efficacy and $X_3$ represents intrinsic goal orientation.

Extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use, self regulation and gender are excluded from the equation, because they do not have a significant contribution to variance in

mathematics achievement. Table 5.7 shows the results of linear stepwise regression analysis of seven excluded variables.

Table 5.7 Results of Linear Stepwise Regression Analysis of Seven Excluded Variables

| Variables | Beta In | t | p-value | Partial Correlation | Tolerance |
|---|---|---|---|---|---|
| Extr | 0.004 | 0.130 | 0.897 | 0.005 | 0.878 |
| Taskva | 0.088 | 1.951 | 0.052 | 0.081 | 0.460 |
| Contro | 0.010 | 0.280 | 0.780 | 0.012 | 0.770 |
| Testan | -0.029 | -0.847 | 0.397 | -0.035 | 0.814 |
| Csu | -0.002 | -0.055 | 0.956 | -0.002 | 0.626 |
| Sr | 0.071 | 1.871 | 0.062 | 0.078 | 0.649 |
| Gender | 0.046 | 1.495 | 0.135 | 0.062 | 0.961 |

A linear stepwise regression is performed in order to see which motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety), self-regulated learning components (cognitive strategy use and self-regulation), gender and school type could account for the mathematics achievement. As it can be seen in Table 5.6, there are three variables (school type, self efficacy and intrinsic goal orientation) as a significant predictor. Also, in Table 5.7, it can be seen that seven variables (extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self-regulation) are not significant predictors.

Table 5.8 shows the variances of three predictors of mathematics achievement according to linear stepwise analysis of mathematics achievement.

Table 5.8 Linear Stepwise Regression Analysis of Mathematics Achievement on Motivational Beliefs, Self-Regulated Learning Components, Gender and School Type

| Step | Variable | $R^2$ | Standard Error of The Estimate |
|---|---|---|---|
| 1. | Stype | 0.427 | 3.5702 |
| 2. | Stype, Selfef | 0.463 | 3.4595 |
| 3. | Stype, Selfef, Intr | 0.466 | 3.4506 |

As seen in Table 5.8, school type is the strongest significant predictor in mathematics achievement with a variance of 42.7 % ($R^2$ change=0.427, F(1,575)=427.924, p=0.000). Secondly, self efficacy accounted for additional variance of 3.6 % ($R^2$ change= 0.036, F(1,574)=38.368, p=0.000). Last predictor is intrinsic goal orientation with an additional variance of 0.4 % ($R^2$ change=0.004, F(1,573)=3.986, p=0.046).

### 5.2.1.2 Results of Testing of the Hypotheses of the Second Sub-Problem

The second sub-problem of the first problem in the present study is: "P1.2 What is the extent to which motivational beliefs and self-regulated learning components could account mathematics achievement by controlling gender and type of school?" For investigating this sub-problem, four hypotheses are stated. These hypotheses are like the following:

**H1.2.1** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at public schools.

**H1.2.2** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at private schools.

**H1.2.3** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at public schools.

**H1.2.4** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at private schools.

Firstly, results related with the first hypothesis of the second sub-problem are given.

**H1.2.1** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at public schools.

Before testing H1.2.1 by using Linear Stepwise Regression, its assumptions were tested.

The first assumption is sample size. According to Tabachnick and Fidell (1996), the sample size must be greater than 50+8m where m is equal to number of independent variables (N>50+8m). There are 8 independent variables for this hypothesis; therefore the sample size of this study should be greater than 114. The sample size of boys at public schools in the present study is 109. The sample size assumption is not satisfied, but the difference is small.

Another assumption is multicollinearity. As it is done in the first sub-problem, again the interrelationships among boys at public schools is examined by using Pearson product moment correlations in order to check multicollinearity before examining the first hypothesis of the second sub-problem. As it can be seen in Table 5.9, the predictive variables do not have high correlations among themselves. In other words, the multicollinearity assumption is satisfied.

In Table 5.9, correlations among predictors for boys at public schools can be seen.

Table 5.9 Pearson Product Moment Correlation for Boys at Public Schools

| Variable | Extr | Taskva | Contro | Selfef | Testan | Csu | Sr | Mach |
|---|---|---|---|---|---|---|---|---|
| Intr | 0.43 | 0.50 | 0.38 | 0.33 | 0.19 | 0.45 | 0.48 | -0.05 |
| Extr | | 0.48 | 0.63 | 0.24 | 0.34 | 0.43 | 0.36 | 0.25 |
| Taskva | | | 0.55 | 0.66 | 0.10 | 0.64 | 0.60 | -0.05 |
| Contro | | | | 0.32 | 0.31 | 0.40 | 0.45 | 0.19 |
| Selfef | | | | | -0.17 | 0.60 | 0.53 | -0.09 |
| Testan | | | | | | 0.17 | 0.05 | 0.07 |
| Csu | | | | | | | 0.66 | -0.12 |
| Sr | | | | | | | | -0.05 |

The third assumption is singularity. This assumption is satisfied, because all independent variables are not combinations of other independent variables.

Another assumption is related to outliers. The mean is 8.64 and the 5 % trimmed mean is 8.73. Since the difference between these two values is low, there is no outlier. In other words, outlier assumption is satisfied.

Next assumption is normality. In order to test the normality, Kolmogorov-Smirnov statistics is used. The significance value is found as 0.000. It reveals that there is a violation of the assumption of normality, but this is quite common in larger samples (Pallant, 2001 p. 59). In order to test the normality, the normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots it is observed that each score is plotted against the expected value from the normal distribution. According to Pallant (2001), if a reasonably straight line is obtained, it suggests a normal distribution. The scores of the achievement test appear to be reasonably normally distributed in the present study. Thus, normality assumption is satisfied.

The last assumption is linearity. In linearity, the residuals should have a straight line relationship with dependent variable score (Pallant, 2001). In the present study, the normal p-p plot of regression standardized residual shows that residuals have a straight line relation with dependent variable. Thus, the linearity assumption is satisfied.

The stated hypothesis (H1.2.1) is examined by using Linear Stepwise Regression at a significance level of 0.05.

Table 5.10 shows that the effects of two variables on mathematics achievement can be noticed according to linear stepwise regression analysis

Table 5.10 Linear Stepwise Regression Analysis Results for Combined Effect of Two Predictive Variables on Mathematics Achievement

| Regression Statistics | | | | | |
|---|---|---|---|---|---|
| Multiple R | 0.355 | | | | |
| R Square | 0.126 | | | | |
| Adjusted R Square | 0.110 | | | | |
| Standard Error | 3.125 | | | | |
| | df | SS | MS | F | Sig.F |
| Regression | 2 | 149.436 | 74.718 | 7.649 | 0.001 |
| Residual | 106 | 1035.500 | 9.769 | | |
| Total | 108 | 1184.936 | | | |

Table 5.10 indicates that the two variables together (extrinsic goal orientation and cognitive strategy use) explain a significant amount of variance in students' mathematics achievement, $R^2$=0.126, adjusted $R^2$=0.110, F(2,108)=7.649, p=0.001. Thus, 12.6 % of the variances are explained by these variables together for boys at public schools.

Table 5.11 shows the individual effect of each variable. According to it, extrinsic goal orientation and cognitive strategy use explain individually a significant amount of variance in mathematics achievement ($p<0.05$).

Table 5.11 Linear Stepwise Regression Analysis Results for Individual Effects of Two Significant Predictor Variables on Mathematics Achievement

| Variables | Standardized Coefficients | Standard Error | t Ratio | p-value |
|---|---|---|---|---|
| Extrinsic goal orientation | 0.371 | 0.113 | 3.692 | 0.000 |
| Cognitive strategy use | -0.276 | 0.037 | -2.748 | 0.007 |

By the help of Table 5.11, a linear stepwise regression equation can be written in order to estimate students' mathematics achievement from two significant predictors. The regression equation with these two predictors is significantly related to mathematics achievement.

The equation is:

$Y = 0.371\ X_1 - 0.276\ X_2$

In this equation, Y represents the predicted mathematics achievement, $X_1$ represents extrinsic goal orientation and $X_2$ represents cognitive strategy use.

Intrinsic goal orientation, task value, control and learning beliefs, self efficacy, test anxiety, self regulation are excluded from the equation, because they do not have a significant contribution to variance in mathematics achievement. Table 5.12 shows the results of linear stepwise regression analysis of six excluded variables.

Table 5.12 Results of Linear Stepwise Regression Analysis of Six Excluded Variables

| Variables | Beta In | t | p-value | Partial Correlation | Tolerance |
|---|---|---|---|---|---|
| Intr | -0.115 | -1.090 | 0.278 | -0.106 | 0.733 |
| Taskva | -0.086 | -0.697 | 0.487 | -0.068 | 0.541 |
| Contro | 0.115 | 0.965 | 0.337 | 0.094 | 0.584 |
| Selfef | -0.025 | -0.219 | 0.827 | -0.021 | 0.644 |
| Testan | -0.010 | -0.102 | 0.919 | -0.010 | 0.885 |
| Sr | -0.006 | -0.46 | 0.963 | -0.004 | 0.553 |

A linear stepwise regression is performed in order to see which motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety) and self-regulated learning components (cognitive strategy use

and self-regulation) could account for the mathematics achievement. As it can be seen in Table 5.11, there are two variables (extrinsic goal orientation and cognitive strategy use) as a significant predictor. Also, in Table 5.12, it can be seen that six variables (intrinsic goal orientation, task value, control and learning beliefs, self efficacy, test anxiety and self-regulation) are not significant predictors.

Table 5.13 Linear Stepwise Regression Analysis of Mathematics Achievement on Motivational Beliefs and Self-Regulated Learning Components

| Step | Variable | $R^2$ | Standard Error of the Estimate |
|---|---|---|---|
| 1. | Extr | 0.064 | 3.2198 |
| 2. | Extr, Csu | 0.126 | 3.1255 |

As indicated at Table 5.13, extrinsic goal orientation is the strongest significant predictor in mathematics achievement for boys at public school with a variance of 6.4 % ($R^2$ change=0.064, F(1,107)=7.301, p=0.008). The other predictor, cognitive strategy use, accounted for additional variance of 6.2 % ($R^2$ change= 0.062, F(1,106)=3.549, p=0.007).

