THE RELATIONSHIP BETWEEN MATHEMATICS ACHIEVEMENT EMOTIONS, MATHEMATICS SELF-EFFICACY, AND SELF-REGULATED LEARNING STRATEGIES AMONG MIDDLE SCHOOL STUDENTS

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ABSTRACT

THE RELATIONSHIP BETWEEN MATHEMATICS ACHIEVEMENT EMOTIONS, MATHEMATICS SELF-EFFICACY, AND SELF-REGULATED LEARNING STRATEGIES AMONG MIDDLE SCHOOL STUDENTS

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The purpose of this study was to explain the relationship between mathematics achievement emotions, mathematics self-efficacy, and self-regulated learning strategies of middle school students. In addition, mathematics achievement emotions were examined with respect to gender and grade level. Data were collected from 2250 sixth, seventh, and eighth grade students from four districts in Ankara. Data collection instruments were Achievement Emotions Questionnaire in Mathematics (AEQ-M), Mathematics Skills Self-Efficacy (MSSE) and Self-Efficacy for Self-Regulated Learning (SESRL) scales and Self-Regulated Learning Strategies subscale of Motivated Strategies for Learning Questionnaire (MSLQ). AEQ-M, MSSE, and SESRL were adapted by the researcher.

Confirmatory Factor Analysis for Turkish version of AEQ-M yielded seven-factor emotions model with reliability coefficients ranging from .81 to .92. The results confirmed the differentiation of emotions. Turkish versions of MSSE and SESRL

scales both revealed one-factor structure while Cronbach alphas were .96 and .93, respectively. Hence, adaptations of both scales worked as intended.

Multivariate Analysis of Variance results showed that anxiety, hopelessness, and shame differed significantly by gender. Furthermore, all achievement emotions except shame displayed grade level differences. Canonical correlation results indicated that higher levels of positive emotions (enjoyment, pride) were correlated with higher levels of mathematics skills self-efficacy and self-efficacy for self-regulated learning and with greater use of self-regulated learning strategies. Yet, higher levels of negative emotions (anger, anxiety, hopelessness, boredom, shame) were correlated with lower levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and less use of self-regulated learning strategies regardless of grade levels.

Keywords: Mathematics Achievement Emotions, Mathematics Self-Efficacy, Self-Regulated Learning Strategies, Grade Level, Gender

ÖZ

ORTAOKUL ÖĞRENCİLERİNDE MATEMATİK BAŞARI DUYGULARI, MATEMATİK ÖZYETERLİĞİ VE ÖZDÜZENLEYİCİ ÖĞRENME STRATEJİLERİNİN İLİŞKİSİ

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Bu çalışma, ortaokul öğrencilerinin matematik başarı duyguları, matematik özyeterlikleri ve özdüzenleyici öğrenme stratejileri arasındaki ilişkiyi açıklamayı amaçlamıştır. Aynı zamanda, öğrencilerin matematik başarı duygularının cinsiyet ve sınıf düzeyine göre değişip değişmediği incelenmiştir. Çalışmanın verileri Ankara'nın dört ilçesinde öğrenim gören 2250 altıncı, yedinci ve sekizinci sınıf öğrencisinden toplanmıştır. Çalışmada veri toplama araçları olarak araştırmacı tarafından Türkçe'ye uyarlanan Matematik Başarı Duyguları Ölçeği (Pekrun, Goetz, Frenzel, Barchfeld ve Perry, 2011), Matematik Becerileri Özyeterlik Ölçeği (Usher, 2007), Özdüzenleyici Öğrenmeye yönelik Özyeterlik Ölçeği (Usher, 2007) ve Öğrenmede Güdüsel Stratejiler Anketi'nin Özdüzenleyici Öğrenme Stratejileri (Pintrich, Smith, Garcia ve McKeachie, 1991) alt boyutu kullanılmıştır.

Doğrulayıcı Faktör Analizi, Matematik Başarı Duyguları Ölçeği'nin yedi farklı duygu boyutunu ölçtüğü sonucunu vermektedir. Sonuçlar duyguların ayırt edilebilirliğini göstermektedir. Her bir faktörün güvenirlik katsayısı .81 ile .92 arasında değişmektedir. Matematik Becerileri Özyeterlik Ölçeği ve Özdüzenleyici

Öğrenmeye yönelik Özyeterlik Ölçeği tek faktörlü bir yapı göstermektedir. Cronbach alfa değerleri sırasıyla .96 ve .93'tür. Ölçekler beklenildiği gibi çalışmaktadır.

Çok Değişkenli Varyans analizine göre, kaygı, umutsuzluk ve utanç duyguları cinsiyete göre istatiksel olarak anlamlı değişmektedir. Ayrıca, utanç haricindeki tüm başarı duygularında sınıf seviyesine göre farklılıklar vardır. Kanonik korelasyon sonuçları, sınıf seviyesine bakılmaksızın pozitif matematik duyguları (haz, gurur) ile matematik becerileri özyeterliği, özdüzenleyici öğrenme özyeterliği ve özdüzenleyici öğrenme stratejilerinin pozitif yönde ilişkili olduğunu göstermiştir. Öte yanda, negatif duygularla (öfke, kaygı, umutsuzluk, bıkkınlık, utanç) matematik becerileri özyeterliği, özdüzenleyici öğrenme özyeterliği ve özdüzenleyici öğrenme stratejileri arasında negatif yönde ilişkili bulunmuştur.

Anahtar kelimeler: Matematik Başarı Duyguları, Matematik Özyeterliği, Özdüzenleyici Öğrenme Stratejileri, Sınıf Seviyesi, Cinsiyet

To my mother, father and brother
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LIST OF ABBREVIATIONS

MoNE: Ministry of National Education

NCTM: National Council of Teachers of Mathematics

PISA: Programme for International Student Assessment

AEQ: Achievement Emotions Questionnaire

AEQ-M: Mathematics Achievement Emotions Questionnaire

MSSE: Mathematics Skills Self-Efficacy

SESRL: Self-Efficacy for Self-Regulated Learning

MSLQ: Motivated Strategies for Learning Questionnaire

AMOS: Analysis of Moment Structures

SPSS: Statistical Package for the Social Sciences

EFA: Exploratory Factor Analysis

CFA: Confirmatory Factor Analysis

ANOVA: Analysis of Variance

MANOVA: Multivariate Analysis of Variance

CHAPTER I

INTRODUCTION

The chapter one firstly provides a brief introductory about the background of the study. The second section informs the readers about the reasons to study academic or achievement emotions especially on mathematics as a specific subject domain, while discussing the significance of the study. Finally, the definitions of the important terms in the study are given in detail.

1.1. Background of the study

Affect is a general term encompassing feelings, emotions, and moods (Boekaerts, 2007) and affective variables are posited to be predictors of learning outcomes and success in several academic domains. Due to including abstract concepts as a result of its nature, mathematics as an academic domain is highly influenced by the affective variables (Kleine, Goetz, Pekrun, & Hall, 2005). Actually, there are three concepts related to affect in mathematics education research: beliefs, attitudes, and emotions (McLeod, 1992). DeBellis and Goldin (2006) proposed a "tetrahedral" model, in which they added values as another subdomain.

Beliefs are consisted of individuals' attributions of their truths to some proposition systems. They are highly stable, cognitive, and structured; while attitude is defined as a kind of predisposition of each individual to reply positively or negatively to a situation, a concept or another person (Nicolaidou & Philippou, 2003). Values hold by people represent their personal truths including ethics and morals (Goldin, 2004). They are both cognitive and affective; and also stable and structured. Lastly, emotions are people's feeling states that are highly intense and unstable compared to other subdomains of affect.

Emotions stem from individuals' past experiences involving multiple interactions with affective, cognitive (appraisal), conative (motivational), and behavioral processes (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Scherer, 2009), and they are related to learning goals and metacognitive strategies of individuals (Op't Eynde, 2004). Although they provide an understanding of teaching and self-regulated learning of individuals, they cannot be studied via traditional methods in educational era due to methodological difficulty, ethical reasons, and their highly changing nature (Schutz & De Cuir, 2002). Actually, people especially students might experience many emotions during their academic lives. They might feel pride when they got high grades from a tough examination, or they might experience anxiety before entering this exam, or hopelessness might arise if they do not obtain the desired outcomes, or they might enjoy during a laboratory session of a science lesson due to their high interest toward this course, or they might get bored while doing homework. Hence, there are many types of emotions that might be experienced on different academic settings such as attending the class, doing homework, or taking a test or an exam.

Paris and Turner (1994; as cited in Op't Eynde, 2004) characterize emotions with respect to four aspects. Firstly, emotions are based on students' cognitive interpretations and appraisals of specific situations. Secondly, students' interpretations and appraisals stem from their knowledge and beliefs varying according to their age, history and culture. Another aspect is the context dependent nature of emotions. Lastly, emotions are unstable since people and circumstances change and develop in time.

Nowadays, there is a huge interest toward academic emotions not only in education but also in economics, neuroscience, anthropology, and the humanities (Linnenbrick-Garcia &, Pekrun, 2011). Achievement emotions based on Reinhard Pekrun's control-value theory (2006), provide an integrative framework depending on the expectancy-value theories of emotions (Turner & Schalhert, 2001), Weiner's

attribution theory (Weiner, 1985), models looking at the effects of emotions on performance and learning (Pekrun, Goetz, Titz, & Perry, 2002a). They are defined as "Emotions that are tied directly to achievement activities or achievement outcomes" (Pekrun, 2006, p.317). Shortly, they address emotions related to student academic learning and achievement. There is no general consensus over what basic emotions are or how many they are. Test anxiety has been analysed as an example of achievement emotions of students since 1930's. However, there are variety of emotions other than anxiety such as anger, frustration, confusion, boredom, shame, hopelessness, enjoyment, hope, relief, pride, etc. Even though these emotions have been neglected for a long time, it is assumed that they play prominent roles on student behaviour and academic achievement (Spangler, Pekrun, Kramer, & Hofmann, 2002). Indeed, studying the emotions and their nature in different educational contexts was considered to be important to understand teaching, motivation, and self-regulated learning (Schutz & Lanehart, 2002).

Achievement emotions are classified with regard to object focus: activity and outcome emotions. The former one is related to on-going achievement related activities like boredom or anger toward instruction, while the latter one is about outcomes of these activities such as joy and pride as a result of goal accomplishment or frustration and shame due to failure of the task (Pekrun, Frenzel, Goetz, & Perry, 2007). Outcome related achievement emotions are consisted of prospective and retrospective emotions considering time as a reference point. Prospective emotions deal with possible success and failure whereby retrospective emotions focus on prior success or failure (Pekrun, 2006).

Achievement emotions are also grouped according to valence (either positive or negative) and activation degree of affective arousal (either activating or deactivating) (Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007). For instance, enjoyment, hope, and pride imply positive activating emotions encouraging learners to continue the learning (Chiang & Liu, 2014) while relief and relaxation are positive deactivating

emotions leading individuals to slow down but also stimulating them to learn (Chiang & Liu, 2014). On the other side, negative activating emotions (e.g., anger, anxiety, and shame) prompt learners to deal with the difficulties of the task or refrain themselves from failures (Chiang & Liu, 2014) while boredom and hopelessness as negative deactivating emotions (Pekrun et al., 2007) undertake the perception toward inability to accomplish a goal (Chiang & Liu, 2014). Moreover, emotions are identified as state versus trait. If individuals have predispositions toward the experience of these emotions in habitual ways, they are called as trait emotions like habitual test anxiety. If they experience the emotion at a specific point of time within a given situation such as test anxiety before a specific exam, it is called as state emotion (Pekrun, Goetz, Perry, Kramer, Hochstat, & Molfenter, 2004). Generally, contextual factors are assumed to have a predominant role on triggering the state like emotions (Quano, 2011).

In the theoretical literature, control and value appraisals are considered to be main determinants of achievement emotions (Boekaerts, 2007; Pekrun, 2006; Pekrun et al., 2007). The subjective value, being positive or negative, is consisted of perceived valence of actions and outcomes, while the subjective control includes control-related cognitions such as self-efficacy, achievement-related expectancies, and causal attributions of outcomes (Pekrun, 2006; Pekrun et al., 2007).

Of the appraisals, self-efficacy is posited to be one of the important antecedents of achievement emotions and is defined as students' beliefs to perform successfully on a given task (Bandura, 1997). Self-efficacy beliefs stem from past experiences of individuals including their achievements and difficulties they deal with. Boeakerts (2007) also contends that student academic history, which highly affects their self-efficacy beliefs, directs their academic emotions and appraisals depending on subject domain and context. Based on the assumptions of the theory, high competency beliefs will be associated with high levels of positive emotions like enjoyment, pride,

whilst incompetent beliefs will be associated with negative emotions like anxiety, hopelessness, and shame (Frenzel, Pekrun & Goetz, 2007b).

Moreover, achievement emotions influence individuals' cognitive, motivational, and regulatory processes, personality development, social climate in classrooms, life satisfaction, student interest, engagement, and achievement (Meyer & Turner, 2002; Pekrun, Goetz, Titz & Perry, 2002b; Pekrun, 2006; Turner & Schallert, 2001). In addition to this, emotional experiences of students are associated with their cognitive and metacognitive knowledge and strategies (Pekrun et al., 2007). They are seen necessary to facilitate adaptive use of information processing strategies. The theory (Pekrun, 2006) suggests that positive activating emotions (e.g., enjoyment, pride) promote the use of elaborative, organizational, and metacognitive strategies. Positive deactivating emotions (e.g., relief) are expected to promote the use of superficial learning strategies and prevent the use of deep and metacognitive strategies. Negative deactivating emotions (e.g., boredom) restrict the use of any strategy (Ahmed, Van der Werf, Kuyper, & Minnaert, 2013).

In seven cross sectional, three longitudinal and one diary study with university and secondary school students, Pekrun et al. (2002a) indicated that students' positive emotions (enjoyment, hope, pride) were positively related to elaboration, organization, metacognition, and critical thinking. However, the relations were weak and inconsistent for negative emotions (anger, anxiety, boredom, and hopelessness).

Pekrun et al. (2002a) also mentions that positive emotions "help to envision goals and challenges, open the minds to thoughts and problem solving, protect health by resiliency, create attachments to significant others, lay the groundwork for individual self-regulation, and guide the behavior of groups, social systems, and nations" (p.149). Not only positive ones but also negative emotions have a high influence on human beings regarding their future goals. For example, an individual's future career might be affected by the degree of positive and negative emotions experienced

previously on a subject area resulting to choose or not to choose an occupation related to this area (Goetz, Frenzel, Hall, & Pekrun, 2008). Shortly, emotions affect motivation, learning strategies, problem solving, cognitive resource availability, and self-regulation, which mediate the effects of emotions on performance and achievement (Pekrun, Goetz, Perry, Kramer, Hochstatt, & Molfenter, 2004). According to control-value theory, the existence of reciprocal causation between achievement emotions and their determinants and influenced components is contended to appear as result of feedback loops in the given model (Pekrun, 2000, 2006; Pekrun et al., 2007).

In general, high efforts are invested to figure out the role of emotions on academic settings, social interactions, cognitive processing, and students' achievement and performance (Linnenbrick-Garcia & Pekrun, 2011). Unfortunately, there is still a huge gap in the current literature about the development of achievement or academic emotions and some other aspects with regard to empirical studies (Linnenbrick-Garcia & Pekrun, 2011; Schutz & Pekrun, 2007). On the other side, emotions should be studied in classrooms and schools by taking their antecedents and consequences into consideration in order to figure out their roles in education more clearly. Hence, examining the nature of the relationship between achievement emotions in mathematics, mathematics self-efficacy, and learning strategies of middle school students would be meaningful to understand the association between aforementioned variables from a domain-specific perspective.

1.2 Purpose of the Study

The purpose of this study was to investigate the achievement emotions by gender and grade level and the relationship between achievement emotions in mathematics, mathematics self-efficacy, and self-regulated learning strategies of middle school students. In addition, the scales, which were used to measure student achievement emotions in mathematics (Pekrun, Goetz, Frenzel, Brachfield, & Perry, 2011) and

mathematics self-efficacy (Usher, 2007), were adapted to Turkish language by the researcher within the context of the current study.

1.3 Significance of the study

In educational settings, a variety of emotions are experienced. Mathematics is a part of life as it is a highly interrelated discipline with many others such as science, engineering, statistics, and even with arts. Moreover, it has been viewed crucial to enter a more prestigious high school and university, which in turn provides having a good job and career. Especially the nature of nationwide tests to enter high schools and universities and the role of mathematics to be successful on those tests create stressful situations for students. Hence, enjoyment and interest have been less observed in mathematics compared to other subject areas (Tulis & Ainley, 2011). When looking at Turkish educational contexts, the same situation is valid as well under the impact of abundance of examinations. This case might cause not only arousal of anxiety but also some other negative emotions. Hence, this study aimed at examining achievement emotions in mathematics, which will contribute to the literature in order to understand the kinds of emotions experienced in mathematics learning environments.

The middle school mathematics curriculum has been changed in Turkey due to the latest regulation named as 4+4+4. In the new curriculum, students are expected to understand mathematical concepts easily and communicate in mathematical language while connecting it with other disciplines and the real life at the same time. Children are encouraged to be more systematic, organized, and responsible individuals. In addition to this, their positive attitudes and self-confidence levels in mathematics are aimed to be increased (MoNE, 2013). Indeed, the new program holding the similar goals compared to the previous one tries to bring up students as math literate people having necessary mathematical knowledge, skills, and attitudes for their current education level and for the subsequent years. The program is framed under five general category including problem solving, process skills (communication,

reasoning, and connection), psychomotor skills, information and technology skills, and *affective skills*. Actually affective skills, already considered in the theoretical literature, play a prominent role on the subsequent learning of students. Accordingly, a high relevance is given to some important aspects within the affective skills frame in the new curriculum such as increasing positive attitudes and self-confidence levels of students, developing their self-regulation skills, realization of where to use mathematics and its beneficiaries. Children are motivated to learn and study mathematics and take part in related activities while increasing their enjoyment, confidence, and efficacy levels at the same time (MoNE, 2013). Anxiety, one of the achievement emotions, is specifically mentioned in the curriculum. However, not only anxiety but also other emotions such as shame, pride, and hope need to be studied to understand their roles on individuals' academic life. Hence, this study tries to examine the nature of mathematics achievement emotions under the implementation of new curriculum.

On the other side, student self-efficacy has been approved as one of the control appraisals of individuals (Kyttölö & Björn, 2010; Pekrun et al., 2002a). Since this construct is domain- and task-specific, examining the nature of relationship between mathematics self-efficacy and achievement emotions would be more practical and meaningful. In the previous research studies, positive relationship has been found with mathematics self-efficacy and positive emotions while negative relationship has been observed with negative emotions (Pekrun, 2000). However, there are few empirical research studies in Turkey examining this relationship but all investigated test anxiety with regard to different grade levels and gender (Çapa & Emmioğlu, 2008; Genç, 2013; Güçlü, 2009; Kapıkıran, 2002; Oksal, Durmaz, & Akın, 2013; Yerin-Güneri, 2003). Hence this study might fill the gap in the literature examining the different achievement emotions and their relations with self-efficacy in mathematics considering grade levels and gender together. Due to the predictive role of self-efficacy, examining the association between these variables might help

educators to arrange learning environments in order to promote students' positive emotions in the long run.

Taken together, the study not only does examine the relationship between mathematics self-efficacy and mathematics achievement emotions but also the relationship of these emotions with learning strategies of students, which are also effective on student academic performance. Pekrun's theory (2006) proposes that the high level of negative emotions is related with less use of deep cognitive and metacognitive strategies and more use of shallow strategies. Isen (2004) also stated that people might easily adopt use of elaboration and organization when they are in positive states. Thus, promoting individuals' positive emotions might guide students to use more flexible and creative learning strategies, which in turn would be effective on their achievement.

All in all, the study would contribute to the literature by investigating the relationship between mathematics self-efficacy, achievement emotions, and self-regulated learning strategies of middle school students. In addition, Mathematics Achievement Emotions Questionnaire (AEQ-M) was adapted to Turkish language in the current study. The scale was administered to Chinese and German students before (Frenzel, Thrash, Pekrun, & Goetz, 2007). However, there is no scale measuring students' variety of mathematics emotions in Turkish language, so the present study also filled this gap in the Turkish literature. Indeed, it would be beneficial to compare different cultures by also taking different grade levels and gender into account.

1.4 Definition of Important Terms

Achievement emotions: Achievement or academic emotions is defined as "Emotions tied directly to achievement activities or achievement outcomes" (Pekrun, 2006, p.317). It includes the following emotions: enjoyment, pride, anxiety, anger, shame, hopelessness, and boredom.

Enjoyment: Enjoyment is explained as “good feelings people experience when they break through the limits of homeostasis” (Seligman & Csikszentmihalyi, 2000, p.12).

Pride: This construct is found to be pleasant and resulted from positive self-evaluation (Lewis, Takai-Kawakami, Kawakami, & Sullivan, 2010).

Anxiety: Anxiety is described to be “a future-oriented mood state in which one is ready or prepared to attempt to cope with upcoming negative events” (Barlow, 2000, p.1249).

Anger: Anger is defined as “relationally being unfairly slighted or demeaned, which in turn depends on there being an external agent that is held blameworthy for the harmful action” (Lazarus, 1991, p. 828).

Shame: Shame is contended to have feelings related to personal ideals, self-conception while facing the others attributing a social aspect to this emotion at the same time (Thrane, 1979).

Hopelessness: Hopelessness is defined as “the degree to which an individual is pessimistic about the future” (O Connor, Connery, & Cheyne, 2000, p.155).

Boredom: Boredom refers the low arousal state and dissatisfaction due to lack of stimulation (Mikulas & Vodanovich, 1993).

Self-Efficacy: Self-efficacy refers to “the beliefs in one’s capabilities to organize and execute the courses of action required producing given attainments” (Bandura, 1997, p.3).

Mathematics Self-Efficacy: Mathematics self-efficacy is defined as “a situational or problem-specific assessment of an individual's confidence in her or his ability to

successfully perform or accomplish a particular task or problem" (Hacket & Betz, 1989, p.262).

Self-Regulated Learning Strategies: Self-regulated learning strategies can be defined as "actions and processes directed at acquiring information or skill that involve agency, purpose and instrumentality perceptions by learners" (Zimmerman & Martinenz-Pons, 1986, p.615). The following strategies are elements of self-regulated learning strategies: rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation.

Rehearsal: Rehearsal is a cognitive learning strategy that involves copying, underlining and reciting the major parts of the material at hand for the selection and acquisition of the information (Weinstein & Mayer, 1983). This strategy is mainly used to store information in working memory rather than in the long term memory (Pintrich, Smith, Garcia, & McKeachie, 1991).

Elaboration: Elaboration is a cognitive learning strategy that includes paraphrasing, summarizing, describing the information, creating analogies, and generative note taking in order to integrate the current knowledge with the previous one (Weinstein & Mayer, 1983). This strategy is mainly used to store the information in the long term memory (Pintrich et al., 1991).

Organization: Organization as a cognitive learning strategy is consisted of clustering, outlining and selecting the main ideas in a given material providing individuals to select and structure the relevant knowledge to be learned (Pintrich et al., 1991).

Critical thinking: Critical thinking as a cognitive learning strategy is about the application of knowledge in a novel condition to solve problems and make criticisms (Pintrich et al., 1991).

Metacognitive Self- Regulation: Metacognitive strategy implies the methods for students to manage their behaviour and affect. Metacognitive self-regulation is consisted of generally three main activities: monitoring, planning and regulating (Pintrich et al., 1991).

CHAPTER II

LITERATURE REVIEW

This chapter scrutinizes the related literature regarding the variables of the study. In the first section, the theoretical framework of the construct providing a general perspective about control-value theory considering the antecedents of achievement emotions and the current research studies with regard to the variables is discussed. The second section describes the self-efficacy beliefs and presents the research studies to display the relationship of the construct with achievement emotions. In the third section, self-regulated learning strategies are explained in detail. Finally, a brief summary of the chapter is presented to provide a general overview of the chapter.

2.1 Control-Value Theory of Achievement Emotions

Emotions are described as a multifaceted phenomenon, which is comprised of affective, cognitive, physiological, motivational, and psychological processes (Pekrun, Goetz, Perry, Kramer, Hochstat, & Molfenter, 2004; Pekrun, Goetz, Titz, & Perry, 2002b; Pekrun & Stephens, 2010). For instance, task-related enjoyment increases the excitement level of individuals during the completion of the task, provides them to consider the relevant issue as challenging, and increase their physiological arousal level. Individuals finally become more highly motivated to the task (Pekrun et al., 2002b).

The term “achievement emotion” is based on Pekrun’s control-value theory and defined as “Emotions that are tied directly to achievement activities or outcomes” (Pekrun 2006, p. 317). Although several researchers considered emotions as a result of achievement outcomes for a long time, there are also several other emotions induced by achievement activities. The control-value theory provides a dynamic system within (presented in Figure 2.1) which is consisted of cognitive appraisals,

situational antecedents, learning, and achievement outcomes proposing a reciprocal relationship with each element with positive and negative feedback loops in the model (Pekrun, 2006).