Secondly, results related with the second hypothesis of the second sub-problem are given.

**H1.2.2** The eight variables together do not explain a significant amount of variance in *boys'* mathematics achievement at private schools.

Before testing H1.2.2 by using Linear Stepwise Regression, its assumptions were tested.

The first assumption is sample size. According to Tabachnick and Fidell (1996), the sample size must be greater than 50+8m where m is equal to number of independent variables (N>50+8m). There are 8 independent variables for this hypothesis; therefore the sample size of this study should be greater than 114.

Since the sample size of boys at private schools in the present study is 165, the sample size assumption is satisfied.

Another assumption is multicollinearity. The interrelationship among boys at private schools is examined by using Pearson product moment correlations in order to check multicollinearity before examining the second hypothesis of the second sub-problem. As it can be seen in Table 5.14, the predictive variables do not have high correlations among themselves. In other words, the multicollinearity assumption is satisfied.

In Table 5.14, correlations among boys at private schools can be seen.

Table 5.14 Pearson Product Moment Correlation for Boys at Private Schools

| Variable | Extr | Taskva | Contro | Selfef | Testan | Csu | Sr | Mach |
|---|---|---|---|---|---|---|---|---|
| Intr | 0.20 | 0.58 | 0.40 | 0.25 | 0.09 | 0.62 | 0.52 | -0.05 |
| Extr | | 0.45 | 0.52 | 0.30 | 0.16 | 0.29 | 0.32 | -0.01 |
| Taskva | | | 0.54 | 0.64 | -0.10 | 0.47 | 0.49 | 0.22 |
| Contro | | | | 0.30 | 0.16 | 0.32 | 0.30 | 0.01 |
| Selfef | | | | | -0.36 | 0.20 | 0.26 | 0.36 |
| Testan | | | | | | 0.20 | -0.06 | -0.16 |
| Csu | | | | | | | 0.65 | -0.04 |
| Sr | | | | | | | | 0.13 |

Next assumption is singularity. This assumption is satisfied, because all independent variables are not combinations of other independent variables.

Another assumption is related to outliers. The mean is 15.45 and the 5 % trimmed mean is 15.64. Since the difference between these two values is low, there is no outlier. In other words, outlier assumption is satisfied.

The fifth assumption is normality. In order to test the normality, Kolmogorov-Smirnov statistics is used. The significance value is found as 0.000. It reveals that there is a violation of the assumption of normality, but this is quite common in larger samples (Pallant, 2001 p. 59). In order to test the normality, the normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots it

is observed that each score is plotted against the expected value from the normal distribution. According to Pallant (2001), if a reasonably straight line is obtained, it suggests a normal distribution. The scores of the achievement test appear to be reasonably normally distributed in the present study. Thus, normality assumption is satisfied.

The last assumption is linearity. In linearity, the residuals should have a straight line relationship with dependent variable score (Pallant, 2001). In the present study, the normal p-p plot of regression standardized residual shows that residuals have a straight line relation with dependent variable. Thus, the linearity assumption is satisfied.

The stated hypothesis (H1.2.2) is examined by using Linear Stepwise Regression at a significance level of 0.05.

Table 5.15 shows that there are effects of two variables on mathematics achievement. This result is concluded by using Linear Stepwise Regression.

Table 5.15 Linear Stepwise Regression Analysis Results for Combined Effect of Two Predictive Variables on Mathematics Achievement

| Regression Statistics | | | | | |
|---|---|---|---|---|---|
| Multiple R | 0.390 | | | | |
| R Square | 0.152 | | | | |
| Adjusted R Square | 0.141 | | | | |
| Standard Error | 3.222 | | | | |
| | df | SS | MS | F | Sig.F |
| Regression | 2 | 301.187 | 150.593 | 14.507 | 0.000 |
| Residual | 162 | 1681.625 | 10.380 | | |
| Total | 164 | 1982.812 | | | |

Table 5.15 indicates that the two variables together (self-efficacy and intrinsic goal orientation) explained a significant amount of variance in students'

mathematics achievement, $R^2$=0.152, adjusted $R^2$=0.141, F(2,164)=14.507, p=0.000. Thus, 15.2 % of the variances are explained by means of these variables together for boys at private schools.

Table 5.16 explained the individual effect of each variable. According to it, self-efficacy and intrinsic goal orientation explain individually a significant amount of variance in mathematics achievement ($p<0.05$).

Table 5.16 Linear Stepwise Regression Analysis Results for Individual Effects of Two Significant Predictor Variables on Mathematics Achievement

| Variables | Standardized Coefficients | Standard Error | t Ratio | p-value |
|---|---|---|---|---|
| Self-efficacy | 0.399 | 0.072 | 5.340 | 0.000 |
| Intrinsic goal orientation | -0.152 | 0.096 | -2.033 | 0.044 |

By the help of Table 5.16, a linear stepwise regression equation can be written in order to estimate students' mathematics achievement from two significant predictors. The regression equation with two motivational belief predictors is significantly related to mathematics achievement.

The equation is:

$Y= 0.399 X_1 - 0.152 X_2$

In this equation, Y represents the predicted mathematics achievement, $X_1$ represents self-efficacy and $X_2$ represents intrinsic goal orientation.

Extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation are excluded from the equation, because they do not have a significant contribution to variance in mathematics

achievement. Table 5.17 shows the results of linear stepwise regression analysis of six excluded variables.

Table 5.17 Results of Linear Stepwise Regression Analysis of Six Excluded Variables

| Variables | Beta In | t | p-value | Partial Correlation | Tolerance |
|---|---|---|---|---|---|
| Extr | -0.110 | -1.443 | 0.151 | -0.113 | 0.895 |
| Taskva | 0.125 | 1.113 | 0.267 | 0.087 | 0.413 |
| Contro | -0.067 | -0.831 | 0.407 | -0.065 | 0.797 |
| Testan | 0.000 | 0.001 | 0.999 | 0.000 | 0.832 |
| Csu | -0.038 | -0.407 | 0.684 | -0.032 | 0.609 |
| Sr | 0.141 | 1.648 | 0.101 | 0.129 | 0.711 |

A linear stepwise regression is performed in order to see which motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety) and self-regulated learning components (cognitive strategy use and self-regulation) could account for the mathematics achievement. As it can be seen in table 5.16, there are two variables (self-efficacy and intrinsic goal orientation) as a significant predictor. Also, in Table 5.17, it can be seen that six variables (extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self-regulation) are not significant predictors.

In Table 5.18, variances of two predictors on mathematics achievement can be seen.

Table 5.18 Linear Stepwise Regression Analysis of Mathematics Achievement on Motivational Beliefs and Self-Regulated Learning Components

| Step | Variable | $R^2$ | Standard Error of the Estimate |
|---|---|---|---|
| 1. | Selfef | 0.130 | 3.2527 |
| 2. | Selfef, Intr | 0.152 | 3.2219 |

As seen in Table 5.18, self-efficacy is the strongest significant predictor in mathematics achievement for boys at private schools with a variance of 13 % ($R^2$ change=0.130, F(1,163)=24.412, p=0.000). The other predictor, intrinsic goal orientation, accounted for additional variance of 2.2 % ($R^2$ change= 0.022, F(1,162)=4.134, p=0.044).

Thirdly, results related with the third hypothesis of the second sub-problem are given.

**H1.2.3** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at public schools.

Before testing H1.2.3 by using Linear Stepwise Regression, its assumptions were tested.

The first assumption is sample size. According to Tabachnick and Fidell (1996), the sample size must be greater than 50+8m where m is equal to number of independent variables (N>50+8m). There are 8 independent variables for this hypothesis; therefore the sample size of this study should be greater than 114. Since the sample size of girls at public schools in the present study is 133, the sample size assumption is satisfied.

Next assumption is multicollinearity. As it is done in the previous hypotheses, again the interrelationships among girls at public schools is examined by using Pearson product moment correlations in order to check multicollinearity before examining the third hypothesis of the second sub-problem. As it can be seen in Table 5.19, the predictive variables do not have high correlations among themselves. Thus, the multicollinearity assumption is satisfied.

Table 5.19 shows the correlations of variables for girls at public schools.

Table 5.19 Pearson Product Moment Correlation for Girls at Public Schools

| Variable | Extr | Taskva | Contro | Selfef | Testan | Csu | Sr | Mach |
|---|---|---|---|---|---|---|---|---|
| Intr | 0.49 | 0.60 | 0.52 | 0.44 | -0.02 | 0.51 | 0.50 | 0.04 |
| Extr | | 0.45 | 0.53 | 0.22 | 0.33 | 0.35 | 0.39 | 0.05 |
| Taskva | | | 0.44 | 0.62 | 0.05 | 0.68 | 0.62 | 0.17 |
| Contro | | | | 0.40 | 0.09 | 0.36 | 0.35 | 0.07 |
| Selfef | | | | | -0.20 | 0.54 | 0.62 | 0.22 |
| Testan | | | | | | 0.14 | -0.14 | -0.04 |
| Csu | | | | | | | 0.72 | 0.18 |
| Sr | | | | | | | | 0.13 |

Another assumption is singularity. This assumption is satisfied, because all independent variables are not combinations of other independent variables.

The fourth assumption is related to outliers. The mean is 9.52 and the 5 % trimmed mean is 9.45. Since the difference between these two values is low, there is no outlier. In other words, outlier assumption is satisfied.

The fifth assumption is normality. In order to test the normality, Kolmogorov-Smirnov statistics is used. The significance value is found as 0.002. It reveals that there is a violation of the assumption of normality, but this is quite common in larger samples (Pallant, 2001 p. 59). In order to test the normality, the normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots it is observed that each score is plotted against the expected value from the normal distribution. According to Pallant (2001), if a reasonably straight line is obtained, it suggests a normal distribution. The scores of the achievement test appear to be reasonably normally distributed in the present study. Thus, normality assumption is satisfied.

The last assumption is linearity. In linearity, the residuals should have a straight line relationship with dependent variable score (Pallant, 2001). In the present study, the normal p-p plot of regression standardized residual shows that residuals have a straight line relation with dependent variable. Thus, the linearity assumption is satisfied.

The stated hypothesis (H1.2.3) is examined by using Linear Stepwise Regression at a significance level of 0.05.

Table 5.20 shows the results of linear stepwise regression analysis. According to this analysis, there is one predictive variable on mathematics achievement.

Table 5.20 Linear Stepwise Regression Analysis Results for the Effect of One Predictive Variable on Mathematics Achievement

| Regression Statistics | | | | | |
|---|---|---|---|---|---|
| Multiple R | 0.220 | | | | |
| R Square | 0.048 | | | | |
| Adjusted R Square | 0.041 | | | | |
| Standard Error | 3.881 | | | | |
| | df | SS | MS | F | Sig.F |
| Regression | 1 | 100.546 | 100.546 | 6.677 | 0.011 |
| Residual | 131 | 1972.657 | 15.058 | | |
| Total | 132 | 2073.203 | | | |

Table 5.20 indicates that one variable (self-efficacy) explain a significant amount of variance in students' mathematics achievement, $R^2$=0.048, adjusted $R^2$=0.041, F(1,132)=6.677, p=0.011. Thus, 4.8 % of the variances are explained by this variable for girls at public schools.

Table 5.21 explains the individual effect of the variable. According to it, self-efficacy explains a significant amount of variance in mathematics achievement ($p<0.05$).

Table 5.21 Linear Stepwise Regression Analysis Results for Individual Effect of One Significant Predictor Variable on Mathematics Achievement

| Variables | Standardized Coefficients | Standard Error | t Ratio | p-value |
|---|---|---|---|---|
| Self-efficacy | 0.220 | 0.109 | 2.584 | 0.011 |

By the help of Table 5.21, a linear stepwise regression equation can be written in order to estimate students' mathematics achievement from one significant predictor. The regression equation with one motivational belief predictor is significantly related to mathematics achievement.

The equation is:

$Y = 0.220\ X_1$

In this equation, Y represents the predicted mathematics achievement, $X_1$ represents self-efficacy.

Intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation are excluded from the equation, because they do not have a significant contribution to variance in mathematics achievement. Table 5.22 shows the results of linear stepwise regression analysis of seven excluded variables.

Table 5.22 Results of Linear Stepwise Regression Analysis of Seven Excluded Variables

| Variables | Beta In | t | p-value | Partial Correlation | Tolerance |
|---|---|---|---|---|---|
| Intr | -0.066 | -0.694 | 0.489 | -0.061 | 0.810 |
| Extr | -0.001 | -0.016 | 0.987 | -0.001 | 0.950 |
| Taskva | 0.056 | 0.515 | 0.608 | 0.045 | 0.611 |
| Contro | -0.19 | -0.199 | 0.842 | -0.017 | 0.838 |
| Testan | 0.007 | 0.082 | 0.935 | 0.007 | 0.961 |
| Csu | 0.093 | 0.920 | 0.359 | 0.080 | 0.714 |
| Sr | -0.002 | -0.021 | 0.983 | -0.002 | 0.619 |

A linear stepwise regression is performed in order to see which motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety) and self-regulated learning components (cognitive strategy use and self-regulation) could account for the mathematics achievement. As it can be seen in Table 5.21, there are one variable (self-efficacy) as a significant predictor. In addition, in Table 5.22, it can be seen that seven variables (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self-regulation) are not significant predictors.

In table 5.23, variances are given according to linear stepwise regression analysis of mathematics achievement.

Table 5.23 Linear Stepwise Regression Analysis of Mathematics Achievement on Motivational Beliefs and Self-Regulated Learning Components

| Step | Variable | $R^2$ | Standard Error of the Estimate |
|---|---|---|---|
| 1. | Selfef | 0.048 | 3.8805 |

Self-efficacy is the only significant predictor in mathematics achievement for girls at public schools with a variance of 4.8 %

($R^2$ change=0.048, F(1,131)=6.677, p=0.011).

Finally, results related with the last hypothesis of the second sub-problem are given.

**H1.2.4** The eight variables together do not explain a significant amount of variance in *girls'* mathematics achievement at private schools.

Before testing H1.2.4 by using Linear Stepwise Regression, its assumptions were tested.

The first assumption is sample size. The same inequality which is N>50+8m is used. N represents the sample size and m represents the number of independent variables. There are 8 independent variables for this hypothesis; therefore the sample size of this study should be greater than 114. Since the sample size of girls at private schools in the present study is 170, the sample size assumption is satisfied.

Another assumption is multicollinearity. As it is done in the previous hypotheses, again the interrelationships among girls at private schools is examined by using Pearson product moment correlations in order to check multicollinearity before examining the last hypothesis of the second sub-problem. As it can be seen in Table 5.24, the predictive variables do not have high correlations among themselves. Thus, the multicollinearity assumption is satisfied.

In Table 5.24, correlations of variables are given for girls at private schools.

Table 5.24 Pearson Product Moment Correlation for Girls at Private Schools

| Variable | Extr | Taskva | Contro | Selfef | Testan | Csu | Sr | Mach |
|---|---|---|---|---|---|---|---|---|
| Intr | 0.25 | 0.52 | 0.36 | 0.35 | -0.09 | 0.50 | 0.46 | 0.04 |
| Extr | | 0.22 | 0.37 | 0.05 | 0.34 | .020 | .011 | -0.08 |
| Taskva | | | 0.44 | 0.63 | -0.25 | 0.51 | 0.60 | 0.27 |
| Contro | | | | 0.32 | -0.02 | 0.29 | 0.32 | 0.01 |
| Selfef | | | | | -0.47 | 0.33 | 0.51 | 0.37 |
| Testan | | | | | | -0.05 | -0.23 | -0.26 |
| Csu | | | | | | | 0.68 | 0.12 |
| Sr | | | | | | | | 0.24 |

Another assumption is singularity. This assumption is satisfied, because all independent variables are not combinations of other independent variables.

Next assumption is related to outliers. The mean is 15.46 and the 5 % trimmed mean is 15.61. Since the difference between these two values is low, there is no outlier. In other words, outlier assumption is satisfied.

Another assumption is related to normality. In order to test the normality, Kolmogorov-Smirnov statistics is used. The significance value is found as 0.000. It reveals that there is a violation of the assumption of normality, but this is quite common in larger samples (Pallant, 2001 p. 59). In order to test the normality, the normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots it is observed that each score is plotted against the expected value from the normal distribution. According to Pallant (2001), if a reasonably straight line is obtained, it suggests a normal distribution. The scores of the achievement test appear to be reasonably normally distributed in the present study. Thus, normality assumption is satisfied.

The last assumption is linearity. In linearity, the residuals should have a straight line relationship with dependent variable score (Pallant, 2001). In the present study, the normal p-p plot of regression standardized residual shows that residuals have a straight line relation with dependent variable. Thus, the linearity assumption is satisfied.

The stated hypothesis (H1.2.4) is examined by using Linear Stepwise Regression at a significance level of 0.05.

Table 5.25 shows the linear stepwise regression analysis results of effect of one variable on mathematics achievement.

Table 5.25 Linear Stepwise Regression Analysis Results for the Effect of One Predictive Variable on Mathematics Achievement

| Regression Statistics | | | | | |
|---|---|---|---|---|---|
| Multiple R | 0.366 | | | | |
| R Square | 0.134 | | | | |
| Adjusted R Square | 0.128 | | | | |
| Standard Error | 3.2611 | | | | |
| | df | SS | MS | F | Sig.F |
| Regression | 1 | 275.617 | 275.617 | 25.917 | 0.000 |
| Residual | 168 | 1786.595 | 10.634 | | |
| Total | 169 | 2062.212 | | | |

Table 5.25 indicates that one variable (self-efficacy) explains a significant amount of variance in students' mathematics achievement, $R^2$=0.134, adjusted $R^2$=0.128, F(1,169)=25.917, p=0.000. Thus, 13.4 % of the variances are explained by this variable for girls at private schools.

Table 5.26 explained the individual effect of the variable. According to it, self-efficacy explains a significant amount of variance in mathematics achievement ($p<0.05$).

Table 5.26 Linear Stepwise Regression Analysis Results for Individual Effect of One Significant Predictor Variable on Mathematics Achievement

| Variables | Standardized Coefficients | Standard Error | t Ratio | p-value |
|---|---|---|---|---|
| Self-efficacy | 0.366 | 0.077 | 5.091 | 0.000 |

By the help of Table 5.26, a linear stepwise regression equation can be written in order to estimate students' mathematics achievement from one significant predictor. The regression equation with one motivational belief predictor is significantly related to mathematics achievement.

The equation is:

$Y = 0.366\ X_1$

In this equation, Y represents the predicted mathematics achievement, $X_1$ represents self-efficacy.

Intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation are excluded from the equation, because they do not have a significant contribution to variance in mathematics achievement. Table 5.27 shows the results of linear stepwise regression analysis of seven excluded variables.

Table 5.27 Results of Linear Stepwise Regression Analysis of Seven Excluded Variables

| Variables | Beta In | t | p-value | Partial Correlation | Tolerance |
|---|---|---|---|---|---|
| Intr | -0.100 | -1.314 | 0.191 | -0.101 | 0.879 |
| Extr | -0.099 | -1.380 | 0.169 | -0.106 | 0.997 |
| Taskva | 0.066 | 0.711 | 0.478 | 0.055 | 0.600 |
| Contro | -0.115 | -1.521 | 0.130 | -0.117 | 0.901 |
| Testan | -0.110 | -1.355 | 0.177 | -0.104 | 0.778 |
| Csu | 0.001 | 0.007 | 0.994 | 0.001 | 0.893 |
| Sr | 0.072 | 0.857 | 0.393 | 0.066 | 0.741 |

A linear stepwise regression is performed in order to see which motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self-efficacy for learning and performance and test anxiety) and self-regulated learning components (cognitive strategy use and self-regulation) could account for the mathematics achievement. As it can be seen in Table 5.26, there is one variable (self-efficacy) as a significant predictor. Furthermore, in Table 5.27, it can be seen that seven variables (intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self-regulation) are not significant predictors.

In Table 5.28, variance is given by using linear stepwise regression analysis of mathematics achievement.