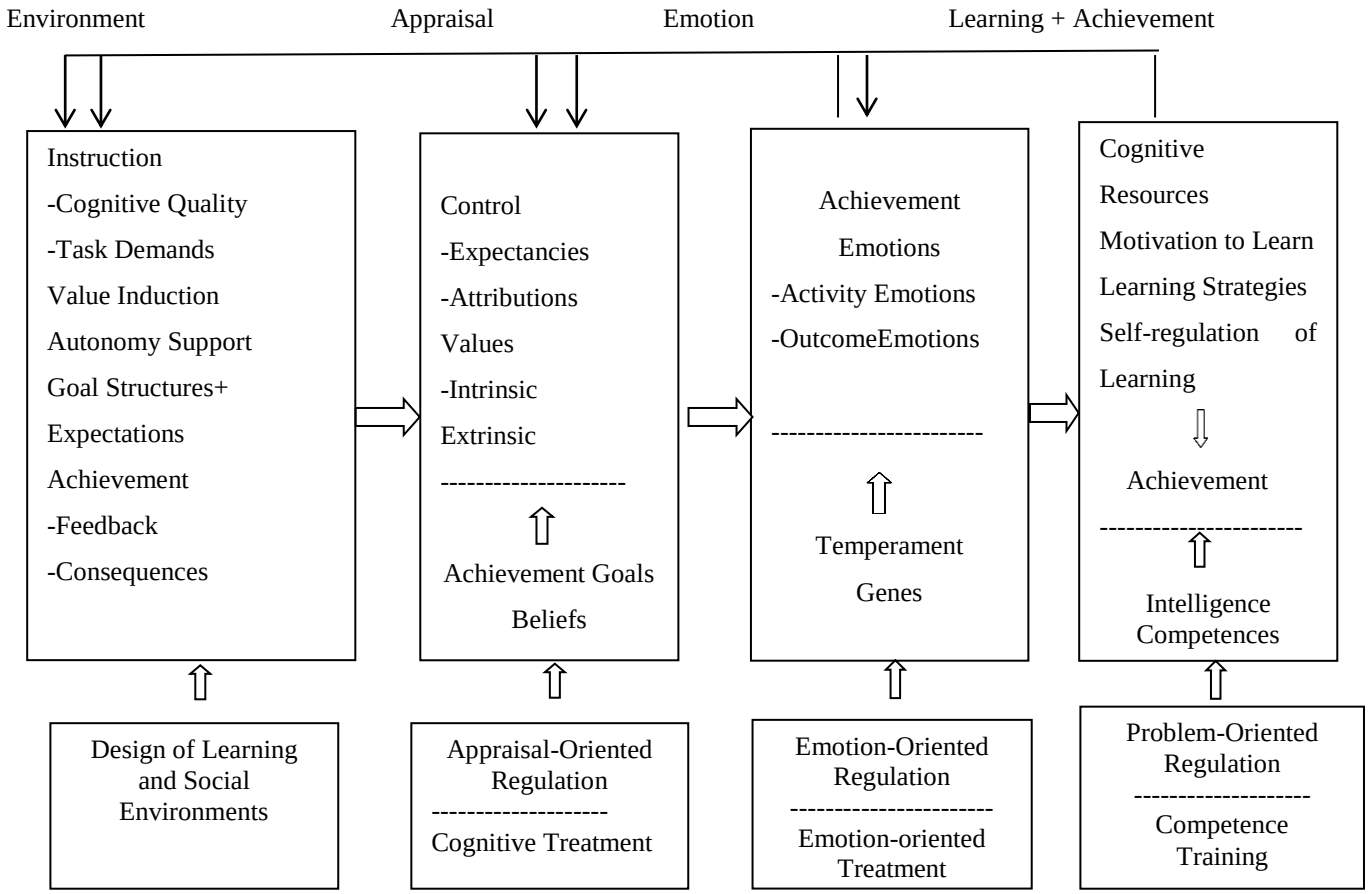

Figure 2.1. The Control-Value Theory of Achievement Emotions Model. Adapted from "The Control-Value Theory of Achievement Emotions: Assumptions, Corollaries, and Implications for Educational Research and Practice" by R. Pekrun, 2006, *Educational Psychology Review, 18,* p. 328. Copyright 2006 by Springer Science + Business Media,LLC.

There is a three-dimensional achievement emotions taxonomy displayed in Table 2.1 showing the structure of emotions including object focus (activity and outcome emotions), valence (positive and negative), and activation degree (activating and deactivating). This taxonomy resembles the "circumplex model" or "contrasting couples" proposed by Watson and Tellegen (1985) comprised of valence and activation dimensions to categorize emotions, but in a two-dimensional space (Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007).

Table 2.1.

The three-dimensional taxonomy of achievement emotions

	Positive[a]		Negative[b]	
Object focus	Activating	Deactivating	Activating	Deactivating
Activity	Enjoyment	Relaxation	Anger Frustration	Boredom
Outcome/ Prospective	Hope Joy[c]	Relief	Anxiety	Hopelessness
Outcome/ Retrospective	Joy Pride Gratitude	Contentment Relief	Shame Anger	Sadness Disappointment

Note. [a]Positive=pleasant emotion; [b]Negative=unpleasant emotion; [c]Antipatory joy/relief. Adapted from "Achievement Emotions: A Control-Value Approach" by R. Pekrun and E.J. Stephens,2010, *Social and Psychology Personality Compass*, *4*, p.239. Copyright 2010 by The Authors Journal Compilation, Blackwell Publishing.

The model focused on the valence dimension of emotions being positive and negative. Accordingly, enjoyment, pride, hope and relief are some examples of positive while anger, anxiety, shame, hopelessness, and boredom refer negative achievement emotions presented in Table 2.1 as well. Although valence dimension is classified in bipolar dimension, activation degree of emotions is multipolar. That is, emotions would be concerned as positive activating (enjoyment, hope, pride, joy and gratitude, positive deactivating (relaxation, relief, contentment), negative activating (anger, anxiety, shame and frustration) and negative deactivating (boredom, hopelessness, disappointment and sadness).

Positive activating emotions are considered to encourage learners to maintain their learning while positive deactivating emotions are viewed as a kind of sign to slow down their learning pace. Negative activating emotions prompt learners to tackle with obstacles or avoid failures while negative deactivating emotions lead individuals to create negative perceptions toward their abilities (Chiang & Liu, 2014).

On the other hand, the model differentiates achievement emotions according to object focus as “activity emotions” versus “outcome emotions.” Activity emotions are related to on-going achievement related activities relying on perceived controllability of activities and their values. For example, if activities are viewed as controllable and positively valued, enjoyment might be experienced whereas if negatively valued, anger might appear. Furthermore, if activities are valued but there is no sufficient control over them, frustration might arise.

Outcome emotions are also about outcomes of these activities including prospective and retrospective emotions. Prospective emotions are also called as anticipatory because success or failure is expected. When the perceived control is high and the focus of the individual is on the success, anticipatory joy is experienced; however, if the focus is on the failure, individuals attempt to prevent themselves from an anticipated failure, so relief would be experienced. The situations directing to focus to success or failure under partial control lead occurrence of hope and anxiety respectively. What is more, unless the success is attainable and failure is avoidable, hopelessness is undergone (Pekrun, 2006; Pekrun, Frenzel, Goetz, & Perry, 2007). Retrospective emotions are experienced after possible success and failure conditions. They consider control while thinking about the causes of outcomes whether they are because of the self, others, or external circumstances. For instance, pride and shame are emotions due to attribution of success or failure to the self, but gratitude and anger is because of attribution to others. Generally, prospective and retrospective

outcome emotions and activity emotions are determined by different appraisal antecedents, according to control-value theory (Pekrun, 2006).

2.1.1 Measurement of Achievement Emotions

There was scarce evidence in the literature on assessing individuals' achievement emotions other than anxiety. Achievement Emotions Questionnaire (AEQ) contributed to the literature to measure students' distinct emotions from different age groups. The original version of AEQ was constructed by Pekrun, Goetz, Frenzel, Barchfeld, and Perry (2011) to measure individuals' achievement emotions in general. It was developed based on control-value theory and several quantitative and qualitative studies. Enjoyment, hope, pride, relief, anger, anxiety, hopelessness, shame, and boredom were chosen to be included in the scale according to results of exploratory studies (i.e., Pekrun et al., 2002a) and the three dimensional taxonomy (valence, activation degree, and object focus). Accordingly, enjoyment, pride, hope, and relief were classified as positive while anxiety, anger, shame, hopelessness, and boredom were negative emotions. In addition, activity emotions (enjoyment, boredom, anger), prospective outcome emotions (hope, anxiety, hopelessness), retrospective outcome emotions (pride, relief, shame) were grouped under the object focus dimension. Emotions were also categorized considering activation degree such that enjoyment, pride, hope, anger, anxiety, and shame implied activating emotions whereas hopelessness, boredom, and relief referred deactivating emotions.

AEQ comprised of three sections involves 24 scales considering different educational settings such as class-related (80 items), learning-related (75 items) and test-related (77 items) emotions measuring students' trait-like emotions. However, students' state or course-specific emotions might be assessed through the instrument if the instructions are adapted accordingly (Pekrun et al., 2011). Within the instrument each scale measures the relevant emotion in terms of affective, cognitive, motivational, and physiological components highlighting the interaction of different constructs as mentioned earlier. Each section is also divided to three parts as before,

during, and after. During part is consisted of activity emotions while before is comprised of prospective outcome emotions and after part is related to retrospective outcome emotions.

The researchers proposed and tested several models (one-emotion factor model, eight emotions-factors model, three settings-factors model and emotion x setting factors model) to validate the instrument. Of the models, two-facet structure of AEQ indicating that emotions represent latent factors while the influence of settings are considered at the same time fit better compared to other models. Moreover, Cronbach alpha coefficients of both scales did not fall below .75. Hence psychometric properties of AEQ proved to be a valid and reliable measure to assess individuals' achievement emotions.

Actually, AEQ was also adapted to measure students' achievement emotions on specific subject domains like mathematics (AEQ-M). However, the use of restricted range of emotions and settings compared to original scale was specified as well (Pekrun et al., 2011). On the other hand, AEQ is used not only on different subject domains but also with different group of participants such as elementary grade children (AEQ-ES). Likewise AEQ-M, AEQ-ES has the limitations within addressing restricted range of emotions. Hence, AEQ could be considered to have a full potential to measure individuals' achievement emotions in general perspective.

2.1.2 Antecedents of Achievement Emotions

Taken the three-dimensional taxonomy into account, cognitive appraisals hold a major role on the arousal of achievement emotions on the proposed model. Subjective control and value are two groups of appraisals related to emotions. Subjective control involves individuals' beliefs toward how effectively they produce the desired outcomes and prevent themselves from undesired ones (Pekrun, 2006; Pekrun, Frenzel, Goetz, & Perry, 2007; Pekrun, Goetz, Titz, & Perry, 2002a). Perceived controllability of achievement activities and outcomes are directed by

causal and outcome expectancies, causal attributions, and competence appraisals. Causal expectancies are prospective cognitions insisting on relations between causes and their future effects including action control, action outcome, situation outcome, total outcome expectancies. Action control expectancies looks for whether an action might be initiated and performed like self-efficacy perceptions (e.g., students' expectations to invest high efforts on learning material) while action outcome expectancies refer the occurrence of positive outcomes or prevention of negative ones as a result of one's own actions (e.g., students' expectations to gain high grades due to their own efforts). Generally, the attainability of the success or prevention from failure is assumed to be related with internal control over achievement activities and outcomes. Contrary to these situations, situation outcome expectancies refer external control over outcomes regarding that outcomes would arise within a given situation regardless of one's own action (e.g., students' expectations to gain high grades even though sufficient effort is not invested at all). Total outcome expectancies are related to situation outcome, action-control, and action-outcome expectancies (Pekrun, 2006; Pekrun et al., 2007). On the other hand, causal attributions are retrospective cognitions focusing on relations between causes of a given effect, whether these causes are because of self or others. Pride, shame, gratitude and anger might be induced by causal attributions of success and failure ascribed to individuals or others (Pekrun & Stephens, 2010).

Subjective value means perceived importance of actions and outcomes. There is a distinction among values being intrinsic and extrinsic. Intrinsic value refers appreciation of activities or outcomes for its own sake like learning mathematics or science regardless of getting high grades. Extrinsic value means the instrumental utility of activities or outcomes such as being interested in mathematics to gain high grades, which in turn provide finding a job in the near future (Pekrun, 2006; Pekrun et al., 2007). Interestingly, the theory does not mention the effects of control and value appraisal interaction on individuals' emotions although some studies show the

existence of such an interaction on prediction of positive emotions and emotional experiences (Goetz, Frenzel, Stoeger, & Hall, 2010).

There are also individual and social determinants of achievement emotions. Achievement goals are proximal elements of the model because they function as mediators on appraisals and have an influence on achievement emotions. Of the goals, mastery goals take students' attention toward learning activities and facilitate positive activity emotions while reducing negative ones. Performance goals insist on performance outcomes and facilitate positive outcome emotions whilst performance avoidance goals promote negative outcome emotions (Pekrun, 2006). Classroom instruction, aspects of environment, and cultural values are also mediated by control and value appraisals. Structure of the task and the clarity of the instruction refer cognitive quality of the task and influence valuing of the learning material. Value induction gives information about motivational quality of academic environment. If tasks and environment are structured by teachers' and peers' direct and indirect messages and meet the needs of individuals, positive activity emotions are induced. Furthermore, if autonomy is promoted with tasks and environment, perceived control and value will be affected in a positive manner. In addition, feedbacks shape perceived values of future performance and expectations. They are effective on prospective emotions. For instance, positive emotions are promoted as a result of accomplishments having prosperous long-term outcomes but failure might result achievement-related anxiety and hopelessness as negative emotions (Pekrun, 2006; Pekrun & Stephens, 2010).

2.1.2 Domain Specific Nature of Achievement Emotions

There are several research studies conducted to determine how individuals' emotions are shaped with respect to grade level and gender. Although the basic structure and causal mechanisms of achievement emotions are similar on both studies, contrasting results were obtained in general or according to specific subject domains and different cultures.

Pekrun et al. (2002a) worked with secondary school and university students to test the control-value theory on several exploratory studies. Students were asked to remember specific memories during their academic life and they were expected to state the emotions they experience and they were also interviewed after instruction, examination or studying on the following studies. Consequently, distinct emotions have been reported at different levels in those academic settings. Of the emotions, anxiety has been the most frequent one to have been reported in class, during studying, at home or taking exams. On the other hand, learning enjoyment, hope, pride, relief, anger, boredom, and shame followed anxiety whilst gratitude, admiration, envy and hopelessness were reported less frequently. The study showed the rich and intense emotions of students in various academic settings different than anxiety.

On the other side, some of the studies examined the domain specificity of emotions such as in foreign language (Goetz, Pekrun, Hall, & Haag, 2006) or in mathematics classes (Frenzel, Thrash, Pekrun, & Goetz, 2007; Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010). Since control and value appraisals such as task value, achievement goals are stated to be domain-specific, emotions, which are joint products of cognitive appraisals, are thought to be domain-specific as well (Goetz et al., 2007; Goetz, Frenzel, Hall, & Pekrun, 2008). Hence, several studies were conducted to confirm the domain-specific nature of academic emotions. For instance, Goetz et al. (2007) studied with 8th and 11th grade students in Germany to investigate the within and between domain relations of academic emotions (enjoyment, pride, anxiety, anger and boredom) in different subject domains including mathematics, physics, German and English. AEQ was used to collect data about students' emotions in classroom learning and the scale was designed appropriate to each academic domain. The results indicated that domain specificity of emotions were stronger in 11th grade then 8th grade. Among the emotions, enjoyment and anxiety displayed the weakest while pride displayed the strongest correlations of emotions between domains. For example, the correlation between mathematics enjoyment and

English enjoyment or mathematics anxiety and physics anxiety was small. On the other side, the strongest within domain relations were found for mathematics, physics, English and German, respectively. This result was considered due to homogenous and narrower structure of mathematics than language courses. Goetz, Frenzel, Pekrun, and Hall (2006) also examined the domain-specificity of achievement emotions for mathematics, Latin, German, and English domains for enjoyment, anxiety, and boredom. Their participants were seventh grade students. Confirmatory multi-trait and multi-method factor analysis for emotions and domains revealed domain-specificity of emotions. Of the emotions, enjoyment was found to be the most domain specific one. Hence, it is misleading to view students' academic emotions as domain general attributes instead of habitual as many teachers do (Goetz et al., 2008).

2.1.3 Effects of Achievement Emotions

Apart from the determinants, achievement emotions influence cognition, motivation, and regulation playing a mediator role on learning and achievement, life satisfaction, and happiness (Pekrun, 2006). For instance, activating positive emotions strengthen intrinsic and extrinsic motivation to learn while facilitating the use of flexible and creative learning strategies. On the other side, activating negative emotions foster the use of rigid learning strategies whereby deactivating emotions direct people to use superficial ways of information processing (Pekrun, 2006). What is more, self-regulation of learning is stimulated by positive emotions but reliance on an external guidance is observed on negative emotions. According to the model, cognitive resources, motivation to learn, learning strategies, and self-regulation of learning mediate the effects of achievement emotions on achievement (Pekrun, 2006).

Actually, there is a reciprocal causation between emotions and their individual and social antecedents and effects. For example, promoting the cognitive quality of instruction and assignments may increase students' sense of control and their positive values. In addition to this, providing autonomy support provide students to self

regulate their learning which in turn promotes their sense of competence. Both of these processes influence emotions positively (Pekrun, 2006).

Given the influence on achievement of individuals as one of the consequences of achievement emotions, mathematics anxiety has been found to be negatively related to academic performance of students in both elementary and secondary school grades (Ma, 1999). However, there is very limited number of research investigating the association between other academic emotions and achievement. The control-value theory supports the view that subjective control and value mediate the relationship between learning environment and achievement emotions proposing that learning and achievement are influenced by achievement emotions at the same time (Pekrun, 2006). Accordingly, positive emotions play a vital role on empowering the motivation and flexible learning and contribute to academic success whereas negative deactivating emotions have aversive effects due to decline of motivation and loss of attention (Pekrun et al., 2002a). Interestingly, the effects of positive deactivating and negative activating emotions are complex due to ambiguous effects on motivation and cognitive processing (Pekrun et al., 2007).

Nonetheless, positive activating emotions do not always lead to positive effects on performance and motivation while negative activating emotions does not cause aversive effects either (Pekrun, 2006). For instance, anxiety as a negative activating emotion might increase individuals' motivation to study more in order to avoid failure resulting in improvement of learning. Artino (2009) found that frustration became a positive predictor of metacognition of undergraduate students. Although drawing a general conclusion over the effects of achievement emotions on academic achievement might be challenging, low to moderate level positive relationship was appropriate between positive emotions and performance of individuals (Valiente, Swanson, & Eisenberg, 2011).

There are various studies examining the effects of emotions on achievement with regard to several subject domains as well as general academic achievement. Helmke (1993; as cited in Pekrun et al., 2002b) worked with elementary school students and indicated that students' enjoyment was positively correlated with their academic effort, grades, attention, and scholastic achievement implying the positive relationship of positive emotions with performance. Furthermore, Mega, Ronconi, and De Beni (2014) examined the effects of positive and negative emotions, self-regulated learning, and motivation on students' performance. Not only the mediator role of self-regulated learning and motivation on academic performance but also the direct role of emotions was tested with 5805 undergraduate students from different disciplines in Padua, Italy. Results showed that student emotions were influenced by self-regulated learning and motivation and both influenced academic achievement, as asserted by the control-value theory as well.

In Turkey, Erdem-Keklik and Keklik (2013) investigated whether motivational factors and learning strategies predict high school students' mathematics achievement. Results with 440 high school students in Ankara pointed out that self-efficacy and test anxiety perceived as motivational factors and organization as a learning strategy significantly predicted student mathematics achievement. In addition to this relationship, self-efficacy and organization were positively while test-anxiety was negatively related to high school student' mathematics achievement.

On the other hand, Kleine, Goetz, Pekrun, and Hall (2005) examined whether students' emotions differ according to their mathematics performance levels. Mathematics was selected as a specific domain due to its difficult nature. Student emotions during a math test as an example of state emotions and their influence on students' performances were assessed. Sample of the study was consisted of fifth grade German students from 42 schools in German three-track educational system. Students were divided to three groups according to their test performances to examine the relationship between performance levels and emotions. Self-reported

experiences of emotions were collected four times during the math test (one before the test, twice during the completion of the test, and one after completing the test). Results showed the distinct nature of enjoyment and boredom. However, anxiety and anger were not differentiated empirically. In addition, students with average or high performance experienced more enjoyment during the test than students with poor performance whilst anxiety and anger situated between average and low performance levels. Boredom appeared in between low and high performance levels, which might be due to lack of challenge for high performing students or high challenge for poor performing students. Poor performing students mainly experienced anxiety, anger, and boredom while best performing students experienced enjoyment and boredom. Findings of the study imply that students at different performance levels displayed different emotions.

2.1.4 Research on Achievement Emotions according to Gender

Frenzel, Pekrun, and Goetz (2007b) examined the patterns of mathematics emotions on fifth grade students by gender. They hypothesized that there are gender differences between students' emotions due to their control and value beliefs in mathematics. According to the control-value theory (Pekrun, 2006), females' emotional profiles in mathematics are posited to be more anxious, hopeless, and ashamed due to their lower competence beliefs and higher achievement values than males. Hence, the theory refers the difference of mathematics emotions among boys and girls because of their appraisal patterns on this subject domain. According to the findings, girls displayed less enjoyment and pride but more anxiety, hopelessness and shame compared to boys. Frenzel et al. (2007a) also analysed the relationship between perceived learning environment and mathematics emotions (enjoyment, anxiety, anger and boredom) with students from fifth grade to tenth grade. Findings indicate that mathematics achievement and gender are significantly related with individual- and class-level enjoyment, anxiety, and anger. Boys expressed higher level of enjoyment and lower level of anxiety and anger than girls at individual level.

Differently, classes with more boys displayed less enjoyment and high anxiety that imply that class-gender ratio is a significant predictor of individual enjoyment.

Goetz, Frenzel, Hall, and Pekrun (2008) worked with 1380 German students from fifth to tenth grade on three different tracks of German school system (lower, middle and top). Class-related subscale of AEQ-M was used to measure mathematics and language class enjoyment. Items of the scale were designed as appropriate for each domain. Although effects sizes were small in both analyses, boys' class-related math enjoyment and self-concept was significantly higher than girls whereby girls reported significantly higher level of class-related enjoyment than boys in verbal classes.

Pekrun et al. (2011) measured achievement emotions of 389 university students from different faculties in a Canadian university to provide evidence for the convergent validity of AEQ as indicated. Results revealed that female students expressed more class-related enjoyment, more learning and test-related anxiety but less class-related anger and test-related hope than male students. On the other hand, there was no significant mean difference for boredom, pride, shame, hopelessness, and relief considering educational settings between male and female participants.

Lictenfeld, Pekrun, Stupnisky, Reiss, and Murayama (2012) developed and validated an achievement emotions questionnaire for elementary school students (AEQ-ES), as well. The study was comprised of 594 second graders and 595 third graders. Results showed gender differences in elementary school students' achievement emotions. That is, second grade male students reported more class-related enjoyment but less class-related anxiety and learning-related boredom in mathematics than female peers. Furthermore, third grade female students expressed more class-related boredom as well as less enjoyment but more anxiety over different achievement settings such as attending class, doing homework and taking tests or examinations in mathematics.

On the other hand, the studies conducted in Turkey mostly focused on negative achievement emotions such as anxiety and worry. For example, Yüksel-Şahin (2004) investigated whether high school and university students' mathematics worry levels differ according to perceived parental attitude, mathematics attitude, and gender. Findings indicated gender differences on mathematical worry levels of 237 high school students. Females' scores were significantly higher than male peers. Interestingly, there was no gender difference in mathematical worry of university students. Yüksel-Şahin (2008) also studied mathematics anxiety, another achievement emotion, with a different group of participants. Fourth and fifth grade students' math anxiety levels were examined with respect to different variables including gender. Results were consistent with her previous study that girls reported higher anxiety than boys.

Baloğlu and Koçak (2006) also examined college students' mathematics anxiety to determine the relationship of age and gender with this emotion. Differently, students' mathematical experiences were taken into account as a covariate during the study. On the other hand, math anxiety was considered as a multidimensional aspect, so students' math test anxiety, math course anxiety, and numerical task anxiety scores were computed besides their total math anxiety scores. According to results, female students' total math anxiety scores were significantly higher than males; however, this pattern was not valid for other dimensions of math anxiety. That is, while females obtained higher math test anxiety scores, males scored higher on numerical task and math course anxiety. This finding emphasized the impact of multidimensional aspect of the construct on gender.

Yamaç (2014) also developed an emotion scale to measure elementary school students' enjoyment, anxiety and boredom. The scale firstly was administered to 391 fourth and fifth grade students. The final version was administered to 274 students. Results indicated gender differences on enjoyment and boredom. Accordingly, females reported more class-related enjoyment and less class-related boredom than

males. Yet, no mean difference was observed in anxiety levels of male and female participants.

Contrary to the previous researches, many studies failed to find gender differences on different achievement emotions. For instance, Birgin, Baloğlu, Çatlıoğlu, and Gürbüz (2010) examined the mathematics anxiety of totally 220 sixth, seventh and eighth grade students in Black Sea Region of Turkey. Results revealed no gender differences in mathematics anxiety scores. Similarly, Dede and Dursun (2008) studied sixth, seventh and eighth grade students' mathematics anxiety levels in Sivas. Findings of the study indicated moderate mathematics anxiety, besides no mean difference among male and female students was found. Likewise, Keshavarzi and Ahmedi (2013) found no gender difference on mathematics anxiety levels of high school students in Iran. Apart from anxiety, Yenilmez (2010) examined high school students' mathematics hopelessness with respect to gender, grade level, mathematics achievement and the status of taking private mathematics courses. The study was conducted on ninth, tenth and eleventh grade students in Eskişehir. Yet, results indicated that there was no significant mean difference between male and female students' mathematics hopelessness scores.

2.1.5 Research on Achievement Emotions according to Grade Levels

There are also several studies looking for the emotions of students with respect to grade levels. According to Wigfield and Mecce's (1988) cross-sectional study, students at ninth grade reported higher levels of worry in mathematics than students at sixth grade. In a cross sectional study conducted by Larson and Richards (1991), boredom showed an increasing trend from fifth to eighth grades. Interestingly, Yenilmez's (2010) study revealed a different pattern in high schools students' mathematics hopelessness as a negative achievement emotion with respect to grade level. Students' hopelessness seemed to decrease as they passed from ninth to tenth and eleventh grades. Indeed, this change was attributed to the adaptation process of students to the new system (Yenilmez, 2010).

Frenzel, Goetz, Lüdtke, Pekrun and Sutton's (2009) longitudinal study with German students from three school tracks of the German school system yielded a decreasing trend for mathematics class-related enjoyment from seventh to eighth grades despite the small effect size. Actually, Pekrun (2014) stated the reasons of decreasing trend of positive emotions during middle school years as teacher-centred instruction, abundance of academic and non-academic interests during adolescence, and students' changing subject matter interests.

Yamaç (2014) examined elementary school students' level of enjoyment, anxiety and boredom with respect to grade level as well. The study results indicated significant grade level differences on anxiety and boredom. Accordingly, fifth graders experienced more class-related anxiety and boredom than fourth grade students. However, no significant mean difference was reported for class-related enjoyment.

On the other side, several studies from national and international contexts failed to find grade level differences on different achievement emotions. For instance, Yüksel-Şahin (2008)'s study to examine the mathematics anxiety levels of fourth and fifth grade students revealed no significant mean differences between these two grades. The reason of this result was attributed to include consecutive grade levels into the study. Normak & Talts (2009) also found no grade level difference in test- related pride, anger, anxiety and hopelessness on students from sixth to seventh grades in Estonia.

2.2 Self-efficacy

Social Cognitive Theory (Bandura, 1986) deals with people's knowledge, skills, strategy, beliefs, and emotions based on their interactions with and observation of others (Pintrich & Schunk, 2002). This situation leads an on-going interaction between personal, behavioural, and environmental factors and named as triadic reciprocal causation. They are, generally, interdependent to each other through a bidirectional relationship (Bandura, 1997).