Table 5.28 Linear Stepwise Regression Analysis of Mathematics Achievement on Motivational Beliefs and Self-Regulated Learning Components

| Step | Variable | $R^2$ | Standard Error of the Estimate |
|---|---|---|---|
| 1. | Selfef | 0.134 | 3.2611 |

Self-efficacy is the only significant predictor in mathematics achievement for girls at private schools with 13.4 % ($R^2$ change=0.134, F(1,168)=25.917, p=0.000).

### 5.2.2 Results of Testing of Second Problem

The second problem of the present study is: "P2 What is the effect of gender and type of school on students' mathematics achievement, motivational beliefs and self-regulated learning components?"

Three hypotheses are stated to investigate this problem. These hypotheses are as follows:

**H2.1.** There is no statistically significant interaction between gender and type of school with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

**H2.2** There is no statistically significant mean difference between girls and boys with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

**H2.3** There is no statistically significant mean difference between public and private schools with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

Before testing hypotheses of the second problem, its assumptions were tested.

The first assumption is sample size. In order to check this assumption, N values are checked in the descriptive box. N values represent the cell sizes. Since there are more subjects in each cell than the number of dependent variables, sample size assumption is satisfied.

Another assumption is related to normality. In order to check normality assumption, both univariate normality and multivariate normality must be checked. In order to check univariate normality, Kolmogorov-Smirnov statistics is used. The significance values are found smaller than 0.05 for all dependent variables which are achievement, intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy, test anxiety,

cognitive strategy use and self regulation. They reveal that there are violations of the assumption of normality, but this is quite common in larger samples (Pallant, 2001, p. 59). In order to test the normality, the normal probability plots (labeled Normal Q-Q Plots) are checked. In these plots the observed values for each score is plotted against the expected value from the normal distribution. By controlling gender and school type, if a reasonably straight line is obtained, it suggests a normal distribution (Pallant, 2001). The scores of the achievement test appear to be reasonably normally distributed in the present study. Also multivariate normality must be checked. In order to check it, Mahalanobis distance value must be evaluated. For nine dependent variables, the critical value should be 27.88 according to Pallant (2001), but in the present study it is calculated as 64.23. Since 64.23 is greater than 27.88, there is multivariate outliers in this data file. When the highest and the lowest values for the Mahalanobis distance variable are checked, there are five values higher than 27.88. The highest value is 64.23 and the second highest value is 35.03. Since there are five people out of 577 people and the difference between scores are not too high, these people do not left out from the data file (Tabachnick & Fidell, 1996).

The third assumption is outliers. The mean and 5 % trimmed mean are 8.98 and 8.39, respectively. In other words there is no outlier.

Table 5.29 shows the mean and 5 % trimmed mean values with respect to gender and school types.

Table 5.29 Mean and 5 % Trimmed Mean Values with respect to Gender and School Type

| Dependent Variables | Gender | | | | School Type | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | Private | | Public | |
| | Mean | 5 % Trimmed Mean | Mean | 5 % Trimmed Mean | Mean | 5 % Trimmed Mean | Mean | 5 % Trimmed Mean |
| Intr | 10.35 | 10.43 | 11.28 | 11.37 | 10.27 | 10.33 | 11.63 | 11.77 |
| Extr | 16.17 | 16.43 | 16.85 | 17.14 | 16.33 | 16.58 | 16.80 | 17.14 |
| Taskva | 14.60 | 14.73 | 15.18 | 15.36 | 14.74 | 14.90 | 15.13 | 15.30 |
| Contro | 14.66 | 14.84 | 15.79 | 15.92 | 14.93 | 15.11 | 15.69 | 15.88 |
| Selfef | 13.93 | 14.00 | 13.79 | 13.83 | 14.09 | 14.16 | 13.54 | 13.57 |
| Testan | 12.68 | 12.80 | 13.10 | 13.20 | 12.11 | 12.15 | 14.00 | 14.10 |
| Csu | 44.04 | 44.23 | 47.67 | 47.99 | 44.05 | 44.28 | 48.58 | 48.87 |
| Sr | 32.85 | 32.97 | 35.95 | 36.19 | 33.93 | 34.12 | 35.23 | 35.33 |

As seen in Table 5.29, the difference between the mean scores and 5 % trimmed mean scores is low for both boys and girls. Also the same result is reached for both private schools and public schools. Thus, there is no outlier in those groups.

Another assumption is linearity. Linearity is related with straight line relationship between each pair of dependent variables (Pallant, 2001). According to scatterplots, plots do not display any evidence of non-linearity. In other words, it can be said that linearity assumption is satisfied.

Next assumption is multicollinearity. As seen in Table 5.4, dependent variables are not highly correlated with each other. Thus, there is no multicollinearity.

Another assumption is related with singularity. This assumption is satisfied because any independent variables are not combinations of other independent variables.

The final assumption is about homogeneity. In order to test equality of covariance matrices, Box's Test is used. According to it, the data violates the assumption of homogeneity of variance-covariance matrices, because the Box's M significant value is 0.000. In order to test equality of error variance, Levene's

Test is used. When total achievement, intrinsic goal orientation, task value, self-efficacy, cognitive strategy use and self-regulation do not violate the assumption of equality of variance, extrinsic goal orientation, control and learning beliefs and test anxiety violate the assumption of equality of variance. As a result of Box's M Test and Levene's Test, more conservative alpha level is set for determining the significance for that variable in the MANOVA. This alpha level is 0.025 as suggested by Tabachnick and Fidell (1996).

After testing the assumptions, the hypotheses of second problem are tested. In order to test these hypotheses, MANOVA is used with gender and school type as independent variables and mathematics achievement, six motivational beliefs and two self regulated learning components (totally nine) as dependent variables.

The first hypothesis says that (H2.1) There is no statistically significant interaction between gender and type of school with respect to achievement in mathematics, motivational beliefs and self-regulated learning components. In respect to this initial hypothesis, it is clarified that there is an overall significant mean difference among the mean scores of the nine variables with respect to gender (Wilks' $\lambda$=0.91, $F(9,565)=6.19$, $p\leq 0.025$). Thus there is no interaction between gender and school type with respect to mathematics achievement.

For testing the second hypothesis that says (H2.2) There is no statistically significant mean difference between girls and boys with respect to achievement in mathematics, motivational beliefs and self-regulated learning components, Univariate ANOVA for each dependent variable with respect to gender is conducted for follow-up tests. The results of univariate ANOVA for mathematics achievement, motivational beliefs and self-regulated learning components are given in Table 5.30.

Table 5.30 The Results of Univariate ANOVA for Mathematics Achievement, Motivational Beliefs and Self-Regulated Learning Components

| Independent Variable | Dependent Variable | F | df | Error df | Sig. | $\eta^2$ |
|---|---|---|---|---|---|---|
| Gender | Intr | 18.12 | 1 | 573 | 0.000* | 0.031 |
| | Extr | 5.68 | 1 | 573 | 0.017* | 0.010 |
| | Taskva | 4.99 | 1 | 573 | 0.026 | 0.009 |
| | Contro | 16.84 | 1 | 573 | 0.000* | 0.029 |
| | Selfef | 0.05 | 1 | 573 | 0.829 | 0.000 |
| | Testan | 0.91 | 1 | 573 | 0.342 | 0.002 |
| | Csu | 17.58 | 1 | 573 | 0.000* | 0.030 |
| | Sr | 32.11 | 1 | 573 | 0.000* | 0.053 |
| | Mach | 1.22 | 1 | 573 | 0.270 | 0.002 |

*$p \leq 0.025$

Results of Univariate ANOVA indicate that there is a statistically significant mean difference in intrinsic goal orientation scores in MSLQ with respect to gender ($F(1, 573)=18.12$, $p=0.000$). The girls' mean scores of intrinsic goal orientation are significantly higher than the boys' mean scores of intrinsic goal orientation ($M_{girls}=3.76$, $SD_{girls}=0.81$, $M_{boys}=3.45$, $SD_{boys}=0.88$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.031 shows that there was a small effect.

Table 5.30 demonstrates that there is a statistically significant mean difference in extrinsic goal orientation scores in MSLQ with respect to gender ($F(1, 573)=5.68$, $p=0.017$). The girls' mean scores of extrinsic goal orientation are significantly higher than the boys' mean scores of extrinsic goal orientation ($M_{girls}=4.21$, $SD_{girls}=0.72$, $M_{boys}=4.04$, $SD_{boys}=0.80$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.010 shows that there was a small effect.

Table 5.30 shows that there is a statistically significant mean difference in control and learning beliefs scores in MSLQ with respect to gender ($F(1, 573)=16.84$, $p=0.000$). The girls' mean scores of control and learning beliefs are significantly higher than the boys' mean scores of control and learning beliefs

($M_{girls}$=3.95, $SD_{girls}$=0.69, $M_{boys}$=3.67, $SD_{boys}$=0.85). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.029 shows that there was a small effect.

Additionally, Table 5.30 displays that there is a statistically significant mean difference in cognitive strategy use scores in MSLQ with respect to gender (F(1, 573)=17.58, p=0.000). The girls' mean scores of cognitive strategy use are significantly higher than the boys' mean scores of cognitive strategy use ($M_{girls}$=3.41, $SD_{girls}$=0.65, $M_{boys}$=3.15, $SD_{boys}$=0.74). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.030 shows that there was a small effect.

Finally, from Table 5.30, it can be understood that there is a statistically significant mean difference in self-regulation scores in MSLQ with respect to gender (F(1, 573)=32.11, p=0.000). The girls' mean scores of self regulation are significantly higher than the boys' mean scores of self regulation ($M_{girls}$=3.60, $SD_{girls}$=0.69, $M_{boys}$=3.29, $SD_{boys}$=0.62). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.053 shows that there was a moderate effect.

As a result, it can be said that there is a statistically significant mean difference in intrinsic goal orientation, extrinsic goal orientation, control and learning beliefs, cognitive strategy use and self-regulation scores individually in MSLQ with respect to gender.

From Table 5.30, it can be noticed that there is no statistically significant mean difference in task value scores of girls and boys with F(1, 573)=4.99, p=0.026. ($M_{girls}$=3.80, $SD_{girls}$=0.77, $M_{boys}$=3.65, $SD_{boys}$=0.82)

The same table shows that there is no statistically significant mean difference in self efficacy scores of girls and boys with F(1, 573)=0.05, p=0.829. ($M_{girls}$=3.45, $SD_{girls}$=0.79, $M_{boys}$=3.48, $SD_{boys}$=0.88)

Also, Table 5.30 presents that there is no statistically significant mean difference in test anxiety scores of girls and boys with F(1, 573)=0.91, p=0.342. ($M_{girls}$=3.28, $SD_{girls}$=0.98, $M_{boys}$=3.17, $SD_{boys}$=0.96)

Finally, Table 5.30 shows that there is no statistically significant mean difference in mathematics achievement scores of girls and boys with F(1, 573)=1.29, p=0.270. ($M_{girls}$=12.85, $SD_{girls}$=4.73, $M_{boys}$=12.83, $SD_{boys}$=4.69)

Consequently, it can be said that there is no statistically significant mean difference in task value, self efficacy, test anxiety and mathematics achievement scores individually in MSLQ with respect to gender.

Wilks' λ reveals that there is an overall significant mean difference among the mean scores of the nine variables with respect to school type (Wilks' λ=0.54, F(9,565)=54.22, p≤0.025).

For testing the last hypothesis that says (H2.3) There is no statistically significant mean difference between public and private schools with respect to achievement in mathematics, motivational beliefs and self-regulated learning components univariate ANOVA for each dependent variable with respect to school type is conducted for follow-up tests. The results of univariate ANOVA for mathematics achievement, motivational beliefs and self-regulated learning components are given in Table 5.31.

Table 5.31 The Results of Univariate ANOVA for Mathematics Achievement, Motivational Beliefs and Self-Regulated Learning Components

| Independent Variable | Dependent Variable | F | df | Error df | Sig. | $\eta^2$ |
|---|---|---|---|---|---|---|
| School Type | Intr | 40.68 | 1 | 573 | 0.000* | 0.066 |
| | Extr | 3.17 | 1 | 573 | 0.076 | 0.006 |
| | Taskva | 1.73 | 1 | 573 | 0.188 | 0.003 |
| | Contro | 7.76 | 1 | 573 | 0.006* | 0.013 |
| | Selfef | 4.05 | 1 | 573 | 0.045 | 0.007 |
| | Testan | 35.19 | 1 | 573 | 0.000* | 0.058 |
| | Csu | 29.34 | 1 | 573 | 0.000* | 0.049 |
| | Sr | 4.25 | 1 | 573 | 0.040 | 0.007 |
| | Mach | 429.90 | 1 | 573 | 0.000* | 0.429 |

*p≤0.025

In Table 5.31, results of univariate ANOVA indicate that there is a statistically significant mean difference in intrinsic goal orientation scores in MSLQ with respect to school type ($F(1, 573)=40.68$, $p=0.000$). The public school students' mean scores of intrinsic goal orientation are significantly higher than the private school students' mean scores of intrinsic goal orientation ($M_{public}=3.88$, $SD_{public}=0.78$, $M_{private}=3.42$, $SD_{private}=0.88$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.066 shows that there was a moderate effect.

Table 5.31 demonstrates that there is a statistically significant mean difference in control and learning beliefs scores in MSLQ with respect to school type ($F(1, 573)=7.76$, $p=0.006$). The public school students' mean scores of control and learning beliefs are significantly higher than the private school students' mean scores of control and learning beliefs ($M_{public}=3.92$, $SD_{public}=0.78$, $M_{private}=3.73$, $SD_{private}=0.78$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.013 shows that there was a small effect.

Table 5.31 shows that there is a statistically significant mean difference in test anxiety scores in MSLQ with respect to school type ($F(1, 573)=35.19$, $p=0.000$). The public school students' mean scores of test anxiety are significantly higher than the private school students' mean scores of test anxiety ($M_{public}=3.50$, $SD_{public}=0.80$, $M_{private}=3.03$, $SD_{private}=1.03$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.058 shows that there was a moderate effect.

Table 5.31 demonstrates that there is a statistically significant mean difference in cognitive strategy use scores in MSLQ with respect to school type ($F(1, 573)=29.34$, $p=0.000$). The public school students' mean scores of cognitive strategy use are significantly higher than the private school students' mean scores of cognitive strategy use ($M_{public}=3.47$, $SD_{public}=0.65$, $M_{private}=3.15$, $SD_{private}=0.73$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.049 shows that there was a moderate effect.

Finally, Table 5.31 shows that there is a statistically significant mean difference in mathematics achievement scores in MSLQ with respect to school type ($F(1, 573)=429.90$, $p=0.000$). The private school students' mean scores of mathematics achievement are significantly higher than the public school students' mean scores of mathematics achievement ($M_{public}=9.22$, $SD_{public}=3.69$, $M_{private}=15.45$, $SD_{private}=3.48$). By using commonly used guideline of Cohen (1988, as cited in Pallant, 2001), the eta squared value of 0.429 shows that there was a large effect.

As a result, it can be said that there is a statistically significant mean difference in intrinsic goal orientation, control and learning beliefs, test anxiety, cognitive strategy use and mathematics achievement scores individually in MSLQ with respect to school type.

From Table 5.31 it can be understood that there is no statistically significant mean difference in extrinsic goal orientation scores of students at public and private schools with $F(1, 573)=3.17$, $p=0.076$ ($M_{public}=4.20$, $SD_{public}=0.75$, $M_{private}=4.08$, $SD_{private}=0.77$).

In addition, Table 5.31 demonstrates that there is no statistically significant mean difference in task value scores of students at public and private schools with $F(1, 573)=1.73$, $p=0.188$ ($M_{public}=3.78$, $SD_{public}=0.74$, $M_{private}=3.69$, $SD_{private}=0.84$).

Also, from Table 5.31 it can be seen that there is no statistically significant mean difference in self efficacy scores of students at public and private schools with $F(1, 573)=4.05$, $p=0.045$. ($M_{public}=3.38$, $SD_{public}=0.79$, $M_{private}=3.52$, $SD_{private}=0.86$).

Finally, the same table shows that there is no statistically significant mean difference in self-regulation scores of students at public and private schools with $F(1, 573)=4.25$, $p=0.040$. ($M_{public}=3.52$, $SD_{public}=0.66$, $M_{private}=3.39$, $SD_{private}=0.67$).

As a result, it can be seen that there is no statistically significant mean difference in extrinsic goal orientation, task value, self efficacy and self-regulation scores individually in MSLQ with respect to school type.

## 5.3 Conclusions

By the help of the findings obtained from the examinations of each hypothesis, the following conclusions can be deduced:

1. The combined factors of school type, self efficacy and intrinsic goal orientation affect students' mathematics achievement.
2. School type, self-efficacy and intrinsic goal orientation individually explain a significant amount of variance in students' mathematics achievement.
3. Extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use, self regulation and gender do not individually explain a significant amount of variance in students' mathematics achievement.
4. The combined variables of extrinsic goal orientation and cognitive strategy use affect boys' mathematics achievement at public schools.
5. Extrinsic goal orientation and cognitive strategy use explain a significant amount of variance in boys' mathematics achievement at public schools.
6. Intrinsic goal orientation, task value, control and learning beliefs, self-efficacy, test anxiety and self regulation do not individually explain a significant amount of variance in boys' mathematics achievement at public schools.
7. The combined variables of self-efficacy and intrinsic goal orientation affect boys' mathematics achievement at private schools.
8. Self-efficacy and intrinsic goal orientation explain a significant amount of variance in boys' mathematics achievement at private schools.
9. Extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation do not individually explain a significant amount of variance in boys' mathematics achievement at private schools.
10. Self-efficacy affects girls' mathematics achievement at public schools.

11. Self-efficacy explains a significant amount of variance in girls' mathematics achievement at public schools.

12. Intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation do not individually explain a significant amount of variance in girls' mathematics achievement at public schools.

13. Self-efficacy affects girls' mathematics achievement at private schools.

14. Self-efficacy explains a significant amount of variance in girls' mathematics achievement at private schools.

15. Intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, test anxiety, cognitive strategy use and self regulation do not individually explain a significant amount of variance in girls' mathematics achievement at private schools.

16. There is no statistically significant mean difference between girls and boys with respect to self efficacy.

17. There is no statistically significant mean difference between girls and boys with respect to test anxiety.

18. There is no statistically significant mean difference between girls and boys with respect to task value.

19. There is no statistically significant mean difference between girls and boys with respect to mathematics achievement.

20. There are statistically significant mean difference between girls and boys with respect to intrinsic goal orientation in favor of girls.

21. There are statistically significant mean difference between girls and boys with respect to extrinsic goal orientation in favor of girls.

22. There are statistically significant mean difference between girls and boys with respect to control and learning beliefs in favor of girls.

23. There are statistically significant mean difference between girls and boys with respect to cognitive strategy use in favor of girls.

24. There are statistically significant mean difference between girls and boys with respect to self-regulation in favor of girls.

25. There is no statistically significant mean difference between public schools and private schools with respect to extrinsic goal orientation.

26. There is no statistically significant mean difference between public schools and private schools with respect to task value

27. There is no statistically significant mean difference between public schools and private schools with respect to self-efficacy.

28. There is no statistically significant mean difference between public schools and private schools with respect to self-regulation.

29. There are statistically significant mean difference between public schools and private schools with respect to intrinsic goal orientation in favor of public schools.

30. There are statistically significant mean difference between public schools and private schools with respect to control and learning beliefs in favor of public schools.

31. There are statistically significant mean difference between public schools and private schools with respect to test anxiety in favor of public schools.

32. There are statistically significant mean difference between public schools and private schools with respect to cognitive strategy use in favor of public schools.

33. There are statistically significant mean difference between public schools and private schools with respect to mathematics achievement in favor of private schools.

# CHAPTER 6

# DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

In this chapter, there are discussion, internal and external validity, implications and some recommendations for further studies. The first part includes interpretation of the study and discussion of the results. The second part includes internal and external validity of the present study. Next part includes implications. Finally, the last part consists of some recommendations for further studies.