According to the model, personal factors including self-efficacy judgements of individuals might be in the form of cognitive, affective and biological events (Bandura, 1997). Personal factors also involve a loop on itself considering the model of triadic reciprocal causation. This loop highlights the regulation and influence of the factor with other factors in a continuum. Pajares (1996) contends this situation that "people are both products and producers of their own environment" (p. 544).

Self-efficacy is one of the affective constructs and the most central self-referent thought for the sake of human functioning described in the Social Cognitive Theory. It is defined by Bandura (1997) in his book called "Self -Efficacy: The Exercise of Control" as "the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p.3). Self-efficacy beliefs of individuals are assessed in terms of level, generality, and strength over different activities and circumstances. The level of the construct refers its dependence to the task difficulty while the generality highlights the transferability of the beliefs over different tasks or courses such as beliefs from a statistics course to algebra. Furthermore, the one's certainty to accomplish the goal over a given attainment is viewed as its strength. Generally, the self-efficacy judgements of individuals focus on their personal capabilities rather than personal qualities (Bandura, 1997; Zimmerman, 2000b). Not only domain but also is it a task-specific construct; for instance, a student's self-efficacy belief toward a mathematics test might be high while it may be low toward a physics examination (Zimmerman, 2000b) or a seventh grade student might view himself competent toward equations with one variable but not showing a considerable level of efficacy toward equations with two variables.

Generally, self-efficacy beliefs affect people's choices and actions that will be pursued. People with high efficacy are eager to participate to the task they feel competent that's why self-efficacy judgements of individuals affect their subsequent performances and provide formation of new skills (Bandura, 1997). Efficacious people are expected to work and persist longer even they have experiences with

negative circumstances. They view obstacles as challenges waiting to be solved. Failures are attributed to lack of effort or misuse of knowledge and abilities, which can be refined in the long run. On the other hand, people with low self-efficacy have untrue beliefs toward the nature of the task such that they cannot differentiate the actual difficulty level and they view the task more difficult. Failures are attributed to their inabilities resulting negative emotional states such as stress, depression, and anxiety. Thus self-efficacy beliefs have an influence on individuals' thoughts and emotional reactions as well (Pajares, 1996).

There are four sources of self-efficacy as mastery experiences, vicarious experiences, verbal persuasion, and emotional and physiological states (Bandura, 1977). Mastery experiences are individuals' own experiences over the given task involving performance accomplishments. Self-efficacy beliefs tend to increase if achievements over the task are recurrent while failures lead a decrease over the beliefs (Bandura, 1977). Vicarious experience, which is based on observation of other people and how they cope with threatening situations without negative consequences, is another source of personal efficacy. They influence observers' persistence levels and their expectations. Individuals make normative comparisons. If they find similar attributes among themselves and the observed model, their self-efficacy beliefs will be affected positively (Bandura, 1997). Observed behaviours play an important role on the enhancement of self-efficacy beliefs unless individuals have experienced the given situation before (Bandura, 1986). Individuals may be persuaded through verbal suggestions to deal with obstacles and difficulties experienced in the past, which is known as verbal persuasion. Finally, emotional and physiological states such as anxiety and stress influence individuals' self-efficacy beliefs. Physiological arousal might be curvilinearly related to self-efficacy which means that too much arousal might be detrimental for self-efficacy beliefs while moderate level of physiological arousal might strengthen self-efficacy perceptions of people (Bandura, 1997). Among the sources, mastery experiences are suggested to be the strongest one as they are grounded on individuals' own experiences in real life (Bandura, 1997).

2.2.1 Research about Self-efficacy Beliefs and Achievement Emotions

Self-efficacy is considered as an emotion-regulation construct influencing emotional experiences of individuals through thoughts, actions, and emotions (Bandura, 1997). Namely, people with high self-efficacy might control discouraging thoughts through analysing and recapturing life events resulting positive emotional states. Besides, individuals' behaviours are also stimulated by high efficacy, which in turn positively influences their environment and emotional well-being. Lastly, high efficacy beliefs enhance positive emotional experiences of individuals while reducing negative ones (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010). Since competency perceptions are viewed as one of the main determinants of achievement emotions, ample research studies are conducted to examine the relationship between achievement emotions and self-efficacy.

Pekrun, Goetz, Perry, Kramer, Hochstat, and Molfenter (2004) developed a test emotion questionnaire to measure both state and trait test emotions involving emotions of joy, hope, pride, relief, anger, anxiety, shame, and hopelessness. Results of exploratory analyses with university students during scale construction revealed that emotions are influenced by control and value appraisals. Accordingly, test joy, hope, and pride were positively correlated with academic self-efficacy, interest, use of learning strategies, and achievement whereby the correlations were negative for anxiety, shame, anger, and hopelessness.

In a previous research (Artino, 2009), the relation of students' self-regulated learning (elaboration and metacognition) and academic achievement to their motivational beliefs (self-efficacy, task value) and negative achievement emotions (boredom, frustration) were examined. Participants of the study were comprised of undergraduate students of a service academy in the US. On behalf of the research questions, the relation between motivational beliefs and negative achievement emotions were presented. Accordingly, military students' perceived self-efficacy beliefs toward their ability to learn the material in a self-paced online format were

reported to be significantly related to their boredom (r = -.27) and frustration (r = -.27) in an online course.

Nie, Lau, and Liau (2011) worked with ninth grade Singaporean students to investigate the moderator role of self-efficacy on the relation between task importance and test anxiety in English and mathematics. Participants were given opportunities to choose completing online mathematics or English surveys. Variables of the study were measured through the relevant subscales of MSLQ (Pintrich, Smith, Garcia & McKeachie, 1991) and Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000). The results of the study confirmed the negative predictor role of academic self-efficacy on test anxiety controlling task importance and the interaction; that is, students with high efficacy displayed lower levels of test anxiety in mathematics and English classes.

Artino and Jones (2012) also investigated the relationship between achievement emotions (boredom, frustration and enjoyment) and use of self-regulated learning strategies (elaboration and metacognition) of 302 undergraduate students of service academy in an online course. Besides measuring achievement emotions and learning strategy use, students' cognitive appraisals of task value and self-efficacy beliefs were also assessed within the study. Students' emotions of enjoyment, frustration and boredom were assessed by AEQ (Pekrun et al., 2005) while use of elaboration and metacognitive strategies were measured through the learning strategy subscale of MSLQ (Pintrich et al., 1991). The researchers reported significant relationship between self-efficacy and emotions of boredom, frustration, and enjoyment (r = -.10, r = -.21, and r = .22).

On the other hand, Marchand and Gutierrnes (2012) examined the predictors of course-related emotions. Self-efficacy for learning research methods were included in the study to test its predictive role on graduate level research methods course over 291 graduate students of traditional and online sections of the research methods

course. It was assumed that self-efficacy is one of the antecedents of students' mid-semester academic emotions of hope, frustration and anxiety while emotions were posited to be predictors of their end-semester learning strategy use. The data collection phase of the study was divided to three different time points in a semester. That is, proposed predictor variables of emotions such as utility value, relevance and self-efficacy was assessed at time 1, academic emotions of students were measured at time 2 and learning strategy use of students were measured at time 3. Students' self-efficacy beliefs were assessed through self-efficacy subscale of MSLQ (Pintrich et al, 1991) while academic emotions were examined by AEQ (Pekrun et al., 2005) regarding before and during class parts of the scale just for three emotions of hope, frustration and anxiety. According to the proposed path model, self-efficacy was displayed as the most consistent predictor of students' emotions over settings compared to utility value and relevance. In addition to this, self-efficacy was found a negative antecedent of anxiety and frustration while being a positive predictor of hope across settings.

2.3 Self-Regulated Learning Strategies

How people regulate their own learning regarding the nature, origin and development of this skill is considered comprehensively in Bandura's (1986) Social Cognitive Theory as well. According to this theory, self-regulation is concerned as an interaction between personal, behavioural, and environmental triadic processes (Zimmerman, 2000a). The link between personal, behavioural and environmental factors implies the cyclical structure of self-regulation. Hence, people may need to change their strategies, cognitions, and behaviours according to this continuous cycle (Pintrich & Schunk, 2002). Of the three factors, self-regulated learning is previewed as personal influences involving self-efficacy perceptions of individuals depending on their knowledge, metacognitive processes, goals, and affect. Performance-related influences are consisted of self-observation, self judgement and self reaction to provide strategic adjustments for performances. Environmental influences included enactive outcomes, modelling and verbal persuasion to observe and adjust

environmental conditions and outcomes (Zimmerman, 1989, 2000a). The cyclical nature of self-regulation phases and sub-processes (Zimmerman & Campillo, 2003) is explained in a three-phase self-regulation model as in the following;

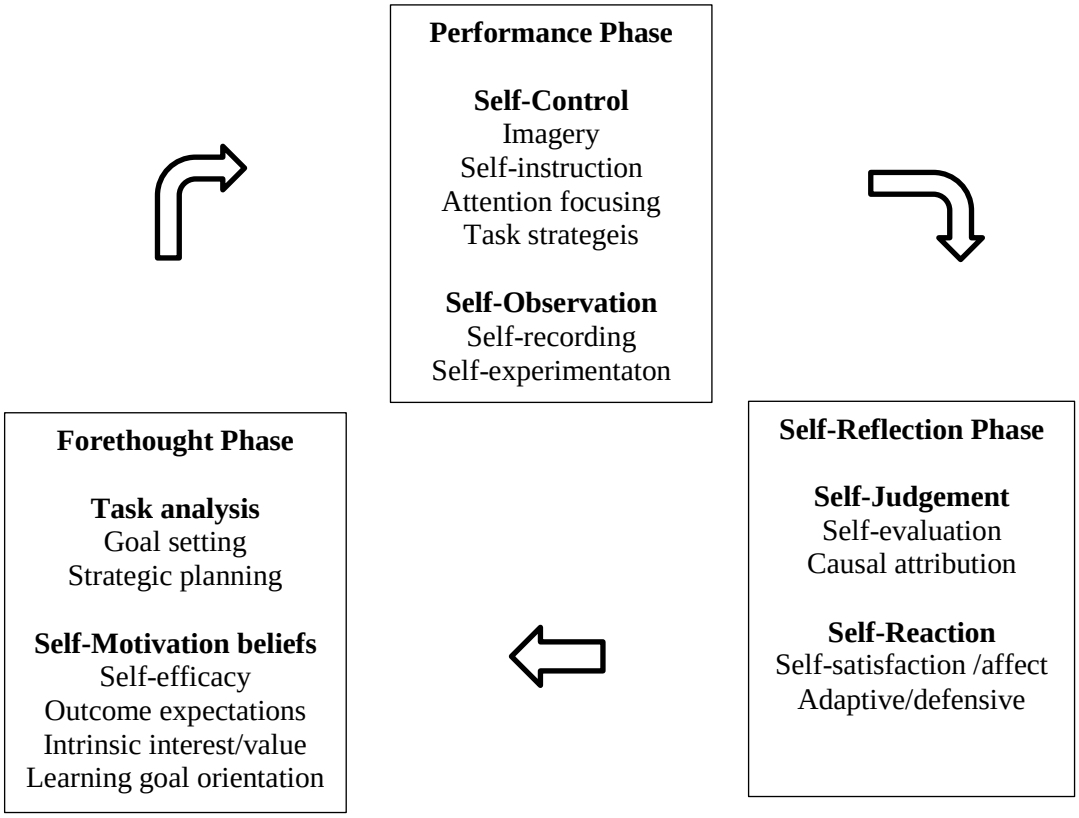

Figure 2.2. Three phases of self-regulation. Adapted from "Motivating self-regulated problem solvers", by B.J. Zimmerman and M. Campillo (2003). In J.E. Davidson and Robert Sternberg (Eds.).*The Nature of problem solving*. NewYork: Cambridge University Press. Copyright 2003 by Cambridge University Press.

Taken the model into account, *forethought phase* comes before individuals' actual performance or actions including two main processes: task analysis and motivation. Goal setting and strategic planning are considered under the task analysis Goal setting is an important process related to identification of some criteria for accomplishment. Students engage several activities, give considerable effort and persist to attain the goal which is also efficient for the enhancement of their efficacy beliefs and effective on academic success as well (Pintrich & Schunk, 2002). In this case, deciding the appropriate strategy is essential in order to attain the determined

goals. Actually, individuals need methods to perform a skill with an appropriate degree, which makes strategic planning essential. The proper strategy selection promotes the success of individual through influencing cognition, affect and motoric processes (Zimmerman, 2000a). Their learning beliefs, outcome expectations, intrinsic interest/value, and goal orientations are framed under self-motivation, considered to be important in order to use self-regulatory skills (Zimmerman, 2000a, 2002). *Performance or volitional control phase* arises during learning and individuals use learning strategies during this phase, which have an influence on their concentration and performances. It is consisted of two main processes: self-control (self instruction, imagery, attention focusing, and task strategies) to help individuals focus on the task and control their own performances and self-observation (self-recording, self-experimentation) to provide individuals tracking their own performances according to appearing conditions. Lastly, individuals give feedback to their own efforts after their performance in the *self-reflection* phase that involves self-judgement and self-reaction processes (Zimmerman, 2000a). Individuals give systematic responses over their performances with respect to a criterion in self-judgements process. On the other side, self-reaction process is about individuals' reactions to their own performances (Zimmerman, 1989). All in all, self-reflection phase influences forethought phase, which in turn forms a cycle according to the model (Zimmerman, 2000a).

Mainly, there are general assumptions in self-regulated learning models. Self-regulated learners are viewed as active participants according to constructive assumption. That is they are active on the learning process metacognitively, motivationally, and behaviourally with the help of directing their efforts to gain knowledge and skills instead of being passive receivers of information from their parents, teachers, or others (Zimmerman, 1989). In addition, learners potentially control, arrange, organize, and judge their own cognition, motivation, and behaviours with regard to potential for control assumption. It is also notified that there is a criterion or standard among all regulation models in relation to criterion or standard

assumption to be able to make comparisons providing to see how the progress is (Pintrich, 2000).

Considering the assumptions toward self-regulation models, learners' degree of self-regulation are determined to what extend they use strategies to attain their intended goals. If individuals exert strategic control over personal, behavioural, and environmental influences explained in Social Cognitive Theory, they would be described as self-regulated. On the other hand, if use of any strategy is insufficient, the aforementioned influences become superior. Zimmerman (1989) contended that students are self-regulated if they use specific strategies to obtain desired goals based on their perceived level of self-efficacy.

In general perspective, learning strategies are defined as "behaviours and thoughts in which a learner engages and which are intended to influence learners' encoding process" (Weinstein & Mayer, 1983, p. 3). Individuals' affective states, ways of knowledge selection, and organization are influenced by these strategies. Cognitive and metacognitive strategy use of students is important in classroom settings considering self-regulated learning (Zimmerman & Martinenz- Pons, 1986). Cognitive strategies refer methods for students to select, obtain, and integrate the new knowledge onto the prior one (Dowson & Mclnerney, 1998). According to Pintrich et al.'s (1991) Motivated Strategies for Learning Questionnaire (MSLQ), which was developed to measure college students' motivational orientations and strategy use, there are several cognitive and metacognitive strategies for learning. These are rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation.

Rehearsal strategy focuses on basic memorization of factual information by overt and covert practice such as underlining main events, shadowing, reciting, listing or naming facts (Dowson & Mclnerney, 1998; Zimmerman & Martinenz- Pons, 1986). Learners are expected to select important parts of the material and transfer them into

their working memory. Elaboration strategy builds a relationship between new and old information to provide integration of new knowledge to the current one that's why it enhances to store information in the long term memory (Pintrich et al., 1991) through paraphrasing, summarizing, or creating analogies (Dowson & Mclnerney, 1998; Weinstein & Mayer, 1983). Organization strategy requires structuring the knowledge to provide assimilation of new information by overt and covert rearrangement of learning materials so that individuals might decide information to be selected through outlining, sequencing, clustering, and reordering (Dowson & Mclnerney, 1998; Weinstein & Mayer, 1983; Zimmerman & Martinenz- Pons, 1986). In the critical thinking strategy, students apply previous knowledge to novel conditions to solve problems and make criticisms according to a definite criterion (Pintrich et al., 1991).

Finally, metacognitive strategy use refers the methods for students to manage their behaviour and affect. There are three important components of metacognitive strategies: monitoring, planning, and regulation. Monitoring is a kind of implementation of self-judgement providing to determine whether the material is understood or not via self-checking or questioning. Planning refers a comprehensive preparation for the accomplishment, activating the previous knowledge, which facilitates comprehension and organization of the material through goal setting, task analysis, and time management. Lastly, regulation attempts altering one's mistakes on a given task as a kind of assistance leading the improvement of the learner (Dowson & Mclnerney, 1998; Pintrich et al., 1991).

2.3.1 Research about the Learning Strategies and Achievement Emotions

Weinstein and Mayer (1983) asserted that learning strategies could be taught. Nevertheless, teachers rarely teach students to these strategies (Zimmerman, 2002). Indeed, learning strategies influence and are influenced by individuals' achievement emotions, so there might be a kind of connection between these variables. Actually,

there are several studies looking for the relationship between learning strategy use and achievement emotions in general and for subject specific domains.

According to control-value theory (Pekrun, 2006), achievement emotions are predictors of learning strategy use, self-regulation, and achievement in classroom contexts. Effects of emotions are mediated by effort, persistence, and learning strategy use (Pekrun et al., 2002a). Activating positive emotions are posited to facilitate the use of flexible learning strategies whilst activating negative emotions may lead people to use rigid learning strategies like rehearsal. On the other hand, negative deactivating emotions (boredom) may cause physiological and cognitive impediments (Pekrun et al., 2002a) pointing the use of more shallow or superficial learning strategies (Pekrun, 2006).

Pekrun et al. (2011) assessed achievement emotions of 389 university students. Results indicate that enjoyment, hope, and pride as positive activating emotions were related positively to elaboration and self-regulation of learning while hopelessness and boredom as negative deactivating emotions were negatively correlated with elaboration, self-regulation, and academic achievement. This situation provides an evidence for the beneficial effect of positive emotions on students' learning but the aversive effects of negative deactivating emotions. On the other hand, anger, anxiety, and shame as negative activating emotions were negatively related to elaboration and self-regulation of learning but positively correlated to extrinsic motivation. In addition, test anxiety was found to be positively associated with rehearsal strategy making the situation more complex to reach a conclusion for negative activating emotions (Pekrun et al., 2011).

Pekrun et al. (2002a) tested control-value theory and the antecedents of achievement emotions in seven cross-sectional, three longitudinal and one diary study with university and secondary school students. AEQ and MSLQ were used to measure students' achievement emotions and learning strategy use respectively. The results of

quantitative studies revealed that positive emotions with the exception of relief were positively related to metacognitive and cognitive strategies while negative and weak relationship appeared between negative emotions and flexible learning strategies such as elaboration.

Artino and Jones (2012) attempted to determine the relations between several different emotions (boredom, frustration, and enjoyment) and self-regulated learning strategy use (elaboration, metacognition) in an online course. Data were collected through a survey from 302 undergraduate students taking the online course in a service academy. Results showed that boredom as a negative deactivating emotion was negatively correlated with elaboration and metacognition. When task value, self-efficacy, and frustration were controlled in the regression model, boredom has been found as a significant predictor of metacognition and elaboration. On the other hand, frustration as a negative activating emotion was negatively associated with elaboration and metacognition. Interestingly, frustration was also found a positive predictor of metacognition. What is more, course-related enjoyment was positively correlated with elaboration and metacognition. After controlling for other variables, enjoyment was one of the strongest predictors of elaboration and metacognition. Shortly, findings implied that negative activating emotions were likely to be related to lower levels of elaboration and metacognition while positive activating emotions were related to higher level of elaboration and metacognition.

Interestingly, Pintrich and De Groot (1990), in a cross sectional study, examined the relation among motivational orientations, self-regulated learning and performance of seventh grade students from English and science lessons. Self-efficacy, intrinsic value and the test anxiety formed the motivational orientations of individuals while self-regulated learning was implied through measuring cognitive (rehearsal, elaboration and organization strategies) and metacognitive strategies. According to the results, self-efficacy was positively related to cognitive (r = .33) and

metacognitive strategy use (r = .44) whereas non-significant relationship of test anxiety with cognitive or metacognitive strategies was reported.

In order to figure out the developmental trajectories of academic emotions in mathematics classrooms especially for anxiety, boredom, enjoyment, and pride and to examine whether the change of emotions are related to change of self-regulated learning strategies and achievement, one year study was conducted in a secondary school setting (Ahmed, Van Der Worf, Kuyper, & Minnaert, 2013). It was a short-term research project looking for changes in motivation, emotions, and self-regulated learning of seventh grade students. Data were collected three times over a school year. Students' mathematics achievement emotions were measured through AEQ-M (Pekrun, Goetz & Frenzel, 2005). Furthermore, self-regulated learning of individuals was assessed by learning strategy subsection of latest version of MSLQ (Wolters, Pintrich, & Karabenick, 2005). However, the learning strategies were classified in three main headings as shallow strategy (e.g., rehearsal), deep strategy (e.g., elaboration and organization), and metacognitive strategy (consisting of items related to planning, monitoring, and evaluation). Multilevel modelling was used to observe changes in emotions and self-regulated learning strategies by within-student model while the changes of individual differences were also inspected through between-student model with growth curve parameters. The growth curve analysis results indicated a decrease of enjoyment and pride and an increase of boredom over study periods; however, anxiety was found to be stable. Findings also indicated that initial levels of enjoyment, pride, and boredom were significant predictors of shallow strategy use in mathematics while changes in these emotions also significantly predicted the changes in shallow strategy use whereas the initial levels of anxiety and changes in this emotion were not significant predictors of initial levels and changes in shallow strategy, respectively. On the other hand, initial levels of enjoyment and pride and changes in these emotions across time significantly predicted the initial levels and changes in deep strategy use, respectively. Furthermore, the initial levels of enjoyment, pride, boredom and anxiety significantly predicted the initial levels of

metacognitive strategy use while changes in enjoyment and pride were significant in changes of this learning strategy.

Villavicencio (2011) also examined the mediator role of critical thinking strategy on the association between negative emotions and trigonometry achievement of 220 engineering students. AEQ-M (Pekrun, Goetz &Frenzel, 2005) was used to measure students' anger, anxiety, boredom, shame, and hopelessness in trigonometry courses and the critical thinking subscale of MSLQ (Pintrich et al., 1991) was used to measure students' critical thinking strategy. It was hypothesized that unless students engage in critical thinking, anxiety and hopelessness would be experienced more which in turn influence their achievement. Results of the study confirmed the hypotheses such that anxiety and hopelessness had a significant mediator role on the relationship between critical thinking and achievement of students. That is, students who engaged critical thinking strategy displayed positive approach to complete the given task; by doing so they became less anxious and hopeless resulting to get a higher final grade. Other emotions (anger, boredom, and shame) were negatively associated to final grade in trigonometry but did not work as a significant mediator.

2.4 Summary of the Literature Review

The relevant literature about the aforementioned variables mostly points out the unidirectional relations. That is, the relationship over the achievement emotions and academic self-efficacy beliefs of individuals at different grade levels is posited to change with respect to valence of emotions. Namely, positive emotions are positively and negative emotions are negatively related to this construct. The self-regulated learning strategies of participants might differ also according to the emotions they experience considering valence and activation dimensions. In other words, individuals who report positive emotions are more likely to adopt flexible and creative learning strategies than individuals who experience negative emotions. However, the relevant literature about achievement emotions considering gender and grade level variables did not yield consistent results. Taken all of these variables

together, this study aimed at investigating the current relationship between math achievement emotions, self-efficacy, and self-regulated learning strategies in a Turkish educational setting and examined achievement emotions with respect to gender and grade levels of the participants.

CHAPTER III

METHOD

This chapter describes the research methodology in detail. Firstly, research design and research questions are given incorporating the purpose of the current study. Research variables are discussed by considering their definitions separately. Then, research participants, data collection instruments and the relevant processes, data collection procedures, and data analysis sections are presented. Consequently, the limitations and assumptions of the study are taken into account briefly in the last section of the chapter.

3.1. Research Design

The research design of the study was correlational research. In correlational research, the relationships between two or more quantifiable variables are investigated without manipulating them. Moreover, the degree of relationship among these variables is also examined in correlational researches (Frankel, Wallen, & Hyun, 2012). The purpose of the study was to investigate the relationship between achievement emotions in mathematics, mathematics self-efficacy, and self-regulated learning strategies of middle school students.

Data were collected cross-sectionally from sixth, seventh, and eighth grade students at schools from Altındağ, Çankaya, Keçiören, and Yenimahalle districts in Ankara. Data collection instruments were "Achievement Emotions Questionnaire in Mathematics" (AEQ-M; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011), "Math Skills Self-Efficacy Scale (MSSE; Usher, 2007), Self-Efficacy for Self-Regulated Learning Scale" (SESRLS; Usher, 2007), and Self-Regulated Learning Strategies subscale of Motivated Strategies for Learning Questionnaire (MSLQ: Pintrich, Smith, Garcia & McKeachie, 1991). AEQ-M, MSSE, and SESRLS were adapted by

the researcher within the scope of this study, while MSLQ was adapted by Sungur (2004).

3.2. Research Questions

The research questions of the present study are:

1. How do middle school students' achievement emotions in mathematics change according to gender and grade level?
2. What is the relationship between middle school students' achievement emotions in mathematics, mathematics self-efficacy, and self-regulated learning strategies?
3. What is the relationship between middle school students' achievement emotions in mathematics, their mathematics self-efficacy, and self-regulated learning strategies according to grade levels?

3.3. Research Variables

Gender: It is a discrete variable involving two levels of being female and male. The scale of measurement of this independent variable is considered as nominal.

Grade level: It is a discrete variable consisting of three levels involving sixth, seventh, and eighth grade students. The scale of measurement of this independent variable is considered as ordinal.

Mathematics Self-Efficacy: Self-efficacy beliefs of students toward mathematics were measured by Turkish version of two different scales: Math Skills Self-Efficacy and Self-Efficacy for Self-Regulated Learning. Higher scores on both scales refer high mathematics self-efficacy beliefs.

Mathematics Achievement Emotions: The math achievement emotions variable of middle school students was assessed by Turkish version of Achievement Emotions Questionnaire in Mathematics (AEQ-M). AEQ-M has seven dimensions: enjoyment, pride, anger, anxiety, shame, hopelessness, and boredom. The mean sore of items for

each emotion dimension was computed to determine math achievement emotions scores of participants. Higher score indicates high emotional feelings of individuals on relevant dimension. The scale of measurement is considered interval.