## 6.1 Discussion

In the present study, understanding the variables that affect mathematics achievement and investigating the effects of these variables between girls and boys with respect to school types on mathematics achievement are the purposes. In addition to these purposes, comparing the mean scores of boys and girls with each other and comparing the mean scores of public school students and private school students are other purposes. In order to fulfill these purposes, the data is gathered from seventh grade students. In this section the results of the analyses will be discussed.

Intrinsic goal orientation, extrinsic goal orientation, task value, control and learning beliefs, self efficacy for learning and performance, test anxiety, cognitive strategy use, self-regulation, gender and school type are the variables of mathematics achievement as the initial purpose. Table 5.4 shows the correlations among these variables. According to that table, task value, self-efficacy for learning and performance and self-regulation are positively correlated with

mathematics achievement. In a research, one of the results showed that self efficacy was positively related to students' mathematics achievement (Eshel & Kohavi, 2003). Task value and self-regulation may also have positive correlations with mathematics achievement, because when students give value to the topic they studied, they become more successful. Also, when they regulated themselves, the level of achievement increases since they are own desirous on that. On the other hand, intrinsic goal orientation, extrinsic goal orientation, control and learning beliefs, test anxiety, cognitive strategy use and school type are negatively correlated with mathematics achievement.

According to the regression results of the present study, school type has a significant effect on students' mathematics achievement accounting for 42.7 % of the variance. In other words, school type is very important in students' mathematics achievement.

In a study of Lubienski, Crane and Lubienski (2008), one of their purposes was to investigate what students gain over time at public and private schools. In the related study, the data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K) was used. According to the results of the study, raw scores for both kindergarten and fifth grades were higher at private schools than at public schools. But after taking into consideration the students' demographics at both two grades and both two types of schools, the scores became nearly similar with each other. Their study also supports the result of this present study. As a result, since the demographics and the students' backgrounds are not controlled in the present study, some differences were observed between private schools and public schools similar to the study of Lubienski, Crane and Lubienski at 2008.

Another significant effect of students' mathematics achievement is self-efficacy. Self efficacy has a variance of 3.6 % on mathematics achievement. In a study done in Greece, self-efficacy was proved as the most significant predictor of performance, cognitive and regulatory strategies (Metallidou & Vlachou, 2007). In that study, the sample was 114 fifth grade and 149 sixth grade students. Another survey was constructed in order to evaluate self efficacy and motivational orientations and to predict variables for mathematics achievement.

The result of this survey was also supported the result of the present study. According to that study self efficacy was a predictor of motivational orientation and mathematics performance (Stevens et al, 2004). Moreover, Multon, Brown and Lent (1991) concluded the same result with the present study. According to their research self efficacy has a variance of 14 %. For Wolters and Pintrich (1998), self-efficacy was a predictor of students' mathematics achievement. In another research done by Ozturk (2003), self efficacy had a significant effect on students' mathematics achievement accounting for 7.4 % of the variance. In addition to these researches, a study was done in Ankara, Turkey with 64 seventh grade students. The main purpose of the study was to investigate the effects of spreadsheet and dynamic geometry software on the mathematics achievement and mathematics self-efficacy. According to the results of the study, there was no significant mean difference between girls and boys with respect to mathematics achievement and mathematics self-efficacy (Isiksal & Askar, 2005). In the present study, self-efficacy is also one of the predictors for three of four groups. As a result, it can be said that many researches supported the present study's result about effects of self efficacy on mathematics achievement. In other words, they supported the importance of self-efficacy on mathematics achievement similar to the present study. As a result, self-efficacy is a predictor of achievement in many researches. The present study also supports this conclusion.

The last significant effect of mathematics achievement in the present study is about intrinsic goal orientation. It has a significant effect on students' mathematics achievement accounting for a variance of 0.4 %. Being motivated intrinsically is important for achievement. According to the example given by Zimmerman (2002), students need to be intrinsic task interested. Also goal orientation is an important part in self-regulated learning since the goal orientation includes the answers of why questions which are one part of questions in self-regulated learning (Zimmerman, 2005). In the study done by Eshel and Kohavi (2003), it was concluded that intrinsic motivation was a predictor for mathematics achievement. Moreover, the study of Metallidou and Vlachou (2007) supported this result, because in their study intrinsic goal orientation is the second important motivational component. Thus, being motivated intrinsically is

important for achievement as the result of the present study. Also many researches support this idea.

As a result, school type, self-efficacy and intrinsic goal orientation can be the predictors of mathematics achievement accounting for a total variance of 46.6 % which is very high. As mentioned above, these predictors can be supported by many researches for achievement.

The regression analyses are also conducted for boys at public schools, boys at private schools, girls at public schools and girls at private schools separately.

According to the regression results for boys at public schools, extrinsic goal orientation and cognitive strategy use are two predictors of mathematics achievement with a total variance of 12.6 %. The variance is 6.4 % for extrinsic goal orientation. It does not have a significant effect on girls at both school types and on boys at private schools. For Deci and Ryan (1985), extrinsic incentives had negative effects on students' mathematics achievement. It was a predictor for only one group and the reason of this can be explained by Deci and Ryan's study. Maybe, school type has some effects on being a predictor for boys at public schools. In public schools, extrinsic orientations may take the attention of boys. Cognitive strategy use is another effect on mathematics achievement. Although it does not have significant effects on girls studying at both school types and boys at private schools, it has significant effect on mathematics achievement of boys at public schools accounting for a variance of 6.2 %. Since cognitive strategy use includes some scales such as rehearsal, elaboration, organisation and critical thinking, they may affect boys' achievement.

According to the regression results for boys at private schools, self-efficacy and intrinsic goal orientation are two predictors of mathematics achievement accounting for a total variance of 15.2 %. The variance of self-efficacy is 13 %. In the study of Al-Balhan (2007), students' academic performance in mathematics was studied. It was done in Kuwait among middle school students. In the experimental group there were 87 male students and 48 female students. 39 students were from the government schools and 96 students were from private schools. 84 were urban-district students and 51 were suburban

district students. According to the results of the study, the highest grade improvement in mathematics was found in male students at private schools who were living in the urban areas of Kuwait in the experimental group. Another predictor for boys at private school is intrinsic goal orientation. Its variance is 2.2 %. In the study of Nagy et al (2006), 1,148 students were chosen from secondary schools in Germany. According to their study, one of the results indicated that males were better than females in mathematics achievement test and males had higher math self-concepts and intrinsic values than females. The predictors for boys at private school are also the predictors of total regression. Thus, the result is as it was hoped.

According to the regression results for girls at public schools and private schools, there is only one predictor which is self-efficacy. The variance is 4.8 % for girls at public schools. On the other hand, the variance is 13.4 % for girls at private schools and it is the greatest variance for self efficacy when compared with boys at private schools and girls at public schools. The effect of self-efficacy is not a surprise since it is a predictor in many groups in the present study. Also many researches support it as a predictor for achievement.

In consequence, it can be noticed that the variances of private school students are higher than the variances of public school students. The reason of this result can be related to students' applications of instruments. It is thought that private school students fill out the instruments with more attention.

In the present study, the other variables which are task value, control and learning beliefs, test anxiety and self regulation do not have statistically significant effects on students' mathematics achievement. Also there is no statistically significant effect of these variables on boys and girls at both school types. In a research, it was concluded that beliefs had no statistically significant direct effects on mathematics outcomes, but they had affected by family education background (Papanastasiou, 2002). These conclusions are similar to the conclusions about the effects of beliefs in this study. Also, in the study of Wolters and Pintrich (1998), task value was not a predictor of performance which was similar to the result of our study about task value. In another study, value of geometry was not a predictive for students' achievement (Pokay & Blumenfeld,

1990). In the present study, it is hoped to observe significant contribution of self-regulation to the variances of students' mathematics achievement, but such a result is not obtained. The reason of it can be the issue at the operational level of our measurement of self-regulation whether it is appropriate or not.

In the second part of the present study, the mean differences of girls and boys and the mean differences of private and public schools are tested with respect to achievement in mathematics, motivational beliefs and self-regulated learning components.

According to the present study, there is a significant mean difference in intrinsic goal orientation, extrinsic goal orientation, control and learning beliefs, cognitive strategy use and self-regulation scores of boys and girls, in favor of girls. In other words, girls are motivated intrinsically and extrinsically better than boys. Also they control their learning beliefs, they use cognitive strategies and regulate themselves easily when they are compared to boys. The main reason of this mean difference may be the growing up factors. Many families in Turkey grow their daughters with many responsibilities. They should study at universities, they should have jobs, and they should be good mothers and wives. All of these factors which can be observed during growing up affect their study habits during the school years.

In the current study, there is no statistically significant mean difference in task value, self efficacy, test anxiety and mathematics achievement scores of boys and girls. In other words, boys and girls are equal in giving value to the tasks they studied, in being panic because of test, in being efficient by themselves and in being successful in mathematics. These variables can affect people in both gender equally.

Finally, in this study, there is a significant mean difference in intrinsic goal orientation, control and learning beliefs, test anxiety and cognitive strategy use scores between public schools and private schools, in favor of public schools. In other words, students at public schools are oriented intrinsically easily. Also, they control their learning beliefs and use cognitive strategies better than students at private schools. The students at public schools may be in low socioeconomic status. This can affect them intrinsically. They have to study hard to have better

life standards in the future. Also this can cause anxiety in the tests. They have to get good marks for better universities and also for better jobs. Addition to these four variables, there is a significant mean difference in mathematics achievement scores between public schools and private schools, in favor of private schools. In other words, students at private schools are more successful in mathematics than the students at public schools. In Turkey, this difference is generally observed from the results of some national exams. The main reason of this difference can be related to opportunities, because private school students have better opportunities than public school students because of families' socioeconomic status. In Turkey, students of families with high socioeconomic standards can study in private schools. They have chance for tutoring or the concrete materials they used at school are better than students from public school. All of them can be an effect for the difference in achievement between these two school types.

It is observed from this study that there is no statistically significant mean difference in extrinsic goal orientation, task value, self efficacy and self-regulation scores between two types of schools. In other words, students at both public and private schools have equality in these variables. They give value to the subjects they studied equally. They are affected equally from extrinsic motivation factors.