Self-Regulated Learning Strategies: Cognitive and metacognitive strategies of middle school students were measured by Turkish version of Learning Strategies Section of Motivated Strategies for Learning Questionnaire (MSLQ). There are five subscales in this section: rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation. Negatively worded items in the scale were reversed before computing total scores while the mean score of items within each subscale was computed to determine scores of learning strategy use of participants. The level of measurement is interval. Higher scores show higher use of learning strategy.

3.4. Participants

The target population of the study was sixth, seventh, and eighth grade public school students in Ankara. Although the fifth grade is also the part of 4 + 4 + 4 curriculum, they were excluded from the study according to expert opinions in the field of Mathematics Education and Guidance and Psychological Counseling. Considering their developmental stages, it was suggested that there were too many items on the AEQ-M for fifth graders to complete. In addition, MSSE scale included many mathematical topics, which were not covered in the fifth grade curriculum. Hence, students would encounter problems if they were included in the study, so the study was restricted to sixth, seventh, and eighth grade public school students.

Since it is difficult to generalize the results of the study to the target population due to the difficulty of approaching all districts in Ankara because of time limitations, the accessible population was sixth, seventh, and eighth grade public school students of four central districts including Altındağ (32 schools; 18.8%), Çankaya (49 schools; 28.8%), Keçiören (48 schools; 28.2%), and Yenimahalle (41 schools; 24.1%). The main reason of selecting only public schools was to control the school type variable

to prevent internal validity threats and to ensure that all schools implement the same curriculum on selected grade levels.

Eventually, cluster sampling as a probabilistic sampling strategy in which intact groups are selected randomly (Frankel, Wallen, & Hyunn, 2012) was applied. It is convenient to use cluster sampling when the population is very large or spread out besides requiring less time and expense compared to simple random sampling (Gay, Mills, & Airasian, 2009). According to General Directorate of Basic Education, there are 549 public middle schools in Ankara including 274.192 students (140.755 males and 133.437 females) (MoNE, 2014). Fourteen schools were selected randomly from Altındağ (n = 2), Çankaya (n = 5), Keçiören (n= 4), and Yenimahalle (n = 3) by considering their proportions in the population to ensure representativeness. On the other hand, there are 117,202 middle school students based on the information reported by National Education Directorate of these four central districts. The number of the participants was identified considering the size of the accessible population and the number of items on the instruments. Consequently, 2250 middle school students from sixth, seventh, and eighth grades voluntarily participated in the study.

Of the participants, female students (n = 1164) constituted 51.7%, while males (n = 1085) formed 48.2% of the sample. One student didn't indicate the gender. In addition, 690 students were from sixth grade (30.7 %), 772 students were from seventh grade (34.3 %), and 784 of them were from eighth grade (34.8%). Four students did not indicate the grade level. Background characteristics of participants are given in Table 3.1.

Table 3.1

Frequency Distribution of Participants by District, Gender, and Grade Level (n = 2250)

	Frequency (*f*)	Percent (%)
District		
Altındağ	419	18.6%
Çankaya	720	31.9%
Keçiören	602	26.8%
Yenimahalle	510	22.6%
Gender		
Female	1164	51.7
Male	1085	48.2
Grade levels		
6th grade	690	30.7
7th grade	772	34.3
8th grade	784	34.8

3.5. Data Collection Instruments

Data were collected with four different instruments: The Achievement Emotions Questionnaire-Mathematics (AEQ-M), Mathematics Skills Self-Efficacy (MSSE) Scale, Self-Efficacy for Self-Regulated Learning (SESRL) Scale, and Motivated Strategies for Learning Questionnaire (MSLQ). The final version of the implemented instrument was consisted of six sections. The first section was about the demographic information part. Participants were asked about their gender and grade level. The second, third and fourth sections of the instrument were related to AEQ-M considering different educational contexts. There were 19 questions in the second section examining the class-related mathematics emotions, 18 questions in the third section looking for the learning related mathematics emotions and 23 questions in the fourth section exploring test or exam related mathematics emotions. Moreover, the fifth section was consisted of questions from Mathematics Skills Self-Efficacy (MSSE) and Self-Efficacy for Self-Regulated Learning (SESRL) scales to

understand learners' mathematics self-efficacy beliefs. Finally, the last section was comprised of questions of learning strategy subscale of MSLQ to examine cognitive and meta-cognitive self-regulated learning strategies of participants in mathematics.

3.5.1. The Achievement Emotions Questionnaire-Mathematics (AEQ-M)

The Achievement Emotions Questionnaire-Mathematics (AEQ-M) was developed by Pekrun et al. (2011) to measure students' achievement emotions in mathematics. Items of the instrument were derived from the original scale of Achievement Emotions Questionnaire (AEQ; Pekrun, Goetz, & Perry, 2005) by selecting items appropriate to students' mathematics emotional experiences in grades 5 to 10. The scale was adapted to Turkish language by the researcher.

AEQ-M is a multidimensional self-report instrument involving 60 items on a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). It assesses seven different emotions in mathematics: enjoyment, pride, anger, anxiety, shame, hopelessness, and boredom (Pekrun, Goetz, & Frenzel, 2005). The questionnaire includes three sections addressing emotional experiences of students while attending class, studying and doing homework, and taking tests or exams. These sections are called as class-related emotions (18 items), learning-related emotions (19 items), and test- or exam-related emotions (23 items). Within each section, there are three parts assessing individuals' emotions according to different time intervals as before, during, and after corresponding to the related section. Pekrun et al. (2011) conducted Confirmatory Factor Analysis to test the nine-dimension structure of AEQ. Results indicated that nine-emotion factor model was reasonably better than one-factor model having the following modification indices: Goodness of Fit Index (GFI) = .64, Comparative Fit Index (CFI) = .92, and Root Mean Square Error of Approximation (RMSEA) = .17. However, Pekrun et al. (2011) reported that achievement emotions might be described better while considering the differences between achievement emotions and the achievement settings. However, they did not test the factorial structure of AEQ-M. Only, they

reported reliability estimates. Cronbach alpha coefficients for each emotion type separately were α= .90 for enjoyment (10 items), α=.87 for pride (6 items), α=.88 for anger (9 items), α=.92 for anxiety (15 items), α=.84 for shame (8 items), α= .89 for hopelessness (6 items), and α=.89 for boredom (6 items) (Pekrun, Goetz, & Frenzel, 2005).

In this study, 60 items of the Turkish version of Achievement Emotions Questionnaire-Mathematics (AEQ-M) was used to measure students' mathematics achievement emotions. Sample items for each emotion type might be given as the following: "The material we deal with in mathematics is so exciting that I really enjoy my class." (Enjoyment, item 8); "I am proud of my contributions to the math class." (Pride, item 19); "My mathematics homework makes me angry." (Anger, item 24); "Even before I take the math test I worry I could fail." (Anxiety, item 41); "I am embarrassed about my lack of knowledge in mathematics."(Shame, item 37); "I have no energy." (Hopelessness, item 56); "I think the mathematics class is boring." (Boredom, item 11).

3.5.1.1. Adaptation Process of Achievement Emotions Questionnaire - Mathematics (AEQ-M)

In general, the Mathematics Achievement Emotions Questionnaire is accessible in German, Chinese, and English languages (Pekrun, Goetz & Frenzel, 2005). In this study, the questionnaire was translated to Turkish language by the researcher and three experts in English language. Then, the translated version was back translated to English by three different experts to make comparison on Turkish and English equivalency. Consequently, two versions of the scale were examined item by item to decide whether they were identical or not. In the questionnaire, there were some words, which do not have equivalent translation in Turkish such as "queasy" in item 3. Rather than literal translation of these words, the method of decentering was used to provide equivalence. Afterwards, expert opinion was taken from two experts in the field of Guidance and Psychological and one expert in the field of Measurement and

Evaluation to evaluate whether the items are coherent with the target culture and whether the meaning of each item corresponds with the original scale. In addition, experts were asked to examine the format, directions, and the rating scale to provide evidence for face validity.

Before piloting the scale, cognitive interviews were done with three students from sixth, seventh, and eighth grades to determine which item might cause possible response errors or was misunderstood by the participants. Actually, cognitive interview is an approach to judge the reasons of response errors in surveys considering the items of the questionnaire rather than the administration process itself (Willis, 2004). Concurrent think aloud protocol was administered; that is, volunteer participants were asked to think aloud while filling out the questionnaire. More specifically, they were asked to comment on the format and design of the instrument such as the length, appearance, and the things that they like and do not like the most at first look. Furthermore, they were expected to read each item loudly and mention the words, sentences or inferred meanings, which are unclear for them. Based on the cognitive interviews, none of the items was found problematic in terms of length or culturally sensitivity. Yet, item 7, item 8, item 15, item 28, item 42 confused students' minds because of the word of "material." Indeed, this word has two meanings in English as the subjects and the related documents, textbooks, worksheets or manipulatives of the lesson. These items needed to be clarified. For doing so, opinions were taken through an expert on Curriculum and Instruction and a bilingual expert on Educational Psychology. Finally, it was agreed that the "subject" meaning should be considered in translation.

3.5.1.2. Pilot Study Achievement Emotions Questionnaire-Mathematics (AEQ-M)

In the pilot study of AEQ-M, three public middle schools, two of them from Altındağ (*n* = 635) and one from Keçiören (*n* = 111) districts of Ankara, were chosen. The questionnaire was administered to totally 746 middle school students. Among the students, 18.2% was from the sixth graders (*n*= 136), 37% were from the seventh graders (*n* = 276), and 44.8% were from the eighth graders (*n* = 334). Furthermore, of the participants 52.1% were female (*n* = 389) and 47.5% were male (*n* = 354).Three students didn't indicate the gender.

Confirmatory factor analysis (CFA) was conducted through Analysis of Moment Structures (AMOS) 20 (Arbuckle, 2011) to understand whether the recommended model fits the data. CFA is a kind of Structural Equation Modeling (SEM) looking for the relationship between observed variables or "indicators" and latent variables or "factors." Not only the factor structure but also information about the patterns of item-factor and factor-factor relations is specified on empirical and theoretical grounds in CFA that differ from the Exploratory Factor Analysis (Brown & Moore, 2012).

The hypothesized model for the AEQ-M suggested the seven-emotion factor model. That is, enjoyment, pride, anger, anxiety, shame, boredom, and hopelessness were the latent variables of the hypothesized model, while items of the scale represented the indicators of each dimension. Before conducting CFA, assumptions were evaluated separately. Accordingly, sample size, missing data, normality, linearity, and absence of outliers are general assumptions of CFA (Tabachnick & Fidell, 2013). First of all, the number of participants was more than ten times of the number of items in the scale (Hair, Black, Babin, & Anderson, 2010), so sample size assumption was met. Then, univariate statistics were examined to determine the missing data profile. The percent of missing values did not exceed 5% which can be ignored as Hair et al. (2010) suggested. In order to handle the missing data, multiple

imputation method was used since it was considered to be “the most respectable method to deal with missing data” (Tabachnick & Fidell, 2013, p.72) besides involving the beneficiary of not requiring missing data at random like MCAR or MAR.

On the other hand, scores of each item were standardized to determine if there was any value exceeding 3.29 that would be considered as an outlier (Tabachnick & Fidell, 2013). Yet, there was no value above or below the critical point except one case and this case was excluded from the sample. However, it does not guarantee that there would be no extreme case on more than one variable referring to the multivariate outlier. Thus, Mahalanobis Distance (D^2) for each case was computed. This measure, as a kind of chi-square, points out the distance of each case from the intersection of means of all variables. Twenty cases out of 745 participants showed serious evidence of being multivariate outliers toward the critical value of 99.607 (107.38, $df = 60$, $p = .001$). These cases were excluded from the sample too.

Afterward, the univariate normality assumption was checked through Skewness and Kurtosis values, Kolmogorov-Smirnov and Shapiro-Wilk tests, histogram and Q-Q plots before evaluating the multivariate normality. Kolmogorov-Smirnov and Shapiro-Wilk results were significant, indicating non-normality. However, reliance on just these tests cannot be considered due to the fact that they are very sensitive to sample size. Skewness and kurtosis values were within the boundaries of -3 and 3. In addition to this, the absolute value of skewness and kurtosis results for each item was not greater than 3 and 10, respectively, showing no extreme case (Kline, 2011). Moreover, histograms and Q-Q plots did not display serious evidence of non-normality in the data.

The first run of CFA with Maximum Likelihood (ML) estimation revealed an inadmissible solution due to the item 45. After eliminating this item, CFA was performed again. Chi-square statistics was found significant but this test is sensitive

to sample size (Tabachnick & Fidell, 2013), so other fit indices were examined: Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), and Root Mean Square Error of Approximation (RMSEA). According to Hu and Bentler (1999), values of CFI and NNFI should be greater than .95 for a good model fit and as low as .90 for a moderate model fit. On the other side, the rule of thumb for RMSEA for a good model fit is the value less than .05; while, values between .05 and .08 indicate mediocre model fit (Browne & Cudeck, 1993). Findings indicated that RMSEA was .06 while CFI and NNFI were found .81 and .80, indicating a poor fitting model. When modification indices were examined, there were two relatively higher error covariances (items 58 and 59, items 10 and 16). As they were expected to load on the same factor, so error terms (e58-e59, e10-e16) were allowed to covary in the model. Nevertheless, there were some other items (item 3, 4, 21, 26, 36, 46, 48, 52) that did not load on the corresponding factors. Under the deletion of these items, CFA revealed following fit indices: CFI = .89, NNFI =. 88, and RMSEA = .05 indicating a mediocre fit with a decreased chi square value despite its significance. The factor loadings of retained items were significant and higher than .40, as well (Table 3.2).

Table 3.2.

Pilot Analysis Results of CFA regarding Factor Loadings of AEQ-M Items

Dimension	Item	Standardized estimates
Enjoyment	Item 1	.80
	Item 5	.83
	Item 8	.79
	Item 12	.81
	Item 22	.79
	Item 28	.55
	Item 35	.68
	Item 39	.47
	Item 54	.59
Pride	Item 18	.84
	Item 19	.79
	Item 32	.70
	Item 58	.74
	Item 59	.71
Anger	Item 9	.69
	Item 13	.69
	Item 15	.75
	Item 17	.81
	Item 24	.75
	Item 29	.65
	Item 34	.69
	Item 53	.64
Anxiety	Item 2	.53
	Item 7	.48
	Item 23	.47
	Item 30	.62
	Item 38	.56
	Item 41	.76
	Item 43	.54
	Item 47	.70
	Item 51	.77
	Item 55	.73
Boredom	Item 6	.58
	Item 11	.76
	Item14	.72
	Item 20	.73
	Item 25	.74
	Item 31	.76
Hopelessness	Item 40	.74
	Item 42	.68
	Item 44	.76
	Item 49	.80
	Item 56	.72

Table 3.2.(cont'd)

Dimension	Item	Standardized estimates
Shame	Item 10	.53
	Item 16	.58
	Item 27	.40
	Item 33	.54
	Item 37	.49
	Item 50	.53
	Item 57	.67
	Item 60	.64

Reliability coefficients of items for enjoyment dimension (α = .91), pride (α = .88), anger (α = .89), anxiety (α = .90), shame (α = .79), hopelessness (α = .86) and boredom (α = .87) were also inspected before eliminating the abovementioned items. After deletion of those items, Cronbach alpha estimates did not change noticeably, except anxiety (α = .87). In order to test these items once more with a larger sample size and with a different group of participants, items were kept in the main study.

3.5.1.3. Further Validity Evidence

To provide further validation of Mathematics Achievement Emotions Questionnaire (AEQ-M), the participants were also administered Turkish version of test anxiety (5 items) subscale of Motivated Strategies for Learning Questionnaire (Sungur, 2004). It was expected that test anxiety would be positively correlated with anxiety, anger, shame, hopelessness, and boredom, while negatively correlated with enjoyment and pride. Bivariate correlations were performed between the scores of test anxiety subscale of MSLQ and factor scores of AEQ-M (Table 3.3).

Table 3.3.

Correlations between Emotions and Test Anxiety Subscale of MSLQ

	1	2	3	4	5	6	7	8
1.Enjoyment	-							
2.Pride	.82*	-						
3.Anger	-.50*	-.54*	-					
4.Anxiety	-.50*	-.54*	.54*	-				
5.Shame	-.41*	-.46*	.54*	.73*	-			
6.Hopelessness	-.57*	-.59*	.62*	.84*	.71*	-		
7.Boredom	-.70*	-.59*	.85*	.60*	.53*	.65*	-	
8.MSLQ	-.08	-.05	.12**	.44*	.33*	.36*	.14*	-

*p<.01, **p<.05

As presented in Table 3.3, the relationships between factor scores of AEQ-M and test anxiety subscale of MSLQ were significant except enjoyment and pride. All of the relationships appeared in the expected direction. The strength of the relationship between anxiety and test anxiety subscale was moderate (r = .44) (Cohen, 1988) but stronger than other emotions.

3.5.2. Mathematics Self-Efficacy

Students' self-efficacy beliefs toward mathematics were measured by two scales constructed by Usher (2007) assessing students' mathematics skills self-efficacy and self-efficacy for self-regulated learning. Brief information regarding scales is given in the next section followed by the adaptation process followed in the current study.

3.5.2.1. Mathematics Skills Self-Efficacy (MSSE)

In this scale, items are likely to measure middle school students' beliefs in their capabilities to solve some mathematical problems. Involving 24 items, the scale was designed as a 100-point rating scale while responses vary from 0 point (not at all confident), 50 points (somewhat confident) to 100 points (completely confident). The scale was constructed according to National Council of Teachers of Mathematics (NCTM) principles and standards (Usher, 2007) with respect to content standards in general five areas including algebra, geometry, measurement, data analysis, and

probability. The sample item might be given as “How confident are you that you can successfully solve math exercises involving rounding and estimating?” Moreover, there are several items assessing process standards including problem solving, reasoning and proof, communication, connection, and representation. The sample item reads “How confident are you that you can successfully solve math exercises involving explaining in words how you solved a math problem?” Cronbach alpha coefficient of the scale for reliability estimate was found .95 (Usher, 2007). Usher did not provide any kind of validity evidence for the scale.

3.5.2.2. Self-Efficacy for Self-Regulated Learning (SESRL)

Usher (2007) developed this scale by adapting Bandura (2006)’s Children Multidimensional Self-Efficacy Scale to measure students’ capability judgments in order to use self-regulated learning strategies in mathematics. The scale was constructed as a 6-point rating scale ranging from 1 “not very well at all” to 6 “very well.” It includes 11 items. The sample item reads “How well can you participate in math class?” The reliability coefficient of the scale was found .91 with a sample of American middle school students from 6th to 8th grades.

3.5.2.3. Adaptation Process of Mathematics Skills Self-Efficacy and Self-Efficacy for Self-Regulated Learning Scales

The Mathematics Skills Self-Efficacy and Self-Efficacy for Self-Regulated Learning scales were adapted to Turkish language within the scope of the current study. During the scale adaptation process, several steps were considered respectively. Firstly, the scales were translated to Turkish by three people, who are fluent in English language and who have mathematics education background. Secondly, the scales were back translated by three different people who are also good at English and who are working toward a master degree in mathematics education. Both versions (original and back translated versions) were examined by the researchers and revisions were made when necessary.

Furthermore, expert opinion was taken from two experts in the field of mathematics education and one expert in the field of measurement and education. As a result of 4+4+4 regulation, goals and objectives of some subjects with respect to grade levels have been changed in the new mathematics curriculum (MoNE, 2013). Therefore, the expert opinions were crucial to evaluate whether the items represent tasks presented in middle mathematics classes.

Considering the curriculum implementation differences among schools, cognitive interviews were done with three middle school students from sixth to eighth grades to be able to figure out whether the items were appropriate for those grade levels. Concurrent think-aloud protocol was used again. Interviews for the Self-Efficacy for Self-Regulated Learning Scale indicated that the place of the word "how well" created confusion for the students in Turkish. Therefore, item 1, item 7, item 8, and item 11 were revised through changing the order of this word in the sentence.

Moreover, during the cognitive interviews for the Mathematics Skills Self-Efficacy Scale, students at sixth grade reported that they have not learned some of the subjects present in the mathematics skills self-efficacy scale. In addition to the cognitive interviews, three elementary mathematics teachers (one with one year, one with five years, and one with thirty-five years of teaching experience) were asked to report their opinions about the scale. Accordingly, some of the items are not studied in the sixth grades. Hence, students were given a chance to not to answer the item that they have not learned yet in the pilot study to find out the items, which are not appropriate for the students.

3.5.2.4. Pilot Study for the Mathematics Skills Self-Efficacy and Self-Efficacy for Self-Regulated Learning Scales

The pilot study was conducted to provide validity and reliability evidence for the Mathematics Skills Self-Efficacy and Self-Efficacy for Self-Regulated Learning Scales. Accordingly, Exploratory Factor Analysis (EFA) was performed through

SPSS 22 to discover the factor structures of both scales. For data collection, one public middle school was chosen from Altındağ district of Ankara. Two of the scales were administered to totally 202 middle school students (48 sixth, 110 seventh, and 44 eighth grade students). Among the participants, 106 of them (51.5%) were female, while 95 of them (47%) were male. One student did not indicate the gender.

Metric variables, correlations above .30, Barlett's Test of Sphericity, Kaiser-Meyer-Olkin (KMO) value, absence of outliers and multivariate normality are assumptions of EFA (Hair et al, 2010). They were considered for each scale before conducting EFA. Since mathematics self-efficacy variable is continuous, the scores obtained from the 6-point Self-Regulated Learning Scale and Mathematics Skills Self-Efficacy Scale confirm the metric variable assumption. Furthermore, each item should correlate with at least one of them with a coefficient of .30 or higher (Tabachnick & Fidell, 2013). For each scale, results showed that there were no items that correlated with other items with a value below .30 or above .90 for each scale. In addition, Barlett's Test of Sphericity result was significant both for Self-Efficacy for Self-Regulated Learning Scale (χ^2 (55) = 1196.02, p < .05) and for Mathematics Skills Self-Efficacy Scale (χ^2 (276) = 3269.38, p < .05), indicating that the correlation matrix was different from the identity matrix. KMO value (1974; as cited in Field, 2009) should be minimum .50 while values within the boundary of .50 - .70, .70 - .80, .80 - .90, and above .90 to reflect mediocre, good, great, and superb aspect of the sample size adequacy, respectively. KMO value was .92 for Self-Efficacy for Self-Regulated Learning Scale and .94 for Mathematics Skills Self-Efficacy Scale. The sample size (n=202) reflecting adequate sample size to continue with EFA (Hair et al, 2010). In addition, standardized score of each item was calculated to determine if there was any outlier. Based on the criteria of Tabachnick and Fidell (2013), standardized scores should not exceed the value of 3.29, and the findings showed that there was not a score above or below the critical value that refers the absence of univariate outliers for both scales. The final check was for normality. Before examining multivariate normality, univariate normality assumption was checked

through skewness and kurtosis values, Kolmogorov-Smirnov and Shapiro-Wilk statistical tests, histograms, and Q-Q plots. Although Kolmogorov-Smirnov and Shapiro-Wilk tests were significant indicating non-normality of data, other values were examined as these tests are too sensitive and finding significant results even from small deviations is inevitable if the sample size is large as the biggest limitation of these tests (Field, 2009). Skewness and kurtosis values were close to zero, within the boundaries of -3.0 and 3.0. Histograms and Q-Q plots did not display serious concern for non-normality. Consequently, multivariate normality was checked with Mardia's Test through SPSS Macro. The Mardia's result for SESRLS (*b2p* = 211.19, *p*< .001) and for MSSE scale (*b2p* = 875.95, *p* < .001) was significant showing that multivariate normality assumption was violated. Hence, Principal Axis Factoring (PAF) extraction method with Oblique rotation was used to simplify and clarify the data to find out maximum orthogonal variance with each revealing factor (Tabachnick & Fidell, 2013) and assuming that the expected factors would be correlated to each other (Costello & Osborne, 2005).

Catell's Scree test and eigenvalue criterion were examined to determine the retained number of factors. The breakpoint of the plot reflects single factor dimension for the Self-Efficacy for Self-Regulated Learning scale in Figure 3.1.

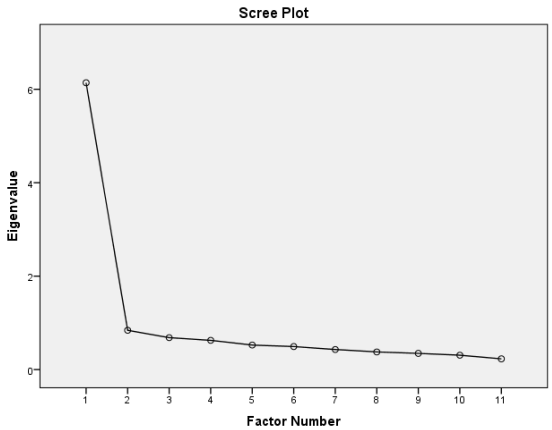

Figure 3.1. Scree plot of Self-Efficacy for Self-Regulated Learning Scale

Furthermore, according to eigenvalues greater than one rule to retain factors, one-factor solution appeared for Self-Efficacy for Self-Regulated Learning Scale, explaining 55.82% of total variance. Factor loadings ranged from .64 to .78 (Table 3.4).

Table 3.4.

Factor Loadings for the Self-Efficacy for Self-Regulated Learning Scale

Item	Factor Loading
Item 5	.78
Item 6	.78
Item 10	.77
Item 3	.77
Item 2	.76
Item 9	.71
Item 1	.71
Item 7	.67
Item 4	.66
Item 8	.64
Item 11	.64
Eigenvalues	6.14
% of variance	55.82

The scree plot and eigenvalue criterion were scrutinized for Mathematics Skills Self-Efficacy Scale as well. The breakpoint of the scree plot (Figure 3.2) reflects two-factor structure for the Mathematics Skills Self-Efficacy Scale.

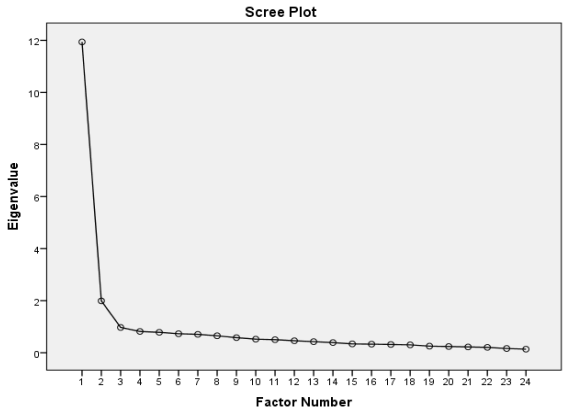

Figure 3.2. Scree plot of Mathematics Skills Self-Efficacy Scale

Consequently, the eigenvalue greater-than-one rule suggested two factors. Two-factor structure explained 58.04% of total variance that was more than 40% as a rule of thumb (Blunch, 2008); while, the first dimension explained the largest portion of the variance (49.74%) compared to the latter ones. Then, pattern matrix was examined to observe if any item was cross loading or freestanding. The retained factors were scanned, and it was found that the factor structure of the scale was based on a kind of response pattern of students. That is, items from 1 to 9 and 10 to 24 on the separate pages generated two dimensions of the scale. For that reason, EFA was performed again for the Mathematics Skills Self-Efficacy Scale by forcing the structure to a single dimension. Results indicated that factor loadings ranged from .56 to .82 (Table 3.5).

Table 3.5.

Factor Loadings for the Mathematics Skills Self-Efficacy Scale

Item number	Factor loading
Item 12	.82
Item 13	.76
Item 22	.76
Item 11	.74
Item 23	.73
Item 16	.73
Item 17	.72
Item 15	.72
Item 3	.72
Item 20	.71
Item 21	.70
Item 4	.70
Item 18	.69
Item 6	.68
Item 2	.68
Item 10	.68
Item 14	.67
Item 19	.65
Item 5	.65
Item 9	.64
Item 7	.62
Item 24	.60
Item 1	.59
Item 8	.56
Eigenvalues	11.94
% of variance	49.74

Besides, Cronbach's alpha coefficient was calculated for internal consistency estimates. The reliability coefficients of the Self-Efficacy for the Self-regulated Learning and Mathematics Skills Self-Efficacy scales were found to be .92 and .96, respectively. These were considered as high according to Nunnally (1978). In addition, findings were parallel with Usher (2007)'s study (.91 for Self-Efficacy for Self-Regulated Learning and .94 for Mathematics Skills Self-Efficacy Scale).

3.5.3. Motivated Strategies for Learning Questionnaire (MSLQ)

The Motivated Strategies for Learning Questionnaire (MSLQ) as a self-report instrument was developed by Pintrich, Smith, Garcia, and McKeachie (1991) to measure college students' motivational orientations and use of learning strategies. The scale was adapted to Turkish language by Sungur (2004). It is consisted of two sections: motivation and learning strategy. There are 31 items in the motivation section assessing students' goals and value beliefs toward a course, while learning strategy section includes 50 items measuring students' strategy use. In the second section, students' cognitive and metacognitive strategies (31 items) and source management (19 items) are assessed. The scale was designed as a 7-point rating scale from 1 (not at all true of me) to 7 (very true of me).

The current study focused on the learning strategies section of Turkish version of MSLQ considering cognitive and metacognitive strategies with regard to mathematics domain of the study. There are 31 items in this part involving five subscales, which are rehearsal (4 items), elaboration (6 items), organization (4 items), critical thinking (5 items), and metacognitive self-regulation (12 items). Sample items for each subscale include "When I study for this class, I practice saying the material to myself over and over" (rehearsal, item 39); "I make simple charts, diagrams or tables to help me organize course material" (organization, item 49); "I try to apply ideas from course readings in other class activities such as lecture and discussion" (elaboration, item 81); "I try to plan around with ideas of my own related to what I am learning in this course" (item 81); "When studying for this course I try to determine which concepts I don't understand well" (metacognitive self-regulation, item 76). For the original scale (Pintrich et al., 1991), Cronbach alpha coefficients of each subscale were reported as .69 for rehearsal subscale, .76 for elaboration subscale, .64 for organization subscale, .80 for critical thinking subscale, and .79 for metacognitive self- regulation subscale. In addition, Sungur (2004) reported reliability estimates of the Turkish version for each subscale as .73, .78, .71, .81, and .81, respectively.

3.6. Data Collection Procedures

Firstly, the permissions to conduct the research were received from METU Human Subjects Ethics Committee and Ministry of National Education (MoNE) before the school selection. A pilot study was conducted with approximately 750 middle school students including 6th, 7th, and 8th grades having similar characteristics with the intended sample. Actually, the pilot study was conducted to provide construct validity evidence for the scales adapted to Turkish within the scope of this study. After the pilot study, the main study was conducted at second semester of 2013-2014 academic year.

The administration of the instruments took approximately one class hour for each grade level, so teachers were requested to help the researcher due to time restrictions. Hence, students were informed about the study and the administration process before data collection procedure. Students participated to the study voluntarily, having the right to withdraw at any time they want. Furthermore, the purpose of the study was explained them carefully, and they were notified that their information would be kept secretly and only used for research purposes by the researcher. The researcher was often present at classes to respond questions of participants if any and to observe whether they respond each item independently or not. Moreover, students were asked to read items carefully for the quality of the study.

3.7. Data Analysis

Data analysis was done with respect to descriptive and inferential statistics with IBM SPSS 22 for windows. Confirmatory factor analysis was conducted with AMOS 20 (Arbuckle, 2011) to test the proposed seven-factor model of AEQ-M and to test one-factor structure of MSSE and SESRL scales. Chi square (χ^2) statistics and fit indices are commonly used methods to estimate the fit of the model relative to a baseline model. The cut of values for chi square statistics should be within the boundary of 0 and 1 and close to 0 for a perfect fit, while the p value should be non-significant. However, as chi-square statistics is highly sensitive to sample size (Tabachnick &

Fidell, 2013), other goodness of fit indices were examined to test the hypothesized models. Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI) are incremental fit indices, whereas Root Mean Square Error of Approximation (RMSEA) looks for the discrepancy between the proposed model and the obtained covariance matrices (Byrne, 2009). According to Hu and Bentler (1999), values of CFI and NNFI should be greater than .95 for a good model fit and as low as .90 for a moderate model fit. For RMSEA, The rule of thumb for a good model fit imply the values less than .05, while values between .05 and .08 indicate moderate model fit (Browne & Cudeck, 1993). Furthermore, the internal consistency reliability of all scales was also checked by Cronbach alpha coefficients.

Descriptive statistics results were examined to see the differences with regard to gender and grade level focusing on means and standard deviations of the sample whereby percentage and frequency values were investigated for the demographic qualities of participants to describe the characteristics of the sample well. Consequently, two-way multivariate analysis of variance (MANOVA) was conducted to investigate the effects of gender and grade level on mathematics achievement emotions. Before running MANOVA, the assumptions of this multivariate test were examined separately, which are independent observation, multivariate normality, homogeneity of population covariance matrices for dependent variables, and interval or ratio scale on the dependent variables.

Finally, canonical correlation was utilized to answer the second and third research questions: “What is the relationship between middle school students’ achievement emotions in mathematics, mathematics self-efficacy, and self-regulated learning strategies?” and “What is the relationship between middle school students’ achievement emotions in mathematics, their mathematics self-efficacy and self-regulated learning strategies according to grade levels?” Canonical correlation tests a multivariate statistical model that allows for examining the correlation between entire sets of multiple dependent and independent variables. Multiple independent

variables are predicted from multiple dependent variables (Hair et al., 2010). Absence of outliers, multivariate normality, linearity, homoscedasticity, and multicollinearity are assumptions of canonical correlation to be reported. After checking the assumptions, significant canonical variate(s), canonical loadings, and the redundancy indices were explained in details and accompanied by a diagram of the model.

3.8. Limitations of the Study

The present study presents several limitations. Firstly, the study examines the relationship between achievement emotions, mathematics self-efficacy and self-regulated learning strategies of middle school students with cross-sectional design. For that reason, cause-and-effect inferences between these variables are not possible due to the nature of correlational studies. Secondly, the data were collected through self-report measures in order to study student perceptions. It is possible that people might not reflect their true feelings because of social desirability problem. In addition, subconscious processes of individuals cannot be thoroughly considered or dynamics of emotional processes cannot be sufficiently analyzed (Pekrun, 2014); however, reliance on these instruments was taken into consideration in this study. Thirdly, the study is limited to 6th, 7th, and 8th grade public school students and domain of mathematics. Therefore, it is not possible to generalize the findings of the study to other education levels and other subject domains. The findings can be generalized only to chosen districts in Ankara. There are 25 districts in Ankara with regard to different socioeconomic status, ethnic and cultural backgrounds, so it is not possible to expect making generalizations on other settings in Ankara or to generalize the results to other cities in Turkey. This situation restricts the ecological generalizability of the study.

3.9. Assumptions of the Study

The following assumptions were made for the current study: Firstly, all of the data collection instruments were administered to the participants under the standard conditions. Secondly, participants' responses toward Achievement Emotions Questionnaire-Mathematics, Self-Efficacy for Self-Regulated Learning Scale, Mathematics Skills Self-Efficacy Scale, and Learning Strategies subscale of MSLQ were sincere and reflected their own ideas. Lastly, participants were not influenced from each other while responding the items on the instruments.

CHAPTER IV

RESULTS

In this chapter, the descriptive and inferential statistics results are presented in terms of research questions. In the first two sections, missing data analysis and the psychometric properties of both instruments (i.e., validity and reliability issues) are explained in detail before performing relevant analyses. The current study aimed to investigate the relationship among mathematics achievement emotions, mathematics self-efficacy and self-regulated learning strategies of middle school students and to examine their mathematics achievement emotions according to grade level and gender. Therefore, Multivariate Analysis of Variance (MANOVA) and Canonical Correlation were performed based on 2250 participants to answer research questions. Before running analyses, statistical assumptions are examined, and then the findings of each analysis are presented.

4.1 Missing Data Analysis

First of all, frequency statistics were examined prior to main analysis to determine the missing data profile. The percentage of missing values for Mathematics Achievement Emotions Questionnaire (AEQ-M), Self-Regulated Learning Self-Efficacy Scale, and Learning Strategies subscale of Motivated Strategies for Learning Questionnaire (MSLQ) did not exceed 5%. Therefore, the missing data is not a critical concern, as it does not exceed 10% (Hair, Black, Babin, & Anderson, 2010). Multiple imputation method was used to handle with the missing data as in the pilot study. However, the ratio of missing values exceeded 5% for the eighth items on the Mathematics Skills Self-Efficacy Scale. It appeared that students mostly from the sixth grade left these items unanswered. To handle this situation, mean imputation was used for the Mathematics Skills Self-Efficacy Scale instead of listwise deletion.

4.2 Validity and Reliability Issues

Mathematics Achievement Emotions Questionnaire (AEQ-M), Self-Efficacy for Self-Regulated Learning Scale (SESRLS), Mathematics Skills Self-Efficacy Scale (MSSE), and Learning Strategy Scale of Motivated Strategies for Learning Questionnaire (MSLQ) were used in the current study to examine the relationships among variables. However, the abovementioned scales should be verified by supporting evidence about their construct-related validity. Thus, Confirmatory Factor Analysis (CFA) was conducted to test the factorial structure of the scales.

4.2.1 Psychometric Properties of Mathematics Achievement Emotions Questionnaire (AEQ-M)

CFA was conducted with Maximum Likelihood (ML) estimation through Analysis of Moment Structures 20 (AMOS) (Arbuckle, 2011) to validate the factor structure of Achievement Emotions Questionnaire (AEQ-M). The Turkish version of AEQ-M proposed seven emotion factors model which are enjoyment, pride, anger, anxiety, shame, hopelessness and boredom. Of the assumptions, there was no problem for the univariate normality assumption based on the skewness and kurtosis tests. The absolute values of skewness and kurtosis results for each item were not greater than 3 and 10 (Kline, 2011). Further, histograms and Q-Q plots did not display any evidence of non-normality. Although multivariate normality was violated according to Mardia's test, it is stated that "all such tests are limited by the fact that slight departures from normality could be statistically significant in a large sample" (Kline, 2011, p.60). Based on the univariate normality results, deviations on multivariate normality were assumed plausible. Consequently, ML estimation method was preferred as it is recommended as a better alternative for medium to large samples (Tabachnick & Fidell, 2013).

After the model specification and estimation, assessing the fit of the model should be examined carefully using several indices (Tabachnick & Fidell, 2013). The first run of CFA revealed an inadmissible solution due to one item in anxiety dimension as in

the results of the pilot study. Hence, this item (item 45) was eliminated from the scale. The next run revealed a significant chi-square statistics χ^2 (1573) =13316.03, $p < .001$. However, this statistics is heavily influenced by sample size (Tabachnick & Fidell, 2013). Therefore, other indices were examined as well. RMSEA value was found .06 indicating a fair fit (Browne & Cudeck, 1993), besides Comparative Fit Index (CFI) of .85 and Non-Normed Fit Index (NNFI) of .84 values indicated a poor fit of the model (Hu & Bentler, 1999). Therefore, modification indices were examined, and the items with higher error covariances were examined. Item 3, 4, 21, 26, 36, 48, and 52 were detected as not working properly. These findings are parallel to the findings of pilot study. Hence, these items were decided to be eliminated from the scale.

In addition, there were some other high error covariances among pairs of items excluding the abovementioned ones. These pairs of items belonged to the same factor and they were meaningfully close items, so error terms (e10-e16, e58-e59) were allowed to covary in the model, and CFA was performed again to check out the fit of the model. Results revealed a decreased chi-square value from 14265.26 to 8026.94. Moreover, RMSEA value was .05 indicating an acceptable fit (Browne & Cudeck, 1993). CFI =.90 and NNFI=.90 did not satisfy the criteria for a good model fit. However, .90 was concerned as a cut off value between adequate and inadequate model fit since it was recommended to have a value for CFI as low as .90 for a moderate fit (Bentler & Bonett, 1980; Schumacker & Lomax, 1996) especially if the sample size is large and the number of indicator variables are above 30 (Hair et al., 2010). Furthermore, factor loading of each item was significant. The loadings were from .68 to .84 for enjoyment, .72 to .85 for pride, from .66 to .83 for anger, from .45 to .80 for anxiety, from .47 to .73 for shame, from .74 to .86 for hopelessness, and from .64 to .81 for boredom dimension (Table 4.1). Hence, the measurement model is accepted as reasonable.

Table 4.1.

Factor Loadings of Items for AEQ-M

Dimension	Item	Standardized estimates
Enjoyment	Item 1	.84
	Item 5	.86
	Item 8	.81
	Item 12	.83
	Item 22	.81
	Item 28	.48
	Item 35	.67
	Item 39	.51
	Item 46	.73
	Item 54	.68
Pride	Item 18	.85
	Item 19	.77
	Item 32	.72
	Item 58	.78
	Item 59	.76
Anger	Item 9	.70
	Item 13	.71
	Item 15	.77
	Item 17	.83
	Item 24	.78
	Item 29	.66
	Item 34	.75
	Item 53	.73
Anxiety	Item 2	.59
	Item 7	.53
	Item 23	.45
	Item 30	.66
	Item 38	.65
	Item 41	.79
	Item 43	.66
	Item 47	.80
	Item 51	.78
	Item 55	.74
Boredom	Item 6	.64
	Item 11	.77
	Item14	.72
	Item 20	.76
	Item 25	.79
	Item 31	.81
Hopelessness	Item 40	.80
	Item 42	.74
	Item 44	.81
	Item 49	.86
	Item 56	.74

Table 4.1. (cont'd)

Dimension	Item	Standardized estimates
Shame	Item 10	.53
	Item 16	.59
	Item 27	.47
	Item 33	.55
	Item 37	.53
	Item 50	.55
	Item 57	.73
	Item 60	.70

Moreover, Cronbach alpha coefficients for each emotion subscale were calculated. They ranged from .81 (shame) to .92 (enjoyment). When item-total correlations were examined, item 36 on pride dimension, item 48 on anger dimension, and item 52 on hopelessness dimension seemed problematic. These items also appeared problematic in CFA. Reliability estimates for the final version are shown in Table 4.2. All of them were above .80.

Table 4.2.

Reliability Coefficients of Emotion Subscales

Emotion subscales	Item number	Cronbach alpha coefficients
Enjoyment	10	.92
Pride	5	.89
Anger	8	.91
Anxiety	10	.89
Shame	8	.81
Hopelessness	5	.89
Boredom	6	.88

4.2.2 Psychometric Properties of Self Efficacy for Self-regulated Learning Scale

CFA was performed through AMOS 20 (Arbuckle, 2011) to test the one-dimensional structure of Self-Efficacy for Self-Regulated Learning Scale, as revealed in the pilot study. The first run of CFA revealed a significant chi-square statistics χ^2 (44) =744.80, $p < .001$ and the following fit index values: CFI = .96, NNFI = .94, and RMSEA = .08. Although RMSEA value seemed to be high for a close fit, CFI and NNFI results reflected a good model fit (Hu& Bentler, 1999). In addition, the

standardized estimates of each item were higher than .40 and each item significantly contributed to the hypothesized model. Standardized estimates are displayed in Table 4.3.

Table 4.3.

Factor Loadings of Items for SESRLS

Item numbers	Standardized estimates
Item1	.70
Item2	.74
Item3	.83
Item4	.74
Item5	.83
Item6	.82
Item7	.75
Item 8	.70
Item 9	.78
Item 10	.69
Item 11	.67

Cronbach alpha coefficient of the SESRLS was found .93, deemed acceptable as it is above .70 (Nunnally, 1978).

4.2.3 Psychometric Properties of Mathematics Skills Self-Efficacy Scale (MSSE)

The original version of the scale (Usher, 2007) and the findings of pilot study proposed one dimension model for the Mathematics Skills Self-Efficacy Scale (MSSE). CFA was conducted with AMOS 20 (Arbuckle, 2011) to figure out the admissibility of the model. CFA resulted a significant chi-square value, $\chi^2(252) = 4266.13$, $p < .001$, CFI = .87, NNFI = .86, and RMSEA = .08. By allowing five pairs of items (e1-e2, e2-e3, e12-e13, e14-15, and e22-e23) with higher error covariances to covary, CFA was performed for the second time. The second run of CFA resulted a significant chi-square value again but with a decrease from 4266.13 to 2555.23. Fit indices of the hypothesized model were examined at the same time (CFI = .93, NNFI = .92, RMSEA = .06). CFI and NNFI values exceeded the threshold value of .90

(Bentler & Bonett, 1980) and RMSEA value revealed a moderate fit for the model (Browne & Cudeck, 1993). Furthermore, factor loadings of each item were greater than .40, ranging from .55 to .76, as shown in Table 4.4.

On the other hand, the reliability coefficient of the MSSE was .96, compatible with the findings of the pilot study and the coefficient value obtained from the analysis of original scale (Usher, 2007).

Table 4.4.

Factor Loadings of Items for MSSE Scale

Item numbers	Standardized estimates	Item numbers	Standardized estimates
Item1	.55	Item 13	.66
Item2	.72	Item 14	.63
Item3	.70	Item 15	.64
Item4	.73	Item 16	.71
Item5	.66	Item 17	.76
Item6	.74	Item 18	.75
Item7	.73	Item 19	.67
Item 8	.63	Item 20	.72
Item 9	.73	Item 21	.75
Item 10	.67	Item 22	.68
Item 11	.69	Item 23	.70
Item 12	.73	Item 24	.64

4.2.4 Psychometric Properties of Learning Strategies Scale of Motivated Strategies for Learning Questionnaire (MSLQ)

CFA was performed to test the factor structure of Turkish version of Learning Strategies scale of Motivated Strategies for Learning Questionnaire (MSLQ) through AMOS 20 (Arbuckle, 2011). Since cognitive and metacognitive learning strategies part was the concern of this study, the factor analysis was conducted considering relevant subscales, which were elaboration, rehearsal, organization, critical thinking, and metacognitive self-regulation (Pintrich et al., 1991).

The first run of CFA revealed a significant chi-square value, χ^2 (424) = 3726.70, $p <$ .001. As chi-square is highly influenced by sample size (Tabachnick & Fidell, 2013), other fit indices were also examined to evaluate the measurement model (CFI = .93, NNFI = .92, RMSEA = .06). When factor loadings of each item were examined in order to understand the contribution of each item to hypothesized dimensions, it appeared that item 2 and item 17 on metacognitive self-regulation dimension were loaded with a value less than .40. Therefore, these items were eliminated from the scale.

The second run of CFA revealed an improved model with a decreased chi-square value of 3137.85, $p <$ .001; CFI = .94, NNFI = .93, and RMSEA = .06, indicating an adequate fit of the model. The factor loadings of items given in Table 4.5 were from .69 to .77 for rehearsal dimension, from .70 to .81 for elaboration dimension, from .69 to .81 for critical thinking dimension, from .62 to .75 for organization dimension, and from .66 to .79 for metacognitive self-regulation dimension. Hence, each item significantly contributed to the proposed dimensions on the hypothesized model.

Table 4.5.

Factor Loadings of Items for Learning Strategy Scale of MSLQ

Dimension	Item numbers	Standardized estimates
Rehearsal	Item 5	.76
	Item 9	.77
	Item 18	.69
	Item 27	.74
Elaboration	Item 13	.78
	Item 20	.72
	Item 22	.81
	Item 24	.79
	Item 25	.80
	Item 31	.70
Organization	Item 1	.67
	Item 7	.74
	Item 11	.62
	Item 21	.75
Critical thinking	Item 4	.69
	Item 10	.71
	Item 12	.77
	Item 23	.81
	Item 26	.79
Metacognitive self-regulation	Item 3	.66
	Item 6	.73
	Item 8	.70
	Item 14	.75
	Item 15	.78
	Item 16	.72
	Item 19	.77
	Item28	.78
	Item 29	.79
	Item 30	.72

Reliability estimates of each subscale for Learning Strategies Scale were provided through Cronbach Alpha coefficients. The reliability coefficients for elaboration (α=.90), rehearsal (α=.83), organization (α=.79), critical thinking (α=.87) and metacognition (α=.87) subscales were calculated separately. While inter-item correlations and item total statistics were reviewed, item 2 and 17 were seen problematic confirming the results of factor analysis. When these items were eliminated from the scale, Cronbach alpha coefficient for metacognitive self-regulation subscale increased from .87 to .92 reflecting good reliability coefficients

for all subscales. The reliability estimates of the final version of the scale are presented in Table 4.6.

Table 4.6.

Reliability Coefficients of Learning Strategy Subscales

Learning Strategies	Item number	Cronbach alpha coefficients
Rehearsal	4	.83
Elaboration	6	.90
Organization	4	.79
Critical Thinking	5	.87
Metacognitive Self-Regulation	10	.92

4.3 Descriptive Statistics

Descriptive statistics were generated to understand participants' mathematics achievement emotion profiles, their mathematics self-efficacy, and learning strategy use. Mean and standard deviations of mathematics achievement emotion are presented in Table 4.7. Findings indicated that participants' positive emotion scores were higher than negative ones. More specifically, math enjoyment score (M = 3.27) as one of the positive emotions was higher than the other positive emotion, pride (M = 3.24). Among the negative emotions, anxiety had the highest mean score (M = 2.89). Hopelessness (M = 2.77), shame (M = 2.40), and boredom (M = 2.37) were the next. Anger toward mathematics (M = 2.11) was the least displayed emotion among all.

Table 4.7.

Descriptive Statistics Results of Participants' Mathematics Achievement Emotions

Emotion type	*M*	*SD*
Enjoyment	3.27	1.08
Pride	3.24	1.21
Anger	2.11	1.09
Anxiety	2.89	1.09
Shame	2.40	0.98
Hopelessness	2.77	1.32
Boredom	2.37	1.17

Moreover, mean and standard deviation values for mathematics' skills efficacy and self-efficacy for self-regulated learning scales are generated. Accordingly, students' mathematics skills efficacy score (*M* = 4.41, *SD* = 1.21) was higher than self-efficacy for self-regulated learning score (*M* = 4.02, *SD* = 1.35).

On the other hand, participants' self-regulated learning strategy use was also examined descriptively. As referred in Table 4.8, individuals' metacognitive self-regulation score (*M* = 4.51) was higher than their elaboration (*M* = 4.43), rehearsal (*M* = 4.40), organization (*M* = 4.30) and critical thinking strategy (*M* = 4.27) scores, respectively.

Table 4.8.

Descriptive Statistics Results of Participants' Self-regulated Learning Strategy Use

Self-regulated Learning Strategies	*M*	*SD*
Rehearsal	4.40	1.70
Elaboration	4.43	1.68
Organization	4.30	1.66
Critical thinking	4.27	1.66
Metacognitive self-regulation	4.51	1.57

4.4 Multivariate Analysis of Variance (MANOVA) for AEQ-M regarding Gender and Grade Level

To answer the first research question "How do middle school students' achievement emotions in mathematics change by gender and grade level?" two-way (2x3) Multivariate Analysis of Variance (MANOVA) was conducted. Students' grades with three levels (6th, 7th, and 8th grades) and gender with two levels (female and male) were independent variables. The seven emotion dimensions of AEQ-M (enjoyment, pride, anger, anxiety, boredom, hopelessness and shame) were dependent variables. Since there are multiple dependent variables and more than one independent variable, performing MANOVA was preferred instead of more than one factorial Analysis of Variance (ANOVA) to control the inflation of Type I error.

Besides, ANOVA ignores the relationship among dependent variables or the difference of groups along a combination of variables (Field, 2009); whereas, MANOVA also consider the relationship among the dependent variables.

4.4.1 Assumptions of Multivariate Analysis of Variance (MANOVA)

There are several assumptions of MANOVA, which should be considered beforehand. These are: interval scale of measurement on the dependent variables, independent observations, absence of outliers, absence of multicollinearity, multivariate normality, and homogeneity of covariance matrices assumptions (Field, 2009; Tabachnick & Fidell, 2013).

Each math achievement emotion was measured at the interval scale of measurement. Univariate and multivariate outliers were screened for mean scores of each emotion dimension separately. There was no score below or above the standardized score of 3.29 implying the absence of univariate outliers (Tabachnick & Fidell, 2013). Mahalonobis distance (D^2) was computed to detect multivariate outliers. Accordingly, 20 cases were found to have been exceeding the critical value of 24.322 (df = 7, p = .001), and these cases were eliminated from the sample. Moreover, absence of multicollinearity was examined through tolerance and Variation Influence Factor (VIF) values. Tolerance values were above .10 (ranging from .21 to .44) and VIF values were below 10 (ranging from 2.27 to 4.76), indicating no problem of multicollinearity (Myers, 1990; as cited in Field, 2009). In addition, correlation coefficients (presented in Table 4.9) were not above .90 (Field, 2009).