To sum up, it can be said that some demographic factors, growing up factors, socioeconomic factors cause some mean differences between girls and boys and between public schools and private schools.

## 6.2 Internal and External Validity

In this section, the internal and external validity of the present study will be discussed. Also, the ways of controlling the treats of internal and external validity will be explained.

### 6.2.1 Internal Validity

The internal validity means that any relationship observed among the results are only due to dependent and independent variables, not due to other variables (Onwuegbuzie, 2000).

In the present study, the students are at the same grade level and at the same ages. The number of girls and boys is almost equal to each other. From these points of view, there is no subject characteristic treat, but from the point of intelligence, attitude and socioeconomic status, there is subject characteristic threat. In the current study, students' socioeconomic status may affect the results of the study. Also, the intelligence and the attitudes of students were different from each other. Thus, it can be said that subject characteristic is a treat in the internal validity of the present study.

Loss of subject is not a threat for this study, because the questionnaires are applied for once. Thus, loss of subject because of illness or family relocation is not possible.

Additionally, location is not a threat for the present study, because the questionnaires are applied at each school nearly at the same time. On the other hand, physical conditions of classrooms such as sizes and lighting are almost similar with each other. As a result, location is not a threat in internal validity of the present study.

Instrumentation is not a threat in this study since exactly the same instruments are used in the study.

Data collector characteristic is not a threat in the study, because all the teachers followed the same procedure during applying questionnaires.

Finally, during gathering data, students did not write their names on the instruments. Each student filled two instruments and each instrument was matched with the student's second instrument by means of numbering them. Each student had a number and they wrote their numbers on the instruments. Thus, the students were confident when filling the questionnaires.

### 6.2.2 External Validity

The external validity means that the results of the study can be generalized to groups and environments outside of the settings of the study (Onwuegbuzie, 2000).

In the present study, the results can only generalized to the students with the same characteristics such as grade levels. Also, the classroom settings must be similar to the classrooms in this study in order to generalize.

## 6.3 Implications

In the present study, it was found that seventh grade students' mathematics achievement was explained by school type, self efficacy and intrinsic goal orientation. By taking into consideration the findings related to school type and mathematics achievement, the present study can imply that the families should guide their children in order to improve their mathematics achievement. Furthermore, in teaching/learning process students should be active mentally/physically, the concrete materials should also be used, and both meaningful understanding and procedural skills should be emphasized.

According to the findings on the motivational beliefs and mathematics achievement, students should have high self-efficacy beliefs in order to increase their mathematics achievement. Although one of our findings related to intrinsic goal orientation contradicts the finding of Zimmerman (1994, as cited in Spitzer, 2000) who suggests that students should have intrinsic motivation. In the present study this is also suggested. Furthermore, teachers should have students use their intrinsic motivation in order to increase their achievement.

By taking into the findings of the present study it can be suggested that The Ministry of National Education should have teachers give importance on the motivational beliefs and self-regulated learning components stated in the new elementary mathematics curriculum. For example, the teachers should have in-service training program on how to increase students' efficacy and intrinsic motivation. The pre-service teachers should also have education on these subjects.

To sum up, this study shows that there are some variables that affect mathematics achievement and school type is an important factor in it. All these results imply the ways of increasing mathematics achievement written above.

## 6.4 Recommendations for Further Studies

There are some recommendations for further studies like the following:

- A qualitative study should be conducted including the same variables examined in the present study, especially self-efficacy and intrinsic goal orientation.
- The present study should be replicated by using large sample and/or including the other grade levels.
- A similar study should be conducted for other subjects such as physics and chemistry.
- Experimental study should be organized to explain the effects of the variables stated in the present study on the mathematics achievement.

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# APPENDIX A

## ÖĞRENMEYE GÜDÜMLÜ YAKLAŞIMLAR ANKETİ

**ANKET NUMARASI:**

Değerli Öğrenciler:
Elinizdeki anket, bir dersi öğrenmenize ilişkin stratejilerinizi belirlemek amacıyla geliştirilmiştir. Bu ankette görüş ve yargı bildiren cümleler bulunmaktadır. Bu ifadelerin size uygunluğunu belirtmeniz istenmektedir. Bu cümlelerin **doğru veya yanlış cevapları yoktur**. Doğru cevap, size **en çok uygun olan seçenektir**. İfadeleri cevaplarken almakta olduğunuz **bu derste yaşadıklarınızı** düşününüz ve **en uygun** olan seçeneği işaretleyiniz. Aşağıdaki örnekte yapıldığı gibi, ***"Kesinlikle katılmıyorum", "Katılmıyorum", "Kararsızım", "Katılıyorum"*** *veya* ***"Kesinlikle katılıyorum"*** ifadelerinden **birinin** içine **X** işareti koyunuz.

| Kesinlikle katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|
| | | | **X** | |

Örnek olarak seçilen

Lütfen bütün cümleleri cevaplandırınız. Bu ankete verdiğiniz bütün bilgiler **gizli** tutulacak ve **yalnızca araştırmacı** tarafından kullanılacaktır. Aşağıda istenen kişisel bilgileriniz, anketin güvenilir olması için gerekmektedir. Araştırmaya katkılarınızdan dolayı çok teşekkür ederim.

| **Cinsiyetiniz:** **Kız ○** **Erkek ○** | Kesinlikle katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|---|
| 1. Çalışırken uygun yöntemleri kullanırsam, matematik konularını öğrenebilirim. | | | | | |
| 2. Matematik sınavı sırasında, arkadaşlarıma göre ne kadar kötü yaptığımı düşünürüm. | | | | | |
| 3. Matematik dersinde öğrendiklerimi diğer derslerde kullanabileceğimi düşünüyorum. | | | | | |
| 4. Matematik dersinden çok iyi bir not alacağıma inanıyorum. | | | | | |
| 5. Matematik dersinin çalışma kaynaklarındaki en zor konularını bile anlayabileceğime eminim. | | | | | |
| 6. Matematik dersinden iyi bir not almak beni en mutlu edecek şeydir. | | | | | |
| 7. Matematik dersinin konularını öğrenemiyorsam bu benim hatamdır. | | | | | |
| 8. Matematik dersinin konularını öğrenmek benim için çok önemlidir. | | | | | |
| 9. Not ortalamamı yükseltmek için, matematik dersinden iyi bir not almam önemlidir. | | | | | |
| 10. Matematik dersinde öğretilen temel bilgileri öğrenebileceğim konusunda kendime güveniyorum. | | | | | |
| 11. Eğer becerebilirsem, sınıftaki öğrencilerin çoğundan daha iyi not almak istiyorum. | | | | | |
| 12. Matematik sınavındayken başarısızlığımın getireceği sonuçları düşünürüm. | | | | | |
| 13. Matematik dersinde, öğrenilmesi zor da olsa, merakımı uyandıran konuları tercih ederim. | | | | | |
| 14. Matematik dersinin konularıyla çok ilgiliyimdir. | | | | | |
| 15. Yeterince çaba gösterirsem, matematik dersinin konularını anlarım. | | | | | |
| 16. Sınav sırasında kendimi rahatsız ve tedirgin hissederim. | | | | | |
| 17. Matematik dersini gayet iyi yaparım. | | | | | |
| 18. Matematik dersinde beni en mutlu eden şey, konuları elimden geldiğince iyi anlamaya çaba göstermemdir. | | | | | |
| 19. Ödevlerimi yüksek not için değil, bir şeyler öğrenmek için matematikten seçerim. | | | | | |
| 20. Matematik dersinin konularını anlamıyorsam, bunun sebebi yeterince çalışmamamdır. | | | | | |

| | Kesinlikle katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|---|
| 21. Matematik dersini severim. | | | | | |
| 22. Matematik sınavı sırasında kalbimin hızlı hızlı çarptığını hissederim. | | | | | |
| 23. Matematik dersinde çok başarılı olmak istiyorum, çünkü çevremdekilere başarabileceğimi göstermem önemlidir. | | | | | |
| 24. Matematik çalışırken, çalıştığım konunun ana hatlarını belirlerim. | | | | | |
| 25. Matematik dersi sırasında başka şeyler düşündüğüm için, genellikle önemli noktaları kaçırırım. | | | | | |
| 26. Matematik çalışırken konuları bir arkadaşıma anlatmayı denerim. | | | | | |
| 27. Genellikle dikkatimi toplayabileceğim bir yerde ders çalışırım. | | | | | |
| 28. Ders çalışırken kendime çalıştıklarımı aklımda toparlayacak sorular sorarım. | | | | | |
| 29. Matematik çalışırken içim sıkılır ve planladıklarımı bitirmeden çalışmayı bırakırım. | | | | | |
| 30. Matematik dersinde öğretilen bilgilerin ikna ediciliğini sık sık sorgularım. | | | | | |
| 31. Matematik çalışırken, çalıştıklarımı yüksek sesle kendi kendime söylerim. | | | | | |
| 32. Matematikte konuları öğrenmekte zorluk çeksem bile, dersimi kendi başıma çalışırım. | | | | | |
| 33. Matematik hakkında bir şey kafamı karıştırdığında, geriye dönüp anlamaya çalışırım. | | | | | |
| 34. Matematik dersine çalışırken konunun en önemli noktalarını bulmaya çalışırım. | | | | | |
| 35. Matematik için çalışma zamanımı iyi kullanıyorum. | | | | | |
| 36. Matematik dersinden verilen ödevleri tamamlamak için diğer öğrencilerle de çalışmak isterim. | | | | | |
| 37. Matematiğe çalışırken ders notlarımı tekrar tekrar okurum. | | | | | |
| 38. Matematikte yaptıklarımızı beğenmesem de başarılı olmak için epey çalışıyorum. | | | | | |
| 39. Dersi organize etmeme yardımcı olacak basit grafikler, şemalar veya tablolar yaparım. | | | | | |