Table 4.9

Correlation Coefficients for the Relationship Between Mathematics Achievement Emotions

Dimensions	1	2	3	4	5	6	7
1.Enjoyment	-						
2.Pride	.83*	-					
3.Anger	-.70*	-.58*	-				
4.Anxiety	-.62*	-.60*	.64*	-			
5.Boredom	-.76*	-.62*	.84*	.65*	-		
6.Hopelessness	-.63*	-.64*	.64*	.86*	.64*	-	
7.Shame	-.47*	-.50*	.57*	.70*	.53*	.69*	-

*p<.001

Univariate normality was firstly checked through Kolmogorov-Smirnov and Shapiro-Wilk's statistical tests, skewness and kurtosis values. Although the results of Kolmogorov-Smirnov and Shapiro-Wilk's tests were significant, these tests are sensitive to sample size (Field, 2009). Skewness and kurtosis values were within the boundary of -3 and +3 to discern serious non-normality in the data. In addition to this, histograms and Q-Q plots of each emotion dimension was considered to provide further evidence. Even though boredom and anger displayed slight skewness in the histograms, there is no problem based on the Q-Q plots. Furthermore, multivariate normality assumption was inspected through Mardia's test result. Mardia's Test result was significant ($b2p$ = 68.19, p < .001), indicating deviations from normality. As the sample size was large, it was decided to continue with the analysis.

Then, homogenity of covariance matrices assumption was checked through Box's M test and homogeneity of variance for the univariate tests was examined through Levene's test. Box's M test (286.50, p < .001) was significant, indicating inequality of covariance matrices; however, this test is sensitive to deviations from multivariate normality and to large sample size (Field, 2009). Therefore, Pillai's trace was chosen, as it is a more robust test statistic (Field, 2009). Levene's test yielded significant results for each emotion dimension of AEQ-M (Table 4.10); hence, the assumption of homogeneity of variances was violated. Field (2009) stated: "In large samples, Levene's test can be significant even when group variances are not very different. Therefore, it should be interpreted in conjunction with the variance ratio"

(p. 152). In the present study, variances (or standard deviations) did not differ much (Table 4.8).

Table 4.10

Levene's Test Results for Mathematics Achievement Emotions

	F	*df1*	*df2*
Enjoyment	4.60*	5	2223
Pride	3.46*	5	2223
Anger	13.02*	5	2223
Anxiety	6.81*	5	2223
Boredom	12.98*	5	2223
Hopelessness	11.11*	5	2223
Shame	6.40*	5	2223

*$p<.05$

4.4.2. Multivariate Analysis of Variance (MANOVA) Results for AEQ-M by Gender and Grade Level

Mathematics achievement emotions of participants were also examined according to gender and grade level. Table 4.11 presents mean values (and corresponding standard deviations) of participants by gender and grade level. Accordingly, positive emotion (i.e., enjoyment and pride) scores of male students were higher than those of female students. However, this situation was not valid for negative emotions. Except anger, negative emotion (i.e., anxiety, boredom, hopelessness, and shame) scores of female students were higher than male peers. Anger scores of male and female students were equal. Further, a decreasing trend appeared for positive emotions; whereas, negative emotions revealed an increasing pattern as the grade level increased.

Table 4.11.

Descriptive Statistics Results of Math Achievement Emotions According to Gender and Grade Level

	Mean (SD)		*Mean (SD)*		
Variable	Male	Female	6th grade	7th grade	8th grade
Enjoyment	3.30 (1.04)	3.25 (1.11)	3.64 (1.00)	3.32 (1.03)	2.88 (1.08)
Pride	3.29 (1.17)	3.19 (1.25)	3.54 (1.14)	3.27 (1.18)	2.95 (1.24)
Anger	2.11 (1.06)	2.11 (1.12)	1.85 (0.96)	2.06 (1.05)	2.40 (1.17)
Anxiety	2.76 (1.02)	3.01 (1.14)	2.69 (1.08)	2.88 (1.06)	3.06 (1.11)
Boredom	2.35 (1.13)	2.39 (1.21)	2.04 (1.03)	2.29 (1.13)	2.73 (1.24)
Hopelessness	2.65 (1.21)	2.89 (1.39)	2.57 (1.31)	2.74(1.28)	2.99 (1.32)
Shame	2.34 (0.91)	2.45 (1.04)	2.32 (0.98)	2.40 (0.95)	2.47 (1.01)

Consequently, 2X3 MANOVA with Pillai's Trace approximation was performed. Findings are presented in Table 4.12. MANOVA yielded non-significant multivariate interaction between grade level and gender, F (14, 4436) = 0.81, $p > .05$, a significant multivariate main effect for grade level, F (14, 4436) = 15.93, $p < .05$, $\eta^2 = .05$, and a significant multivariate main effect for gender, F (7, 2217) = 6.84, $p < .05$, $\eta^2 = .05$. According to Cohen (1988), partial η^2 (.05) represents a moderate effect both for the main effects of gender and grade level.

Table 4.12.

MANOVA and ANOVA Results for Gender x Grade Level Effects on Mathematics Achievement Emotions

		ANOVA						
Variable	MANOVA	D1	D2	D3	D4	D5	D6	D7
Gender (G1)	6.84^{*}	1.80	4.17	0.11	30.18^{**}	7.67^{**}	1.00	17.97^{**}
Grade level (G2)	15.93^{*}	96.97^{**}	46.01^{**}	48.95^{**}	20.98^{**}	3.87	68.52^{**}	19.79^{**}
G1xG2	0.81	1.10	0.26	1.30	1.00	0.27	1.30	1.62

Note. F ratio is Pillai's Trace approximation.

D1=Enjoyment; D2=Pride; D3=Anger; D4=Anxiety; D5=Shame; D6=Boredom; D7= Hopelessness

$^{*}p<.05$. $^{**}p<.007$

Then, univariate ANOVA statistics were used to examine whether mathematics achievement emotions vary as a function of gender and grade level. Bonferroni correction was made to prevent inflation of experimentwise error rates due to conducting multiple ANOVAs. That is, alpha level (.05) was divided by the number of dependent variables (seven achievement emotions in this case). Thus, the new alpha value of .007 was established. Univariate ANOVA by gender indicated no significant difference between males and females in mathematics enjoyment, pride, anger, and boredom. However, there was a significant gender effect in mathematics anxiety $F_{anx}(1, 2223) = 30.18$, $p < .007, \eta^2 = .01$, small effect (Cohen, 1988). Mathematics anxiety scores of female students ($M = 3.01$, $SD = 1.14$) were significantly higher than those of male students ($M = 2.76$, $SD = 1.02$). Furthermore, a significant difference was found in mathematics hopelessness, $F_{hopeless}(1, 2223) = 17.97$, $p < .007$, $\eta^2 = .01$, small effect. Accordingly, female students' ($M = 2.88$, $SD = 1.39$) feelings of hopelessness toward mathematics were significantly higher than male peers ($M = 2.65$, $SD = 1.21$). Similarly, female students reported significantly more shame ($M = 2.45$, $SD = 1.04$) than males ($M = 2.34$, $SD = 0.91$), $F_{shame}(1, 2223) = 7.67$, $p < .007$, $\eta^2 = .003$, small effect. Overall, results showed that students did not significantly differ in positive emotions regarding gender. However, male and female students were significantly different in anxiety, hopelessness, and shame in mathematics.

Findings regarding grade level revealed significant differences for all achievement emotions except shame. The F values considering grade level for the rest of the emotions might be given as; $F_{enjoyment}$ (2, 2223) = 96.97, $p < .007$, $\eta^2 = .08$; F_{pride} (2, 2223) = 46.01, $p < .007$, $\eta^2 = .04$; F_{anger} (2, 2223) = 48.95, $p < .007$, $\eta^2 = .04$; $F_{anxiety}$ (2, 2223) = 20.98, $p < .007$, $\eta^2 = .02$; $F_{hopelessness}$ (2, 2223) = 19.79, $p < .007$, $\eta^2 = .02$; $F_{boredom}$ (2, 2223) = 68.52, $p < .007$, $\eta^2 = .06$. The effect sizes ranged from small to moderate according to partial η^2 results.

In order to determine the source of the difference between grade levels, post-hoc comparisons with Scheffe test were conducted. Findings indicated that sixth grade students' mathematics enjoyment scores (*M* = 3.64) were significantly higher than seventh (*M* = 3.32) and eighth grade students' scores (*M* = 2.89). Similarly, sixth grade students' mathematics pride scores (*M* = 3.54) were significantly higher than seventh (*M* = 3.27) and eighth grade students' scores (*M* = 2.95). On the other side, a different pattern appeared among negative achievement emotions. That is, sixth grade students' mathematics anger scores (*M* = 1.85) were significantly lower than seventh (*M* = 2.06) and eighth grade students' scores (*M* = 2.40). The same pattern was valid for mathematics boredom for sixth (*M* = 2.04), seventh (*M* = 2.29) and eighth graders (*M* = 2.73). Eighth grade students reported higher level of math hopelessness *(M* = 2.99) than sixth (*M* = 2.57) and seventh grade students (*M* = 2.74). Nevertheless, there was no significant difference between sixth and seventh grade students. Finally, the significant difference was found for mathematics anxiety scores between sixth (*M* = 2.69) and eighth grade students (*M* = 3.06), with sixth graders reported less anxiety than eight graders. Post hoc comparisons of achievement emotions with respect to grade levels are summarized in Table 4.13.

Table 4.13.

Post Hoc Comparisons of Mathematics Achievement Emotions regarding Grade Levels

	Emotion Measures						
	D1	D2	D3	D4	D5	D6	D7
Group	*M*	*M*	*M*	*M*	*M*	*M*	*M*
6th grade(1)	3.64	3.54	1.85	2.69	2.32	2.04	2.57
7th grade(2)	3.32	3.27	2.06	2.88	2.40	2.29	2.74
8th grade(3)	2.89	2.95	2.40	3.06	2.47	2.73	2.99
Post Hoc	1>2>3	1>2>3	3>2>1	3>1		3>2>1	3>1,2

Note. Post Hoc shows only significant differences

D1=Enjoyment; D2=Pride; D3=Anger; D4=Anxiety; D5=Shame; D6=Boredom; D7= Hopelessness

4.5 Canonical Correlation for the Relationship between Factors of AEQ-M, MSSE, SESRLS and MSLQ

For the last research question, canonical correlation was performed to investigate the relationship between two sets of variables The first set of variables included seven emotion dimensions (enjoyment, pride, anger, anxiety, hopelessness, boredom, and shame); while the second set was consisted of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and self-regulated learning strategies (rehearsal, elaboration, critical thinking, organization, and metacognitive self-regulation. The graphical representation of the canonical correlation is presented in Figure 4.1.

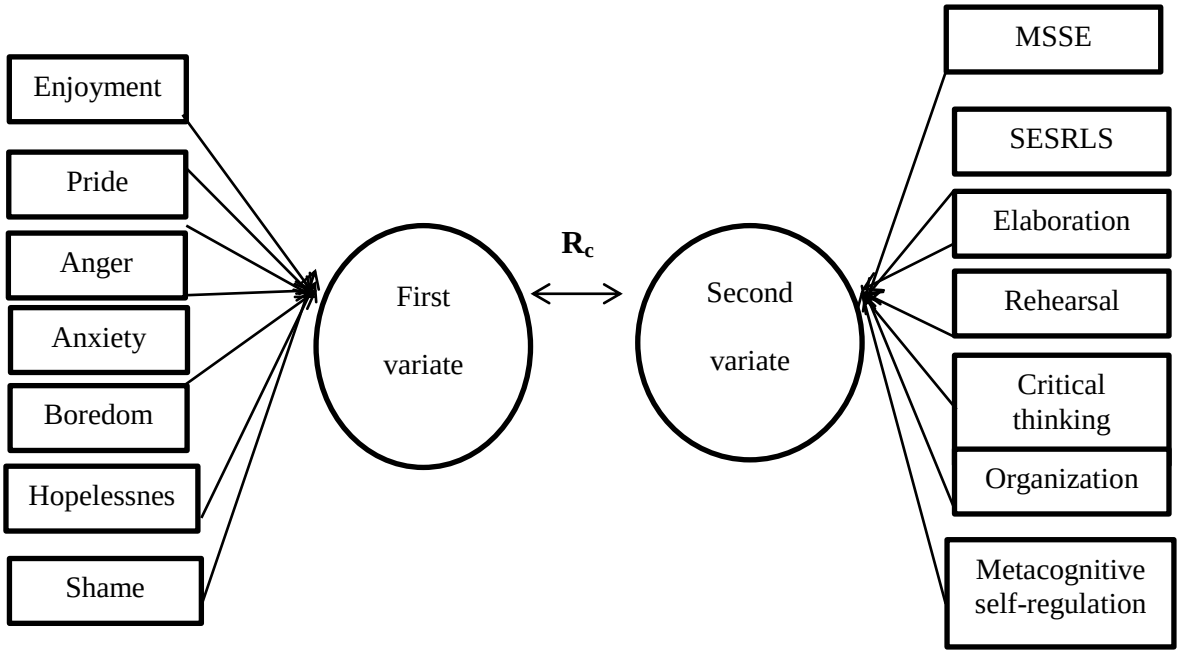

Figure 4.1 Canonical correlation diagram of the model

Absence of outliers, linearity, normality, homoscedasticity, and multicollinearity are the assumptions of canonical correlation (Tabachnick & Fidell, 2013). Of the assumptions, no serious violation was observed on univariate normality for the second set of variables whereas multivariate normality assumption was violated according to Mardia's test result. However, the impact of non-normality might be negligible if the sample size is large (Hair et al., 2010). Besides, multicollinearity was inspected through checking correlation coefficients for pairs of variables within

the sets and between two sets. There was no value equal or exceeding .90, confirming the absence of multicollinearity.

The first canonical correlation was .81 (66% overlapping variance), the second canonical correlation was .19 (4% overlapping variance), and the third canonical correlation was .15 (2% overlapping variance). The remaining four canonical correlations were effectively zero. With all seven canonical correlations included, χ^2 (49) = 2486.84, $p < .001$. Although subsequent two χ^2 were significant, only the first canonical variate accounted for more than 10% overlapping variance. Hence, the first solution was considered for the interpretation.

Table 4.14 presents the canonical loadings and standardized canonical coefficients, percentages of variance explained, and redundancies. Canonical loadings (or structure coefficients) were examined with a cut off value of .30 (Tabachnick & Fidell, 2013). Accordingly, all variables in the first set of AEQ-M and the second set of math self-efficacy and learning strategy use were correlated with the first canonical variate. Of the factors of AEQ-M, enjoyment and pride on the first set had the same direction of relationship with the mathematics skills self-efficacy, self-efficacy for self-regulated learning, rehearsal, elaboration, critical thinking, organization, and metacognitive self-regulation on the second set. Namely, higher levels of math enjoyment and pride were associated with higher levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and greater use of rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation. On the other hand, negative achievement emotions in the first set had the opposite sign with mathematics self-efficacy and learning strategy use variate. That is, those with higher levels of math anxiety, anger, hopelessness, shame, and boredom were associated with lower levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning beliefs, and less use of self-regulated learning strategies.

Moreover, percentages of variances were examined within and between the sets according to the first canonical variate. Overall, 66% of variance was accounted by math achievement emotions while 62% of variance was explained by math self-efficacy and learning strategy use variables. On the other hand, redundancy values indicated that, math achievement emotions variate extracts 43% of variance in mathematics self-efficacy and learning strategy use variables. Likewise, math self-efficacy and learning strategy use variate extracts 40% variance in math achievement emotions variables.

Table 4.14

Results of Canonical Correlation among Math Achievement Emotions, Mathematics Self-Efficacy and Self-Regulated Learning Strategies

	First canonical variate	
	Correlation	Coefficients
Math achievement emotions (AEQ-M)		
Enjoyment	-.97	-.53
Pride	-.91	-.33
Anger	.76	.05
Anxiety	.69	-.04
Boredom	.81	.12
Hopelessness	.72	.05
Shame	.59	.08
Percentage of variance	.66	
Redundancy	.43	
Mathematics self-efficacy and learning strategy use		
Math skills self-efficacy	-.86	-.25
Self-efficacy for self-regulated learning	-.97	-.65
Rehearsal	-.71	.03
Elaboration	-.79	-.11
Critical thinking	-.77	-.03
Organization	-.77	-.05
Metacognitive self-regulation	-.81	-.05
Percentage of variance	.62	
Redundancy	.40	
Canonical correlation	.81	

4.6 Canonical Correlation for the Relationship between Factors of AEQ-M, MSSE, SESRLS and MSLQ by Grade Level

Canonical correlation was also conducted to investigate the relationship between dimensions of AEQ-M, Mathematics Skills Self-Efficacy Scale (MSSE), Self-Efficacy for Self-Regulated Learning Scale (SESRLS) and Learning Strategies subscale of MSLQ with respect to grade levels. The first set was consisted of positive and negative achievement emotions as enjoyment, pride, anger, anxiety, hopelessness, boredom, and shame; while the second set included mathematics skills self-efficacy, self-efficacy for self-regulated learning scores, and the factors of self-regulated learning strategies, which were rehearsal, elaboration, critical thinking, organization, and metacognitive self-regulation.

The first canonical correlations on sixth (n = 683), seventh (n =767) and eighth grade students (n = 776) were .78 (61% overlapping variance), .81 (66% overlapping variance) and .80 (64% overlapping variance) while the second canonical correlations were .23 (5% overlapping variance), .22 (5% overlapping variance) and .26 (7% overlapping variance) respectively. The remaining four canonical correlations were effectively zero for all grade levels. The first canonical variate accounted for more than 10% overlapping variance. Therefore, the first solution of each grade level was considered for the interpretation. Findings for all grade levels are given in Table 4.15.

With the cut of value of .30 (Tabachnick & Fidell, 2013), results indicated that all variables were meaningful for sixth, seventh, and eighth grade students. Enjoyment and pride were positively, while anger, anxiety, hopelessness, boredom, and shame were negatively correlated with mathematics self-efficacy, self-efficacy for self-regulated learning, and self-regulated learning strategy variables in the second covariate. To conclude, those with higher levels of math enjoyment and pride were correlated with higher levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and greater use of self-regulated learning strategies. On the

contrary, those with higher levels of math anxiety, anger, hopelessness, boredom, and shame were associated with lower levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and less use of self-regulated learning strategies regardless of grade levels.

Moreover, percentages of variances within and between the sets based on the first canonical variate were examined for each grade level. Accordingly, 63%, 66%, and 65% of variances were explained by math achievement emotions; while 63%, 57% and 64% of variances were accounted by math self-efficacy and learning strategy variate for the sixth, seventh, and eighth grades, respectively.

Table 4.15

Results of Canonical Correlation regarding Grade Levels

	First canonical variate					
	6th grade		7th grade		8th grade	
	Correlation	Coefficient	Correlation	Coefficient	Correlation	Coefficient
Math achievement emotions						
Enjoyment	-.97	-.64	-.96	-.46	-.96	-.47
Pride	-.88	-.24	-.93	-.41	-.92	-.35
Anger	.73	-.01	.71	.05	.78	.09
Anxiety	.64	.02	.52	-.05	.63	-.08
Boredom	.78	.03	.64	.17	.75	.12
Hopelessness	.75	.11	.81	.02	.81	.06
Shame	.75	.09	.62	.05	.70	.12
Math self-efficacy and learning str.use						
Math skills self-efficacy	-.66	-.22	-.88	-.30	-.84	-.26
Self-efficacy for self-reg learning	-.77	-.73	-.96	-.55	-.97	-.66
Rehearsal	-.54	.04	-.69	.08	-.70	.01
Elaboration	-.59	-.10	-.80	-.14	-.78	-.08
Critical thinking	-.59	-.11	-.77	-.05	-.74	.05
Organization	-.58	-.07	-.75	-.03	-.78	-.07
Metacognitive self-regulation	-.59	.11	-.82	-.11	-.81	-.08
Canonical correlation	.78		.81		.80	

4.7. Summary of Results

This study generally focused on three main issues. Firstly, mathematics achievement emotions questionnaire (AEQ-M) developed by Pekrun et al. (2011), Mathematics Skills Self-Efficacy Scale (MSSE) and Self-efficacy for Self-Regulated Learning Scale (SESRL) developed by Usher (2007) were adapted to Turkish language by the researcher. Accordingly, whether the mathematics achievement emotions of middle school students differ with respect to gender and grade level were attempted to be investigated. In addition, the relationship among math achievement emotions, mathematics self-efficacy beliefs, and self-regulated learning strategy use were examined by taking grade level issue into account as well.

Psychometric properties of scales were also evaluated through confirming their factor structure. Results revealed the seven-emotions factor structure for AEQ-M after eliminating seven items from the scale. Cronbach alpha coefficients for each factor were considerably high ranging from .81 to .92. Besides, confirmatory factor analysis results provided evidence for one-factor structure of MSEE and SESRL scales in line with the findings of original study. Reliability estimates were .96 and .93, respectively.

Consequently, MANOVA findings indicated gender and grade level differences on students' mathematics achievement emotions. Accordingly, mathematics anxiety, hopelessness, and shame significantly differed by gender. Namely, females appeared to be more anxious, hopeless, and ashamed toward mathematics compared to male peers whereas mathematics anger and boredom did not differ remarkably with males and females. On the other hand, a significant difference was found in students' mathematics achievement emotions according to grade level. Of the negative emotions, mathematics anxiety, hopelessness, anger and boredom resulted in an increase whereas mathematics enjoyment and pride tended to decrease while passing from lower to upper classes. Yet, mathematics shame did not significantly differ according to grade level.

The significant relationship between mathematics self-efficacy, self-regulated learning strategy use, and mathematics achievement emotions proved the hypothesized association among the variables. Namely, enjoyment and pride were positively while anger, anxiety, hopelessness, boredom, and shame were negatively correlated with mathematics self-efficacy, self-efficacy for self-regulated learning, and self-regulated learning strategies. In other words, higher levels of positive emotions were correlated with higher levels of mathematics skills self-efficacy and self-efficacy for self-regulated learning and with greater use of rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation strategies. On the other side, higher levels of math anxiety, anger, hopelessness, boredom, and shame were correlated with lower levels of mathematics skills self-efficacy, self-efficacy for self-regulated learning, and less use of self-regulated learning strategies regardless of grade levels.

CHAPTER V

DISCUSSION

The last chapter presents the implications of the results with a critical perspective. Firstly, the results of the study are depicted through comparison of how the results relate to and differentiate from the related literature. Consequently, implications of the findings are discussed followed by the recommendations for further practices.

5.1. Conclusion of the Results

To begin with, this study portrayed the general mathematics emotion profile of middle school students taking different variables into account. From this perspective, the obtained results would form a basis to understand how Turkish school students' positive and negative mathematics achievement emotions are in relation to gender and grade level. Moreover, the revealed association between achievement emotions, mathematics self-efficacy beliefs and self-regulated learning strategies would provide evidence to take initiatives for the promotion of success in mathematics. Hence, the findings of the study were expected to gain attention to an important affective construct in mathematics education different than attitude, beliefs, or values.

Moreover, one of the aims of this study was to adapt Achievement Emotions Questionnaire- Mathematics (AEQ-M), Mathematics Skills Self Efficacy (MSSE) and Self-Efficacy for Self-Regulated Learning (SESRL) scales; therefore, the psychometric characteristics were examined carefully. The proposed models based on the theory, current literature, and the original versions of the scales were verified by the data. That is, seven-emotions factor model fit for AEQ-M scale; however, eightitems did not work properly as intended. Hence, they were eliminated from the scale. Consequently, psychometric properties of the final version of AEQ-M yielded

satisfactory fit indices and reliability estimates. On the other hand, MSSE and SESRL scales both confirmed one factor model with considerably high Cronbach alpha coefficients. Thus, all adapted scales could be used to measure domain-specific emotions and mathematics self-efficacy beliefs of sixth, seventh, and eighth grade students.

Given the influence on female and male mean difference on mathematics achievement emotions, findings were compatible with the literature. Self-report measures of students revealed remarkable differences for mathematics anxiety, hopelessness, and shame for female and male participants. That is, females reported more mathematics anxiety, hopelessness, and shame than male peers consistent with several studies especially related to anxiety (Baloğlu & Koçak, 2006; Frenzel, Pekrun, & Goetz, 2007b; Frenzel, Pekrun, & Goetz, 2008; Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013; Peker & Şentürk, 2012; Wigfield & Meece, 1988; Yüksel-Şahin, 2008). This finding might be related to sex differences on control and value beliefs of individuals because perceived control and academic values were stated to be different according to gender resulting distinct achievement emotions (Pekrun, Frenzel, Goetz, & Perry, 2007). Frenzel, Pekrun, Goetz, and Vom Hofe (2006; as cited in Pekrun et al., 2007) also reported that although the structure of control and value appraisals and achievement emotions are equivalent across males and females, the latter group's perceived control were deemed to be lower than the former one raising more anxiety and shame but less enjoyment in mathematics. On the other hand, Goetz et al. (2013) referred the trait versus state difference in male and female students' mathematics anxiety levels. Accordingly, although girls experienced more habitual mathematics anxiety, they did not express more anxiety than male counterparts during learning and taking tests. In addition to this, girls' stereotypic cognitions as the fact that viewing mathematics as a male dominant subject area and their competence beliefs comprised of their self-efficacy and self-concept perceptions and were given reasons of the difference on habitual mathematics anxiety. Considering stereotyping cognitions of females, the role of curriculum and

the textbooks should be examined as well to explain the reasons of difference comprehensively.

In this respect, Doğan's (2012) study focused on gender stereotypes and class culture in mathematics education from a critical perspective in Turkish educational contexts. The gender discrimination on sixth, seventh, and eighth grade textbooks or curricula in mathematics education was pinpointed to raise awareness toward how to provide gender sensitive education environment. Actually, the results of curriculum and textbook analysis regarding objectives revealed gender inequality, suggesting a need for gender sensitive curriculum. Since the mathematics curriculum and textbooks ascribed more occupational roles to males and more differences in activities compared to females, the gender equity issue seemed problematic which in turn might create gender differences on students' affective constructs such as emotions. Not only textbooks or curricula but also teachers' beliefs upon gender might play a prominent role on stereotypic beliefs as well. In this perspective, Hannula's (2011) considerations on teachers' beliefs to explain the gender differences in affective constructs in mathematics learning gains a high attention. Teachers' views to describe male students as talented but not hardworking and females as hardworking and determined to accomplish but not so much talented than male counterparts were contended to create gender differences in individuals' self-efficacy beliefs as a result of interaction with those thoughts in classroom environment. Actually, the difference cannot be restricted to just self-efficacy beliefs of individuals. Individuals' emotions in this subject domain are also influenced by teachers' beliefs upon gender as a matter of the fact that self-efficacy as a part of cognitive appraisals are grounded in the formation of achievement emotions according to control-value theory..