| | Kesinlikle katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|---|
| 40. Çalışma zamanımın bir kısmını, sınıf arkadaşlarımla ders konularını tartışmak için ayırırım. | | | | | |
| 41. Matematik dersinin kaynaklarını başlangıç noktası olarak alır, konular üzerinde kendi fikirlerimi geliştiririm. | | | | | |
| 42. Bir çalışma programına bağlı kalmakta zorlanıyorum. | | | | | |
| 43. Matematik çalışırken, farklı kaynaklardaki bilgileri bir araya getiririm. | | | | | |
| 44. Matematik dersinde çalıştığım konuları anladığımdan emin olmak için kendime sorular sorarım. | | | | | |
| 45. Matematik konularını iyi anlamadığım zaman, öğretmenimden açıklamasını isterim. | | | | | |
| 46. Matematikteki önemli kavramları hatırlamak için anahtar kelimeleri ezberlerim. | | | | | |
| 47. Matematik çalışırken zorlandığımda, ya çalışmayı bırakırım ya da sadece kolay kısımları çalışırım. | | | | | |
| 48. Mümkün oldukça, matematik dersindeki bilgilerim ile diğer derslerdeki bilgilerimi ilişkilendirmeye çalışırım. | | | | | |
| 49. Matematik çalışırken, ders notlarımın üzerinden geçer ve önemli kavramların listesini çıkarırım. | | | | | |
| 50. Matematik çalışırken, yeni çalıştığım konuları daha öncekilerle ilişkilendirmeye çalışırım. | | | | | |
| 51. Kendi fikirlerimi matematik dersinde öğrendiklerim ile ilişkilendirmeye çalışırım. | | | | | |
| 52. Matematik çalışırken kısa özetler çıkarırım. | | | | | |
| 53. Matematikte öğretilen konuyu anlayamadığım zaman sınıf arkadaşlarımdan yardım isterim. | | | | | |
| 54. Matematik dersine düzenli olarak gelirim. | | | | | |
| 55. Matematik dersinin kaynakları sıkıcı olduklarında bile, bitirinceye kadar çalışmayı beceririm. | | | | | |
| 56. Sınıf arkadaşlarımın arasından gerektiğinde danışabileceklerimi belirlemeye çalışırım. | | | | | |
| 57. Matematik çalışırken iyi anlamadığım konuları belirlemeye çalışırım. | | | | | |
| 58. Diğer etkinliklerim yüzünden matematik çalışmaya çok zaman ayırmadığımı fark ediyorum. | | | | | |

| | Kesinlikle katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|---|
| 59. Matematik çalışırken kendime sürekli hedefler koyarım. | | | | | |
| 60. Matematik sınavından önce ders notlarımı gözden geçirecek zamanı bulamam. | | | | | |

# APPENDIX B

# MATEMATİK BAŞARI TESTİ

**ANKET NUMARASI:**

**Yönerge:** Bu testte toplam 20 soru bulunmaktadır. Lütfen soruları dikkatli okuduktan sonra cevabı işaretleyiniz. Bu test sadece araştırma amacıyla kullanılacaktır ve verdiğiniz cevaplar kesinlikle gizli tutulacaktır. Yardımlarınız için çok teşekkür ederim.

**1)** (12: 6) + (21–8) işleminin sonucu kaçtır?

A) 10 B) 12 C) 15 D) 18

**2)** a= -2 ve b= 1 ise $a^{b} + b$ ifadesinin sonucu kaçtır?

A) -2 B) -1 C) 0 D) 1

**3)** $\dfrac{\left(\frac{3}{4}:\frac{4}{5}\right).\left(\frac{7}{2}.\frac{4}{3}\right)}{\left(\frac{6}{5}-\frac{1}{5}\right):\left(\frac{5}{7}+\frac{2}{7}\right)}$ işleminin sonucu kaçtır?

A) $\frac{3}{8}$ B) $\frac{15}{8}$ C) $\frac{27}{8}$ D) $\frac{35}{8}$

**4)** $1-\dfrac{1}{1-\dfrac{1}{1+\dfrac{1}{2}}}$ işleminin sonucu kaçtır?

A) -2 B) -1 C) 2 D) 0

**5)** $\dfrac{11.10^{-16}+1{,}3.10^{-15}}{36.10^{-13}-1{,}2.10^{-12}}$ işleminin sonucu kaçtır?

A) $\dfrac{1}{1000}$ B) $\dfrac{1}{100}$ C) $\dfrac{1}{10}$ D) 1

**6)** $\dfrac{1{,}25}{0{,}25}+\dfrac{0{,}9}{0{,}03}+\dfrac{0{,}45}{0{,}09}$ işleminin sonucu kaçtır?

A) 44 B) 40 C) 35 D) 30

**7)** $5x - 6 = 4x + 9$ denkleminin çözüm kümesi aşağıdakilerden hangisidir?

A) {8} B) {11} C) {15} D) {19}

**8)** $1+\dfrac{6}{5-x}=4$ denkleminde x kaçtır?

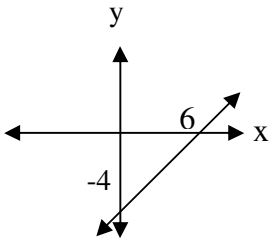
A) -1 B) 1 C) 2 D) 3

**9)** $2(x+3)+7 = 25-2(x-2)$ denkleminin çözüm kümesi aşağıdakilerden hangisidir?

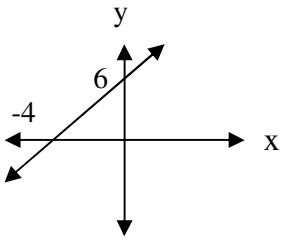
A) {5} B) {4} C) {3} D) {2}

**10)** 2x-3y = 12 doğrusunun grafiği aşağıdakilerden hangisidir?

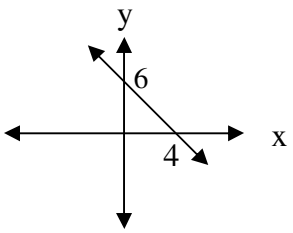
A)



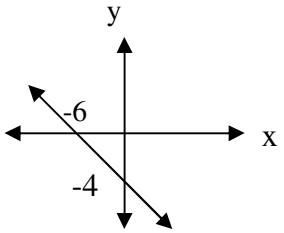

B)




C)




D)




**11)** Bir babanın yaşı, oğlunun yaşının 3 katıdır. 6 yıl önce babanın yaşı oğlunun yaşının 5 katıydı. Baba bugün kaç yaşındadır?

A) 46 B) 36 C) 30 D) 24

**12)** A(a+1, –b) noktasının orijine göre simetriği olan nokta (3, 5) noktası ise, a+b toplamı kaçtır?

A) -1 B) -2 C) 1 D) 2

**13)** $4<3x-2\leq 16$ eşitsizliğini sağlayan x doğal sayılarının toplamı kaçtır?

A) 6 B) 12 C) 16 D) 18

**14)** a, b, c doğal sayılar olmak üzere, $\frac{a}{b}=\frac{5}{4}$ ve $\frac{b}{c}=\frac{3}{4}$ ise

$\frac{a}{c}$ değeri kaçtır?

A) $\frac{16}{9}$ B) $\frac{16}{15}$ C) $\frac{15}{16}$ D) $\frac{9}{16}$

**15)** a sayısı b+1 ile doğru orantılıdır. a=4 iken b=7 ise a=1 iken b kaçtır?

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

**16)** %10 u ile %30 unun toplamı 320 olan sayı kaçtır?

A) 200 B) 400 C) 600 D) 800

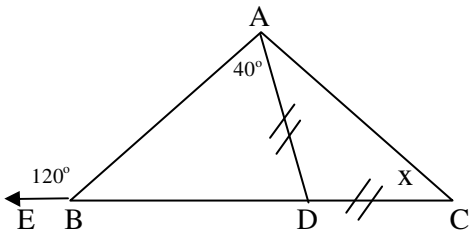
**17)** %80 karla satış fiyatı tespit edilen gömlekler satılamayınca, satış fiyatı üzerinden %20 indirim yapılıyor. Yeni satış fiyatına göre kar % kaçtır?

A) %14 B) %34 C) %24 D) %44

**18)** Bütünler iki açıdan biri, diğerinin 9 katından $20^o$ eksik olduğuna göre, küçük açı kaç derecedir?

A) $10^o$ B) $20^o$ C) $30^o$ D) $40^o$

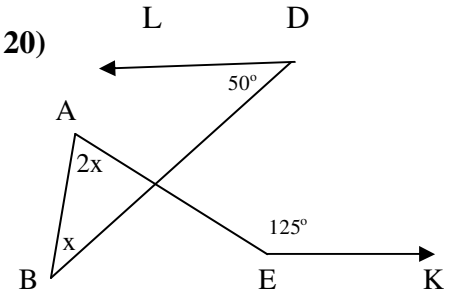
**19)**




Şekildeki ABC üçgeninde, $m(\widehat{ABE}) = 120^o$, $m(\widehat{BAD}) = 40^o$ ve $|AD| = |DC|$ olduğuna göre, x kaç derecedir?

A) $30^o$ B) $35^o$ C) $40^o$ D) $45^o$

**20)**




Şekilde [DL // [EK dır. Verilenlere göre x kaç derecedir?

A) $25^o$ B) $20^o$ C) $15^o$ D) $10^o$

# APPENDIX C

## TABLE OF SPECIFICATION FOR MATHEMATICS ACHIEVEMENT TEST

| Question number | Subject | Knowledge | Comprehension | Application |
|---|---|---|---|---|
| 1 | Integers | X | | |
| 2 | Integers | | X | |
| 3 | Rational Numbers | X | | |
| 4 | Rational Numbers | X | | |
| 5 | Very big and small numbers | X | | |
| 6 | Very big and small numbers | | X | |
| 7 | Equations | X | | |
| 8 | Equations | X | | |
| 9 | Equations | | X | |
| 10 | Coordinate System | | X | |
| 11 | Problem solving by using equations | | X | |
| 12 | Symmetry | X | | |
| 13 | Inequalities | X | | |
| 14 | Rate and Ratio | | X | |
| 15 | Rate and Ratio | X | | |
| 16 | Percentage Problems | X | | |
| 17 | Profit and Loss Problems | | X | |
| 18 | Angles on Line | X | | |
| 19 | Angles on Triangle | | X | |
| 20 | Angles on Line and Triangle | | X | |
| *TOTAL NUMBER* | | 11 | 9 | 0 |
| *TOTAL PERCENTAGE* | | **55%** | **45%** | **0%** |