Moreover, Frenzel, Pekrun and Goetz (2007b) focused on the mediator role of gender on mathematics achievement emotions. The researchers emphasized the factors such as competence beliefs, domain and achievement value of mathematics nourished by the arguments of control-value theory. Thus, girls were found to have

lower competence beliefs and domain value of mathematics whereas they have realized the importance of attaining high grades from mathematics which pointed out high subjective value to this domain of study resulting less enjoyment and pride but more mathematics anxiety, hopelessness, and shame. In line with the findings, females' experience of substantially more negative emotions than male peers supports the idea of competence and value beliefs to explain the possible reasons for the sex-related differences. The results of the current study demonstrate the common assumption of mathematics as a "male domain" (Hyde, Fennema, Ryan, Frost, & Hopp, 1990) again, which should be explored within a large context for further studies.

Besides, individuals' success and failure attributions based on Weiner's attribution theory (1985) could be thought to be indicative on the arousal of emotions as in Stipek and Gralinsky's (1991) research, pointing out female students' negative emotional experiences in mathematics and their experience of less pride after success and more shame after failure emphasizing their attribution to uncontrollable reasons. Indeed, Programme for International Student Assessment (PISA) 2012 results based on Turkish students' scores (OECD, 2013) might be supportive within this perspective. Not only results of mathematical literacybut also students' motivation, drive, and self-beliefs in mathematics were examined through PISA. Accordingly, Turkish female students generally attributed their failure to the difficulty of learning material and their inabilities toward problem solving (Eğitim Reformu Girişimi, 2013) referring the uncontrollability of the result over time and situations. As Weiner (1985) mentioned, personal controllability was connected to shame-related emotions (Pintrich & Schunk, 2002), the female students' significant mean difference on mathematics shame might be related to this phenomenon.

On the other hand, there was no noticeable difference on positive emotions (enjoyment and pride) or other negative achievement emotions like anger and boredom; however, many studies in the literature depicted the perceived gender role

on activation of different emotions. Normak and Talts (2009) compared students' test-related positive and negative emotions with Estonian and Russian language of instruction. Involving 687 students from sixth to ninth grade while taking tests revealed no male and female mean differences for test-related enjoyment, pride, and anxiety whereby sex differences on test-related hope appeared. Interestingly, boys reported more test-related shame and hopelessness than females contrary to the findings of the present study. Furthermore, Yamaç (2014) examined fourth and fifth grade elementary school students' level of enjoyment, anxiety, and boredom. Females expressed higher class-related enjoyment and lower class-related boredom. In addition to this, not only the aforementioned emotions but also findings of anxiety differ from the current study results such that no gender difference was observed in anxiety scores of participants.

Likewise the gender as a kind of genetic disposition, students' grade level implying their developmental stages was explored in this study as well. The increasing pattern of negative emotions except shame and the decreasing pattern of positive emotions appeared. The findings in the literature concerning differences in mathematics achievement emotions for students at different grade levels were parallel with the present study (Aydın, Delice, Dilmaç, & Ertekin, 2009; Frenzel, Goetz, Lüdtke, & Pekrun, 2009; Larson & Richard, 1991; Yamaç, 2014). Motivational constructs were deemed to change across years. Since learning enjoyment was stated to be related to intrinsic motivation (Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006), the decrease of enjoyment specifically during junior high school years were accepted reasonable.

While positive emotions were found to be decreased through sixth to eighth grades, most of the negative emotions increased over these grades. Actually, learning and teaching of mathematics were contended to have become more abstract as the progress through grade levels (Dede & Dursun, 2008), so students might develop more negative affect toward within this perspective.

In addition, the existing nationwide examinations at eighth grade to enter more prestigious magnet schools could prompt increase of anxiety especially for mathematics domain of study. Indeed, the nature of standardized examinations to enter high schools has been changed in the recent past. According to the new system eighth grade students would take tests from six basic subject area including mathematics. Since students view these examinations as a key to enter more prestigious high schools which in turn will provide them good job opportunities in the near future, those nationwide examinations are seen crucial for both parents and students (Sarıer, 2010) which might also influence their emotional states toward the subjects areas that they are assessed. Naturally, exam results were concerned to be the main indicators of mathematics success in Turkey, which in turn increases the given value to exams or tests by parents or peers. These lead to an increase in students' anxiety levels especially at eighth grade as in Birgin, Baloğlu, Çatlıoğlu, and Gürbüz's (2010) study.

Aside from the nationwide examinations, even though the difference among mathematics hopelessness was considerably high between sixth-eight and seventh-eighth grades, there was no remarkable change from sixth to seventh grade, which seems interesting. Yenilmez (2010) reported a decrease of high school students' mathematics hopelessness levels over time. On the other hand, Normak and Talts (2009) found no difference in test-related hopelessness from sixth to ninth grades. Thus, different conclusions could be attained as a result of the exploration of this emotion. Another conflicting finding was related to the feeling of shame. Norman and Talts (2009) reported an increase in test-related shame toward upper classes. Though no difference appeared in the current study.

Although cross-cultural psychologists content to change of relationships across cultural contexts (King & Areepattamannil, 2014), findings over the relationship between cognitive appraisals, achievement emotions, and learning strategy use were in line with the cited literature (Ahmed, Van der Werf, Kuyper, & Minnaert, 2013;

Pekrun, 2006; Pekrun, Goetz, Titz, & Perry, 2002b). Accordingly, those who experience higher levels of enjoyment and pride and lower levels of anger, anxiety, boredom, hopelessness, and shame are more likely to use rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulated learning strategies. Or students who adopt use of learning strategies tend to experience less negative achievement emotions and more positive emotions.

On the other hand, the reciprocal causation among aforementioned constructs has not been fully explored in national and international literature yet. In previous research studies, self-efficacy toward mathematics has been found to be a negative predictor of mathematics anxiety in Turkey (Akın & Kurbanoğlu, 2011; Yıldırım, 2011). Actually, the negative association of self-efficacy was also confirmed by the current study indicating a kind of reciprocal cycle as suggested in social learning theory. As Bandura (1997) mentioned, the stimulating role of high efficacy beliefs on individuals' performances and emotional states, which in turn influence their subsequent efficacy levels as well. Further, while people with low efficacy do not tend to persist toward obstacles to accomplish the task at hand resulting in negative emotional reactions (Pajares, 1996). Thus, describing the self-efficacy as a proximal determinant and consequence of mathematics anxiety might be rational.

Not only self-efficacy beliefs but also learning strategy use of individuals was of the concern. Results suggesting the idea of self-efficacy and self-regulated learning strategies are key variables of mathematics emotions as indicated by Jain and Dowson (2009) for mathematics anxiety. The mediator role of self-efficacy on the relationship between mathematics anxiety and cognitive self-regulation including rehearsal, elaboration and organization was demonstrated within the "will enhancement" framework. Actually, the previous findings strengthened the thought over the current bi-directional relationship among learning strategies, self-efficacy beliefs, and achievement emotions of participants that learning strategies might

enhance individuals' perception to their capability of doing mathematics which in turn decrease negative emotions.

Kim, Park, and Cozart (2014) pointed out that high school students with high self-efficacy beliefs expressed more enjoyment and pride but less boredom, anxiety, anger, shame, and hopelessness in online mathematics courses in the U.S. Besides, students with lower levels of negative and higher levels of positive emotions also reported more use of cognitive strategies including rehearsal, elaboration, and organization, and metacognitive self-regulation to a considerable degree. Although rehearsal strategy was deemed to be a rigid learning strategy (Pekrun, 2006) and fostered through the activating negative emotions of anxiety (Pekrun, Goetz, Perry, Kramer, Hochstatt, and Molfenter (2004), findings of the present study indicate the negative relationship of rehearsal strategy with anxiety, boredom, anger, hopelessness and shame as well. Namely, the rehearsal was not positively related to nor anxiety neither any other negative emotion. However, King and Areepattamannil (2014) also stated the weak facilitator role of anxiety on secondary school students for not only rehearsal but also elaboration as a flexible learning strategy and monitoring and regulating strategies of self-regulation. Hence, individuals' information processing strategies may differ according to their experienced emotions which might be due to cultural differences. Moreover, the current study did not focus on the activation degree of achievement emotions so much that the valence of emotions should be taken into account more while examining the relationship with learning strategies.

Parallel with current findings, King and Areepattamannil (2014) stated the positive relationship of enjoyment and pride and negative relationship of anger and boredom with cognitive strategies of elaboration, organization, and rehearsal and metacognitive strategies of planning, monitoring, and regulating on secondary school students in Philippines. Likewise, Trigwell, Ellis, and Han (2012) studied the issue of university students' emotions and their learning approaches toward a particular

course. Students who experienced more hope and pride and less anger, boredom, anxiety, and shame tended to use deep learning approaches, which are more meaningful learning activities. On the other hand, students who expressed less positive but more negative emotions tended to engage in surface approaches, which are known as less meaningful learning activities. However, the causality issue was left unanswered as in the current study.

To conclude, this study affirmed the substantial role of cognitive and motivational factors on mathematics achievement emotions in relation to control-value theory, gradually developing research field, already discussed in the literature (Pekrun, 2006; Pekrun, Frenzel, Goetz, & Perry, 2007; Pekrun, Goetz, Titz, & Perry, 2002a). Overall, mathematics self-efficacy and self-regulated learning strategies were found to be key variables in middle school students' positive and negative achievement emotions.

5.2. Implications for Practice

Emotions are experienced in variety of academic domains and by many others in educational settings. Hence, the study aimed at describing the reciprocal relationship between middle school students' mathematics emotions, mathematics self-efficacy beliefs, and self-regulated learning strategies.

First of all, students' learning environments should be designed considering their emotional states with high relevance. Motivational and cognitive quality of instruction should be promoted through meeting needs of individuals indicated by many researchers as well (Pekrun, 2014). If the instructional strategy does not address students' needs or abilities, students might alienate from the relevant academic domain besides arousal of negative emotions. In this perspective, student-centred approaches should be adopted in mathematics education such that students' interests toward the task might be kept high through individual-based feedback, provoking discussions, or allocating sufficient time to students' questions to enhance

their self-efficacy levels in mathematics domain. In addition to this, difficulty and the pace of the mathematics lessons should not be above and below students' capacities, otherwise students might experience boredom. Moreover, students should be taught self-regulated learning strategies to be able to regulate their learning and promote self-control since these strategies are deemed to be learnable (Weinstein & Mayer, 1983).

Although students' mathematics anxiety, hopelessness, and shame appeared different by gender, intervention programs should be developed by guidance and psychological counselors in schools involving not only females but also males aiming to reduce negative and to promote positive emotions in mathematics. Middle school mathematics curriculum and mathematics textbooks should be given high relevance as well. That is, gender sensitive programs should be supported. Besides, gender stereotyping beliefs should be eliminated from textbooks which are seen as bridges between curricula and students (Doğan, 2012). On the other hand, teachers' beliefs are thought to be important on classroom practices (Doğan, 2012). Hence, teachers' awareness toward gender sensitive mathematics education should be raised in order to decrease gender differences on mathematics achievement emotions. To do this, preservice training might be supported in teacher education programs at education faculties.

The grade level differences in achievement emotions should be of concern as well. Teacher-student and teacher-parent communication should be kept high and on-going especially under the existence of standardized examinations to prevent students' alienation from mathematics and the school which is the worse. In order to keep the communication continuous between teacher, parent and student triangle, school counsellors might provide several seminars related to exam related emotions especially in mathematics.

On the other hand, teachers' emotions should be taken into consideration as well because teachers' teaching emotions and student emotions in classrooms are considered to be related to each other (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009; Goetz, Lüdtke, Nett, Keller, & Lipnevich, 2013). In this perspective, preservice and inservice teacher training might be implemented to deal with decline of teaching enthusiasm and to promote teachers' and teacher candidates' positive emotions, which might be efficient on teachers' instructional styles and occupational well-being in the long run.

5.3. Recommendations for Further Research

This study attempted to enlighten individuals' concerns about a neglected construct, academic emotions, within a particular subject domain. The relationship between middle school students' mathematics achievement emotions, mathematics self-efficacy, and self-regulated learning strategies were examined within the scope of this study through a correlational study, so it is not possible to talk about cause and effect inferences between these variables. Herein, experimental research might be conducted to be able to understand the reciprocity of causality between these variables and to suggest effective interventions to improve the development of positive emotions among students.

Secondly, mathematics achievement emotions were measured by only self-report measures of students. However, qualitative study is also required to understand individuals' emotional profile coherently. Within the mixed-study perspective, various multi-method approaches might be used such as observations, in-depth interviews with different groups of people (like parents, peers, teachers, and school principals), physiological measures, or document analysis (Goetz, Zirngibl, Pekrun & Hall, 2003).

Moreover, this study focused on seven discrete mathematics emotions; however, there are many other emotions, which might be considered. Besides, the sample of the study might be enlarged by taking diverse educational levels and different subject domains into account to improve generalizability. That is, high school and university school students' achievement emotions on different academic domains might be studied in not only the districts of Ankara but also other provinces of Turkey. In addition, this study is cross-sectional; however, longitudinal data would be helpful to make generalizations over findings.

Finally, including variables such as achievement, achievement goals, school type might provide different insights for further studies. Of the suggested variables, achievement is viewed a crucial outcome of emotions, so the suggested relationship might be tested including the variable to the study. Especially, the relation of emotions with nationwide examinations like TEOG should be considered. Since such standardized tests are viewed as the most important criterion of students' achievement in Turkish educational contexts, the results would be more objective than other achievement criteria. As a final remark, teacher emotions, considered to be mediator in students' emotions (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009), have been playing a substantial role on the quality of instruction. Thus, teacher emotions need to be investigated in relation to control-value theory.

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Appendix A. Approval Form from MoNE

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

Sayı : 14588481/605.99/939969 04/03/2014
Konu: Araştırma İzni
(Başak ÇALIK)

..... İLÇE MİLLİ EĞİTİM MÜDÜRLÜĞÜNE

İlgi : a) MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 2012/13 nolu genelgesi
b) ODTÜ'nün 26/02/2014 tarih ve 002297 sayılı yazısı.

ODTÜ Eğitim Programları ve Öğretim Ana Bilim Dalı Yüksek Lisans Programı öğrencisi Başak ÇALIK'ın "Ortaokul Öğrencilerinin Matematik Dersine Yönelik Duygu ve Düşüncelerinin İncelenmesi" konulu araştırması kapsamında ilçeniz okullarında uygulama yapma isteği Müdürlüğümüzce uygun görülmüştür.

Anketler (9 sayfa) araştırmacıya ulaştırılmış olup, uygulama yapılacak sayıda araştırmacı tarafından çoğaltılarak, araştırmanın ilgi (a) genelge çerçevesinde, okul ve kurum yöneticileri uygun gördüğü takdirde gönüllülük esasına göre uygulanmasını rica ederim.

Hakan GÖNEN
Müdür a.
Şube Müdürü

Appendix B. Questionnaire in Turkish

Sevgili öğrenciler,

Bu anket okuldaki matematik dersi hakkındaki duygu ve düşüncelerinizi araştırmayı amaçlamaktadır. Lütfen tüm soruları dikkatle okuyup tümüne cevap veriniz. Verilen soruların herhangi bir doğru ya da yanlış cevabı yoktur. Dolayısıyla soruları içtenlikle cevaplamanız çalışmanın nitelikli olması açısından çok önemlidir. Çalışma kapsamında bilgileriniz gizli tutulacak ve sadece araştırmacı tarafından değerlendirilecektir. İstediğiniz zaman çalışmayı bırakma hakkına sahipsiniz. Katkılarınız için çok teşekkür ederim.

Başak Çalık

ODTÜ Eğitim Bilimleri Araştırma Görevlisi

cbasak@metu.edu.tr

BÖLÜM I

1. **Cinsiyetiniz**: ☐ Kız ☐ Erkek

2. **Sınıfınız:** ☐ 6. sınıf ☐ 7. sınıf ☐ 8. Sınıf

BÖLÜM II

Matematik derslerine katılım farklı duyguların oluşmasına sebep olabilir. Anketin bu bölümü matematik derslerinde yaşayabileceğiniz duyguları içermektedir. Aşağıdaki soruları cevaplamadan önce, lütfen matematik dersinde yaşadığınız durumları göz önünde bulundurunuz. Eğer sorularda verilen ifadeye kesinlikle katılıyorsanız, 5'i işaretleyiniz. Eğer ifadeye kesinlikle katılmıyorsanız, 1'i işaretleyiniz. Bu iki durum dışında ise 1 ve 5 arasında sizi en iyi tanımladığını düşündüğünüz numarayı işaretleyiniz.

DERSTEN ÖNCE

Aşağıdaki sorular matematik dersine katılmadan önce yaşayabileceğiniz duyguları içermektedir. Lütfen, matematik dersinden önce genellikle nasıl hissettiğinizi işaretleyiniz.

	Kesinlikle Katılmıyorum				Kesinlikle Katılıyorum
2. Matematik dersini düşündüğüm zaman gergin olurum.	1	2	3	4	5

DERS SIRASINDA

Aşağıdaki sorular matematik dersi sırasında yaşayabileceğiniz duyguları içermektedir. Lütfen, matematik dersinde genellikle nasıl hissettiğinizi işaretleyiniz.

5. Matematik dersinden zevk alırım.	1	2	3	4	5

DERSTEN SONRA

Aşağıdaki sorular matematik dersine katıldıktan sonra yaşayabileceğiniz duyguları içermektir. Lütfen, matematik derslerinden sonra genel olarak nasıl hissettiğinizi işaretleyiniz.

18. Bence matematik bilgimle gurur duyabilirim.	1	2	3	4	5

BÖLÜM III

Matematik çalışma ve ödevlerini yapma farklı duyguların oluşmasına sebep olabilir. Anketin bu bölümü matematiğe çalışırken ve ödevleri yaparken yaşayabileceğiniz duyguları içermektedir. Eğer sorularda verilen ifadeye kesinlikle katılıyorsanız, 5'i işaretleyiniz. Eğer ifadeye kesinlikle katılmıyorsanız, 1'i işaretleyiniz. Bu iki durum dışında ise 1 ve 5 arasında sizi en iyi tanımladığını düşündüğünüz numarayı işaretleyiniz.

ÇALIŞMADAN ÖNCE

Aşağıdaki sorular matematiğe çalışmadan ve ödevleri yapmadan önce yaşayabileceğiniz duyguları içermektedir. Lütfen, matematiğe çalışmaya ya da matematik ödevlerini yapmaya başlamadan önce genellikle nasıl hissettiğinizi işaretleyiniz.

	Kesinlikle Katılmıyorum				Kesinlikle Katılıyorum
20. Matematik ödevlerimi sadece düşündüğümde bile içim sıkılıyor.	1	2	3	4	5

ÇALIŞIRKEN

Aşağıdaki sorular matematiğe çalışırken ve matematik ödevlerini yaparken yaşayabileceğiniz duyguları içermektedir. Lütfen, matematiğe çalışırken ya da matematik ödevlerini yaparken genellikle nasıl hissettiğinizi işaretleyiniz.

25. O kadar sıkılırım ki daha fazla çalışacak gibi hissetmem.	1	2	3	4	5

ÇALIŞTIKTAN SONRA

Aşağıdaki sorular matematik çalıştıktan ya da matematik ödevlerini yaptıktan sonra yaşayabileceğiniz duyguları içermektedir. Lütfen, matematik çalıştıktan sonra genellikle nasıl hissettiğinizi işaretleyiniz.

37. Matematikteki bilgi eksikliğimden utanç duyarım.	1	2	3	4	5

BÖLÜM IV

Matematikte test ve sınavlar farklı duyguların oluşmasına sebep olabilir. Anketin bu bölümü matematik dersinden sınav olduğunuzda yaşayabileceğiniz duyguları içermektedir. Eğer sorularda verilen ifadeye kesinlikle katılıyorsanız, 5'i işaretleyiniz. Eğer ifadeye kesinlikle katılmıyorsanız, 1'i işaretleyiniz. Bu iki durum dışında ise 1 ve 5 arasında sizi en iyi tanımladığını düşündüğünüz numarayı işaretleyiniz.

SINAV OLMADAN ÖNCE

Aşağıdaki sorular matematikte sınav olmadan önce yaşayabileceğiniz duyguları içermektedir. Lütfen, matematikte sınav olmadan önce genellikle nasıl hissettiğinizi işaretleyiniz.

	Kesinlikle Katılmıyorum				Kesinlikle Katılıyorum
43. Yakın zamanda bir matematik sınavım varsa mideme ağrılar girer.	1	2	3	4	5

SINAV SIRASINDA

Aşağıdaki sorular matematikte sınav olurken yaşayabileceğiniz duyguları içermektedir. Lütfen, matematikte sınavı olurken genellikle nasıl hissettiğinizi işaretleyiniz.

47. Matematikten sınav olurken gergin ve huzursuz olurum.	1	2	3	4	5

SINAV OLDUKTAN SONRA

Aşağıdaki sorular matematikte sınav ya da test olduktan sonra yaşayabileceğiniz duyguları içermektedir. Lütfen, matematikte sınav ya da test olduktan sonra genellikle nasıl hissettiğinizi işaretleyiniz.

59. Matematik sınavında ne kadar iyi yaptığımla gurur duyarım.	1	2	3	4	5

BÖLÜM V

Aşağıdaki matematik konularıyla ilgili alıştırmaları hesap makinesi kullanmadan başarmada kendinize ne kadar güvendiğinizi, lütfen 1'den 6'ya kadar derecelendirilmiş ölçeği kullanarak işaretleyiniz. Eğer ilgili matematik konusunda kendinize hiç güvenmiyorsanız 1'i işaretleyiniz. Eğer kendinize tamamen güveniyorsanız 6'yı işaretleyiniz. Bu iki durum dışında ise 1 ve 6 arasında sizi en iyi tanımladığını düşündüğünüz numarayı işaretleyiniz.

		Hiç güvenmiyorum					Tamamen güveniyorum
…… içeren matematik alıştırmalarını başarıyla çözeceğinize ne kadar güveniyorsunuz?							
4.	Oran ve orantı	1	2	3	4	5	6
15.	Tablolar, çizelgeler, şemalar ve koordinat sistemleri	1	2	3	4	5	6
24.	Zihinden hızlı işlem yapma	1	2	3	4	5	6

Aşağıdaki her bir ifadeyi dikkatle okuyunuz ve belirtilen ölçeği kullanarak size en çok uyan cevabı işaretleyiniz. 1'den 6'ya kadar herhangi bir sayıyı işaretleyebilirsiniz.

		Hiç iyi değilim					Çok iyiyim
5.	Kendinizi matematik çalışmaya ne kadar iyi motive edebilirsiniz?	1	2	3	4	5	6
7.	Matematik dersine katılmada ne kadar iyisiniz?	1	2	3	4	5	6
11.	İhtiyacınız olduğunda matematik ile ilgili yardımı almada ne kadar iyisiniz?	1	2	3	4	5	6

BÖLÜM VI

Bu bölümde matematik dersinde kullandığınız öğrenme stratejileri ve çalışma becerilerini belirlemeye yönelik ifadeler yer almaktadır. Cevap verirken aşağıda verilen ölçeği göz önünde bulundurunuz. Eğer ifadenin sizi tam olarak yansıttığını düşünüyorsanız, 7'yi işaretleyiniz. Eğer ifadenin sizi hiç yansıtmadığını düşünüyorsanız, 1'i işaretleyiniz. Bu iki durum dışında ise 1 ve 7 arasında sizi en iyi tanımladığını düşündüğünüz numarayı işaretleyiniz.

		Beni hiç yansıtmıyor						Benı tam olarak yansıtıyor
10.	Ders sırasında veya ders için okuduğum bir kaynakta bir teori, yorum ya da sonuç ifade edilmiş ise, bunları destekleyen bir bulgunun var olup olmadığını sorgulamaya çalışırım.	1	2	3	4	5	6	7
16.	Çalışma tarzımı, dersin gereklilikleri ve öğretmenin öğretme stiline uygun olacak tarzda değiştirmeye çalışırım.	1	2	3	4	5	6	7
27.	Matematik dersinde önemli kavramların listesini çıkarır ve bu listeyi ezberlerim.	1	2	3	4	5	6	7

Appendix C. Türkçe Özet (Turkish Summary)

Giriş

Araştırmanın amacı ve önemi

Bu araştırma ortaokul öğrencilerinin matematik başarı duyguları, matematik öz-yeterliği ve öğrenme stratejileri arasındaki ilişkiyi sınıf seviyesi ve cinsiyet değişkenleri açısından incelemek amacıyla yapılmıştır. Ayrıca, öğrencilerin matematik başarı duygularını (Pekrun, Goetz, Frenzel, Brachfield, ve Perry, 2011), matematik öz-yeterliklerini (Usher, 2007) ölçmek için kullanılan ölçekler bu araştırma kapsamında Türkçe'ye uyarlanmıştır.

Matematik; fen bilimleri, mühendislik, istatistik ve hatta sanat gibi birçok disiplinle ilişkili olması bakımından hayatın bir parçasıdır. Ayrıca, bu disiplin saygın bir lise ya da üniversiteye girebilmek ve sonrasında iyi bir iş ve kariyer sahibi olabilmek açısından da önemli görülmektedir. Özellikle bahsedilen okullara girebilmek için standart sınavların varlığı ve bu sınavlarda başarı gösterebilmede matematiğin oynadığı rol öğrenciler için büyük bir strese neden olmaktadır. Bu sebeple, haz ve gurur gibi pozitif duygular diğer konu alanlarına göre matematikte daha seyrek gözlenmektedir (Tulis ve Ainley, 2011). Öte yanda sınavların varlığı sadece kaygının değil başka negatif duyguların da ortaya çıkmasına sebep olmaktadır. Bu çalışma öğrencilerin matematik dersindeki çeşitli başarı duygularını farklı öğrenme ortamlarını göz önüne alarak incelemek açısından alan yazına katkı sağlayacaktır.

Türkiye'deki ortaokul matematik müfredatı 4+4+4 olarak da bilinen ilköğretim kurumları yönetmeliğindeki değişikliği öngören kanun kapsamında çeşitli değişikliklere uğramıştır. Yeni matematik programı beş genel başlık altında toplanmaktadır. Bunlar: problem çözme, süreç becerileri (iletişim, akıl yürütme, ilişkilendirme), devinişsel beceriler, bilgi ve teknoloji becerileri ve duyuşsal becerilerdir (Milli Eğitim Bakanlığı, 2013). Duyuşsal beceriler içerisinde

öğrencilerin pozitif tutumlarını ve kendilerine güvenlerini artırma, öz-düzenleyici öğrenme becerilerini geliştirme, matematiği nerede kullanabileceklerini kavrama gibi birçok duyuşsal faktöre değinilmektedir. Yeni matematik programında bir başarı duygusu olarak kaygıya özellikle dikkat çekilmektedir; fakat kaygı dışında utanç, gurur ve umut gibi birçok duygu üzerinde çalışmanın bu duyguların bireylerin akademik yaşamları üzerindeki etkisini anlamaya yardımcı olacağı düşünülmektedir. Bu sebeple, bu çalışma yeni müfredatın ışığında matematik başarı duygularının doğasını araştırmayı amaçlamıştır.

Bireyin verilen bir görevi başarıyla gerçekleştireceğine yönelik inancı olarak tanımlanan öz-yeterlik kavramı (Bandura, 1997) başarı duygularının belirleyicilerinden biri olarak kabul edilmektedir. Bu kavram alan ya da konuya özgü olduğundan, matematik başarı duyguları ve matematik öz-yeterliği arasındaki ilişkiyi araştırmak bilimsel açıdan daha pratik ve anlamlı gözükmektedir. Alan yazında, matematik öz-yeterliği ve olumlu duygular arasında pozitif, olumsuz duygular arasında ise negatif bir ilişkiden söz edilmektedir (Pekrun, 2000). Öte yanda Türkiye'de yapılan çalışmaların çoğu cinsiyet ve sınıf seviyesi gibi değişkenleri de göz önüne alarak sınav kaygısı üzerinde yoğunlaşmaktadır (Çapa ve Emmioğlu, 2008; Genç, 2013; Güçlü, 2009; Kapıkıran, 2002; Oksal, Durmaz, ve Akın, 2013; Yerin-Güneri, 2003). Bu noktada farklı başarı duygularını ve onların matematik öz-yeterliğiyle ilişkisini cinsiyet ve sınıf seviyesi gibi değişkenler bakımından inceleyerek alan yazındaki boşluğun doldurulması amaçlanmaktadır. Ayrıca, çalışmanın öğrencilerin olumlu başarı duygularını uzun vadede geliştirebilmek adına eğitimcilere öğrenme ortamlarını düzenlemeleri bakımından yardımcı olacağı düşünülmektedir.

Öte yanda, öğrencilerin matematik başarı duyguları ve matematik öz-yeterliği arasındaki ilişkiyi araştırmanın yanı sıra başarı duygularının öğrencilerin öğrenme stratejileriyle olan ilişkisinin de araştırılması amaçlanmıştır. Çünkü Pekrun'un teorisi (2006) olumsuz duyguların daha az bilişsel ve üstbilişsel strateji kullanımıyla

daha çok yüzeysel strateji kullanımıyla ilişkili olduğu tezini öne sürmektedir. Bu yüzden, bireylerin olumlu duygularını geliştirmek onların daha yaratıcı ve esnek öğrenme stratejileri kullanmalarına ve dolayısıyla başarılı olmalarına olanak sağlayacaktır.

Sonuç itibarıyla, ortaokul öğrencilerinin matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasındaki ilişkinin incelenmesi amaçlanmaktadır. Ayrıca, Matematik Başarı Duyguları Ölçeği, Matematik Becerileri Öz-yeterlik Ölçeği, Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği bu çalışmanın kapsamında Türkçe'ye uyarlanmıştır. Türkçe alan yazında öğrencilerin başarı duygularını ölçen bir ölçeğin olmaması ve belirtilen ölçeklerin alan yazına kazandırılması çalışmanın önemli görülen noktalarından biridir.

Araştırma Soruları

1.Ortaokul öğrencilerinin matematik başarı duyguları sınıf seviyesi ve cinsiyete göre nasıl değişmektedir?

2. Ortaokul öğrencilerinin matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasında nasıl bir ilişki vardır?

3.Ortaokul öğrencilerin matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasında sınıf seviyesine göre nasıl bir ilişki vardır?

Literatür Taraması

Başarı duyguları terimi Reinhard Pekrun'un kontrol-değer teorisine (2006) dayanmaktadır. Bu teoriye dayanarak öne sürülen modelde bireylerin bilişsel değerlendirmeleri başarı duygularının oluşumunda önemli rol oynamaktadır. Bilişsel değerlendirmeler, kontrol ve değer değerlendirmeleri olarak iki başlık altında toplanmaktadır. Kontrol değerlendirmeleri bireylerin istendik sonuçlar elde etmesi ve istenmeyen sonuçlardan kendilerini koruması anlamına gelmektedir. Verilen bir görevi gerçekleştirebilmek için kişinin kendine olan inancı (Bandura, 1997) olarak

tanımlanan öz-yeterlik bu çalışma kapsamında bu kavramın başarı duygularıyla ilişkisi üzerinde durulmaktadır. Alan yazında öğrencilerin matematik öz-yeterlik inançlarının matematik başarı duygularının yordayıcısı olduğu savunulmaktadır. Olumlu başarı duyguları (haz, gurur gibi) ile matematik öz-yeterliği arasında pozitif, olumsuz başarı duyguları (kızgınlık, kaygı, bıkkınlık gibi) ile matematik öz-yeterlik inançları arasında negatif ilişki olduğunu öne süren çalışmalar bulunmaktadır (Artino, 2009; Goetz, Cronjaeger, Frenzel, Lüdtke, ve Hall, 2010; Marchand ve Gutierrnes, 2012; Nie, Lau, ve Liau, 2011; Pekrun, Goetz, Perry, Kramer, Hochstat, ve Molfenter, 2004).

Başarı duyguları, Pekrun'un modeli (2006) çerçevesinde bilişsel değerlendirmelerden etkilenmekle birlikte biliş, motivasyon ve öz-düzenleme üzerinde önemli bir etkiye sahip ve başarı, yaşam doyumu ve mutluluk üzerinde aracı bir rol oynamaktadır. Pozitif etkinleştiren duyguların öğrenme için içsel ve dışsal motivasyonu güçlendirdiği, yaratıcı ve esnek öğrenme stratejileri kullanımını teşvik ettiği vurgulanmaktadır. Negatif etkinleştiren duyguların ise kalıplaşmış öğrenme stratejileri kullanımını harekete geçirdiği etkisizleştiren duyguların da bireyleri yüzeysel bilgi üretim yollarına yönlendirdiği savunulmaktadır. Bu çalışmada üzerinde durulan bir diğer nokta öğrencilerin öz-düzenleyici öğrenme stratejileri ile matematik başarı duyguları arasındaki ilişkidir. Çünkü bireylerin öz-düzenleyici öğrenme stratejileri onların matematik başarı duygularına göre çeşitlilik göstermektedir. Kısaca alan yazında olumlu başarı duygularına sahip bireylerin daha esnek ve yaratıcı öğrenme stratejileri kullandıkları olumsuz başarı duygularına sahip bireylerin ise daha yüzeysel öğrenme stratejilerinden yararlandıkları bilgisini öne süren Pekrun' un modeliyle (2006) uyumlu birçok çalışma bulunmaktadır(Ahmed, Van der Werf, Kuyper, ve Minnaert, 2013; King ve Areepattamannil, 2014; Pekrun, Goetz, Frenzel, Barcfeld, ve Perry, 2011; Pekrun, Goetz, Titz, ve Perry, 2002a; Villavicencio, 2011).

Öte yanda, bireylerin başarı duygularını cinsiyet ve sınıf seviyesine göre karşılaştıran çalışmalar her ne kadar birbiriyle uyumlu sonuçlar ortaya koymasa da, yürütülen araştırmalara bakıldığında kız öğrencilerin özellikle matematik dersinde kaygı ve korku gibi olumsuz başarı duygularını erkek öğrencilere göre daha fazla deneyimledikleri görülmektedir. Ayrıca, bireylerin başarı duygularının sınıf seviyesi arttıkça değiştiği birçok çalışmada ortak olarak varılan bir sonuçtur. Buna göre, öğrencilerin olumlu başarı duyguları öğrencilerin sınıf seviyesi arttıkça azalırken olumsuz başarı duyguları ise artış göstermektedir (Frenzel, Goetz, Lüdtke, Pekrun ve Sutton, 2009; Larson ve Richards, 1991; Wigfield ve Mecce, 1988; Yamaç, 2014).

Yöntem

Desen

Bu çalışmada kesitsel ve korelasyon araştırması uygulandı. Çalışmanın verileri Ankara'nın Altındağ, Çankaya, Keçiören ve Yenimahalle merkez ilçelerinde okumakta olan altıncı, yedinci ve sekizinci sınıf öğrencilerinden toplanıldı.

Örneklem

Bu çalışma için hedef evren olarak Ankara'daki devlet okullarında okuyan altıncı, yedinci ve sekizinci sınıf öğrencileri seçilmiştir. Zaman faktöründen dolayı çalışmanın ulaşılabilecek evreni Ankara'nın dört merkez ilçesi olan Altındağ, Çankaya, Keçiören ve Yenimahalle ilçelerinde okumakta olan altıncı, yedinci ve sekizinci sınıf öğrencileri olarak belirlenmiştir. 4+4+4 değişikliği kapsamında beşinci sınıf öğrencileri ortaokul programı içerisinde kabul edilseler de Matematik Eğitimi ve Rehberlik ve Psikolojik Danışmanlık alanındaki uzmanların görüşleri neticesinde beşinci sınıflar bu çalışmaya dâhil edilmemiştir. alanındaki uzmanların görüşleri neticesinde beşinci sınıflar bu çalışmaya dâhil edilmemiştir. Çünkü Matematik Başarıları Ölçeği'ndeki madde sayısı öğrencilerin gelişim seviyelerine göre çok fazla olmakla birlikte Matematik Becerileri Öz-yeterlik Ölçeği'nde ortaokul beşinci sınıf matematik müfredatında işlenmeyen matematik konularıyla ilgili birçok

madde bulunmaktadır. Ulaşılabilir evren üzerinden küme yöntemiyle seçkisiz olarak 14 okul seçilmiştir. Katılımcıların sayısı ulaşılabilir evrenin büyüklüğü ve kullanılan ölçeklerdeki madde sayıları göz önüne alınarak belirlenmiştir. Neticede, altıncı, yedinci ve sekizinci sınıflarda okumakta olan toplam 2250 ortaokul öğrencisi bu çalışmaya gönüllü olarak katılmıştır. Katılımcılardan kızlar (n = 1164) örneklemin %51.7' sini erkek öğrenciler ise (n = 1085) % 48.2'sini oluşturmaktadır. Ayrıca, çalışmaya altıncı sınıftan 690 öğrenci, yedinci sınıftan 772 öğrenci ve sekizinci sınıftan da 784 öğrenci katılmıştır.

Veri Toplama Araçları

Araştırmada veri toplamak amacıyla öğrencilere bir arada dört farklı ölçekten oluşan bir anket uygulanmıştır. Altı bölümden oluşan anketin ilk bölümü katılımcılardan cinsiyet ve sınıf seviyesini istemektedir. İkinci, üçüncü ve dördüncü bölümler katılımcıların sınıf, öğrenme ve sınav gibi farklı eğitim ortamlarındaki matematik başarı duygularını ölçen toplamda 60 maddeden oluşan Matematik Başarı Duyguları Ölçeğini içermektedir. Araştırmacı tarafından çalışma kapsamında Türkçe'ye uyarlanan Matematik Başarı Duyguları Ölçeği (Pekrun , Goetz, Frenzel, Barcfeld ve Perry, 2011) haz, gurur, kaygı, kızgınlık, bıkkınlık, umutsuzluk ve utanç olmak üzere yedi farklı matematik başarı duygusunu ölçmektedir. Bu ölçeğin Türkçe'ye uyarlanma sürecinde çeşitli basamaklar izlenmiştir. Sırasıyla üç uzman tarafından Türkçe'ye çevrilen ölçek üç farklı uzman tarafından yeniden İngilizce'ye çevrilmiştir. Böylece her bir maddenin orijinal ölçekle uyumluluğu kontrol edilmiştir. Rehberlik ve Psikolojik Danışma ve Ölçme ve Değerlendirme alanında iki uzmandan görüş alınmıştır. Altıncı, yedinci ve sekizinci sınıfta okuyan toplam üç öğrenciyle bilişsel mülakat yapılarak uygulamada sorun yaratabilecek maddeler belirlenmiştir. Bu maddeler için Eğitim Programları ve Öğretim ve Eğitim Psikolojisi alanında uzman farklı iki kişiden daha görüş alındıktan sonra ankete son hali verilerek pilot çalışma yapılmıştır. Pilot çalışma, 746 altıncı, yedinci ve sekizinci sınıf öğrencisi üzerinde uygulanmıştır. Matematik Başarı Duyguları Ölçeğinin pilot çalışma kapsamında yapı geçerliğini test etmek amacıyla Doğrulayıcı Faktör Analizi

uygulanmıştır. Faktör analizi sonuçlarına göre 3, 4, 21, 26, 36,46, 48 ve 52. maddeler sorunlu görülmekle birlikte ölçekten çıkarılmama ve ana uygulamada katılımcılara uygulama kararı verilmiştir. Ayrıca ölçeğin güvenirlik katsayıları her bir duygu boyutu için.75'in üzerindedir.

Anketin beşinci bölümü ortaokul öğrencilerinin matematik öz-yeterlik inançlarını araştıran ve araştırmacı tarafından çalışma kapsamında Türkçe'ye uyarlanan Matematik Becerileri Öz-yeterlik Ölçeği (Usher, 2007) ve Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği (Usher, 2007)'nin maddelerinden oluşmaktadır. 24 maddeden oluşan Matematik Becerileri Öz-yeterlik Ölçeği öğrencilerin matematik problemi çözebilmeye yönelik inançlarını ölçmektedir. Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği ise öğrencilerin matematik dersinde öz-düzenleyici öğrenme stratejileri kullanımına yönelik yeterlik algılarını ölçmeyi amaçlamaktadır ve 11 maddeden oluşmaktadır. Ölçeklerin Türkçe'ye uyarlanma sürecinde Matematik Başarı Duyguları Ölçeğinin uyarlama sürecinde izlenen adımlar izlenmekle birlikte farklı olarak öğretim tecrübeleri yıllara bağlı olarak değişen üç ortaokul matematik öğretmeninin Matematik Becerileri Öz-yeterlik Ölçeği hakkında görüşleri alınmıştır. Görüşmelerin sonunda Matematik Becerileri Öz-yeterlik Ölçeğinin özellikle altıncı sınıf matematik öğretim programı kapsamında işlenmeyen bazı konu alanlarını içerdiği sonucuna varılmış ve pilot çalışmada öğrencilere bu konuları içeren maddeleri boş bırakabilme seçeneği sunulmuştur. Pilot uygulama toplamda 202 altıncı, yedinci ve sekizinci sınıf öğrencisi üzerinde gerçekleştirilmiştir. Pilot uygulama sonuçlarına göre iki ölçeğin faktör yapısını test edebilmek için Açımlayıcı Faktör Analizi yapılmış ve iki ölçeğin de tek faktör altında toplandığı sonucuna varılmıştır. Ayrıca, Cronbach alpha katsayıları her iki ölçek için de.90'ın üzerindedir.

Anketin son bölümü 31 maddeden oluşan Öğrenmede Güdüsel Stratejiler Anketi'nin Öğrenme Stratejileri alt boyutunu içermektedir. Sungur (2004) tarafından Türkçe'ye uyarlanan bu ölçek öğrencilerin bilişsel ve üstbilişsel öğrenme stratejilerini araştıran

beş farklı alt boyuttan oluşmaktadır. Bu boyutlar sırasıyla yineleme, açımlama, düzenleme, eleştirel düşünme ve üstbilişsel stratejilerden oluşmaktadır.

Veri Toplama Süreci

Veri toplama sürecine gerekli izinler ODTÜ İnsan Araştırmaları Etik Kurulu'ndan ve Milli Eğitim Bakanlığı'ndan alındıktan sonra başlanıldı. Öncelikle örneklemle benzer özelliklere sahip 746; altıncı, yedinci ve sekizinci sınıf öğrencisi üzerinde Türkçe'ye uyarlanan ölçeklerin yapı geçerliğini test etmek amacıyla bir pilot çalışma gerçekleştirildi. Ana çalışma ise pilot çalışmanın ardından 2013-2014 akademik yılı ikinci dönemi içinde gerçekleştirildi.

Ölçeklerin uygulanması her sınıf seviyesi için yaklaşık bir ders saatini kapsamıştır. Zaman kısıtlılığından ötürü öğretmenlerden uygulama esnasında yardım istendi. Öğrenciler, çalışmanın amacı ve uygulama süreci hakkında önceden bilgilendirilmiş ve çalışmaya gönüllü olarak katılmışlardır. Ayrıca, bilgilerin araştırmacı tarafından gizli tutulacağı ve sadece araştırma amaçlı kullanılacağı konusunda bilgilendirildiler. Araştırmacı, katılımcıların sorularını cevaplayabilmek ya da maddelerin bağımsız bir şekilde cevaplandırıldığından emin olmak için uygulama esnasında çoğunlukla sınıfta hazır olarak bulunmuştur.

Veri Analizi

Veri analizi IBM SPSS 22 programı kapsamında betimsel ve kestirisel analiz yöntemiyle gerçekleştirildi. Matematik Başarı Duyguları Ölçeği, Matematik Becerileri Öz-yeterlik Ölçeği ve Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği'nin faktör yapısını test etmek amacıyla AMOS 20 (Arbuckle, 2011) programı ile Doğrulayıcı Faktör Analizi yapılmıştır. Öte yanda, sonuçların güvenirliğini test etmek için Cronbach alfa katsayısı incelendi. Betimsel analiz yöntemiyle cinsiyet ve sınıf seviyesine göre örneklemin nasıl değiştiğini anlamak için ortalama ve standart sapma değerlerine bakılmıştır. Cinsiyet ve sınıf seviyesi değişkenlerinin ortaokul öğrencilerinin matematik başarı duyguları üzerindeki etkisini incelemek için çok

değişkenli varyans analizi; matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasındaki ilişkiyi araştırmak için ise kanonik korelasyon analizi yapıldı.

Araştırmanın Sınırlılıkları

İlk olarak, araştırma ortaokul öğrencilerinin matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasındaki ilişkiyi araştırdığı için bu değişkenler arasında sebep-sonuç ilişkisinden bahsetmek mümkün değildir. İkinci olarak, veriler anket yoluyla toplandığından öğrencilerin sosyal istenirlik probleminden ötürü gerçek duygu ve düşüncelerini yansıtmama durumu söz konusudur. Ayrıca, bu çalışma altı, yedi ve sekizinci sınıf öğrencileri ve matematik konu alanıyla sınırlandırılmıştır. Bu yüzden, sonuçları diğer eğitim seviyeleri ya da konu alanlarına genellemek mümkün değildir. Bununla birlikte çalışmanın sonuçları sadece Ankara'da seçilen ilçelere genellenebilir. Ankara'daki farklı sosyo-eknomik, kültürel ve etnik yapıya sahip diğer ilçelere ya da Türkiye'deki diğer şehirlere genelleme yapılamaması çalışmanın çevresel geçerliğini sınırlandırmaktadır.

Araştırmanın Varsayımları

Araştırmada uygulanan bütün ölçekler katılımcılara standart koşullarda uygulanmıştır. Katılımcıların, Matematik Başarı Duyguları Ölçeği, Matematik Becerileri Öz-yeterlik Ölçeği, Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği ve Öğrenmede Güdeüsel Stratejiler Anketi Öğrenme Stratejileri alt boyutundaki maddeleri içtenlikle cevapladıkları ve birbirlerinden etkilenmedikleri, cevaplarda kendi fikirlerini yansıttıkları öngörülmektedir

Bulgular

Uygulama sonuçları aşağıda belirtilen bulguları ortaya çıkarmıştır.

- Doğrulayıcı faktör analizi sonuçlarına göre, Matematik Başarı Duyguları Ölçeğinin yapı geçerliği test edilmiştir. Ölçekteki 3, 4, 21, 26, 36, 45, 48 ve 51. maddelerin çıkarılmasına karar verilmiştir. Değerler şu şekilde verilebilir.

Karşılaştırılmalı Uyum İndeksi (Comparative Fit Index, CFI) = .90, Normlaştırılmamış Uyum İndeksi (Non Normed Fit Index, NNFI = .90), Yaklaşık Hataların Ortalama Karekökü (Root Mean Square Error of Approximation, RMSEA) = .05. Buna göre ölçek haz, gurur, kızgınlık, kaygı, umutsuzluk, bıkkınlık ve utanç gibi yedi farklı duygu boyutunu ölçmektedir. Ayrıca, Cronbach alfa katsayıları her bir duygu boyutu için .80 'in üzerinde olupkabul edilir düzeydedir.

- Matematik Becerileri Öz-yeterlik Ölçeği ve Öz-düzenleyici Öğrenme Öz-yeterlik Ölçeği doğrulayıcı faktör analizleri neticesinde pilot çalışma bulgularında olduğu gibi tek faktörlü bir yapıya dayanmaktadır. Değerler iki ölçek için sırasıyla şu şekilde verilebilir. CFI = .93, NNFI = .92, RMSEA = .06; CFI = .93, NNFI=.92, RMSEA = .06. Ölçeklerin güvenirlik katsayıları .90'ın üzerinde olup kabul edilir düzeydedir.
- Öğrenmede Güdüsel Stratejiler Anketi'nin Öğrenme Stratejileri bölümünün yapı geçerliğini test etmek için doğrulayıcı faktör analizi yapılmıştır. Faktör analizi sonucuna göre öğrenme stratejileri yineleme, açımlama, düzenleme, eleştirel düşünme ve üstbilişsel strateji olmak üzere beş alt boyuttan oluşmaktadır. 2. ve 17. maddeler eldeki verilere göre sorunlu olmalarından ötürü ölçekten çıkarılmıştır. Değerler sırasıyla şöyledir: CFI = .94, NNFI = .93, RMSEA = .06. Ölçeğin her bir boyutunun güvenirlik katsayısı .75'in üzerindedir.
- Betimsel analiz sonuçlarına göre altıncı, yedinci ve sekizinci sınıf öğrencilerinin olumlu matematik başarı duygu puanları olumsuz matematik başarı duygu puanlarından daha yüksektir.
- Olumlu matematik başarı duygu puanlarına bakıldığında haz duygusunun, olumsuz duygular içerisinde ise kaygının en yüksek ortalamaya sahip olduğu görülmektedir. Ayrıca gurur olumlu duygular içerisnde, kızgınlık ise olumsuz duygular içerisinde en düşük ortalamaya sahiptir.
- Katılımcıların matematik öz-yeterlik ölçeklerinden aldıkları puanlar karşılaştırıldığında Matematik Becerileri Öz-yeterlik Ölçeği ortalamalarının Öz-

düzenleyici Öğrenme Öz-yeterlik Ölçeği ortalamalarından daha yüksek olduğu sonucuna varılmıştır.

- Öğrencilerin öz-düzenleyici öğrenme stratejileri puanları her bir öğrenme stratejisi için kıyaslandığında, öğrencilerin üstbilişsel öz-düzenleyici strateji puanının en yüksek, eleştirel düşünme strateji puanının ise en düşük olduğu görülmüştür.
- Çoklu varyans analizi sonucuna göre cinsiyet ve sınıf seviyesi değişkenlerinin ortaokul öğrencilerinin matematik başarı duyguları üzerinde anlamlı derecede etkili olduğu görülmüştür.
- Matematik başarı duyguları arasında kaygı, utanç ve umutsuzluk cinsiyete göre anlamlı olarak değişmektedir. Buna göre, kız öğrencilerin matematik dersindeki kaygı, utanç ve umutsuzluk duyguları erkek öğrencilerden daha yüksektir.
- Utanç haricindeki tüm matematik başarı duyguları sınıf seviyesine göre anlamlı olarak değişmektedir. Genel olarak, olumlu duygular altıncı sınıftan sekizinci sınıfa doğru azalan olumsuz duygular ise tersine artan bir eğilim göstermektedir.
- Kanonik korelasyon sonuçlarına göre öğrencilerin olumlu matematik başarı puanları ile matematik becerileri öz-yeterlik, öz-düzenleyici öğrenmeye yönelik öz-yeterlik ve öz-düzenleyici öğrenme stratejileri puanları arasında pozitif; olumsuz başarı puanları arasında ise negatif bir ilişki bulunmaktadır. Sonuçlar sınıf seviyesi bakımından incelendiğinde benzer sonuçlar göstermektedir.

Sonuç ve Öneriler

Ortaokul öğrencilerinin matematik başarı duygularının cinsiyet ve sınıf seviyesi bakımından manidar farklılıklar göstermesi alan yazındaki birçok çalışmayla uyum içerisindedir. Alan yazında kız öğrencilerin kontrol ve değer inançlarının erkek öğrencilerden daha farklı olduğu ve bu farklılığın da matematik başarı duyguları üzerinde cinsiyete dayalı farklılıklara yol açabileceği hususunda çeşitli görüşler bulunmaktadır. Öte yanda, ders kitapları ve matematik öğretim programının yeterli hassasiyeti göstermemesi, öğretmenlerin cinsiyete dayalı inançları, kız öğrencilerin matematik başarılarını kontrol edilemeyen

değişkenlere yükleme gibi durumlar kız ve erkek öğrenciler tarafından farklı matematik başarı duygularının deneyimlenmesine yol açabilmektedir.

Ayrıca, ortaokul öğrencilerinin matematik başarı duyguları üzerinde sınıf seviyesine dayalı farklılıklar da gözlenmektedir. Halihazırda lise ve üniversitelere girebilmek için yürütülmekte olan merkezi sınavların varlığı, ailelerin sınvalar dolayısıyla öğrenciler üzerinde oluşturdukları baskı, matematik dersinin içerdiği konu alanının yıllara bağlı olarak genişlemesi ve soyutlaşması öğrencilerin bir üst eğitim seviyesine geçerken daha az olumlu ama daha fazla olumsuz duygu yaşamasına sebep gösterilebilir.

Öte yanda, araştırmanın değindiği ve aslında temel soru olan matematik başarı duyguları, matematik öz-yeterliği ve öz-düzenleyici öğrenme stratejileri arasındaki ilişki alan yazında yapılmış olan birçok çalışmayla örtüşmektedir. Bu bağlamda, eğitimci ve uygulayıcılara aşağıdaki öneriler sunulmaktadır.

- Öğretim stratejileri öğrencilerin ilgi, yetenek ve ihtiyaçlarıyla uyum içinde olmalıdır. Aksi takdirde öğrenciler ilgili konu alanından uzaklaşmakta ve olumsuz duyguların ortaya çıkışı hızlanmaktadır.
- Öğrenci merkezli eğitim ve öğretim faaliyetleri benimsenmelidir. Kısaca, öğrencilere bireysel geribildirimler verilmeli, sınıfta tartışma ortamları yaratılmalı, öğrencilerin sorularına yeterli zaman ayrılmalıdır.
- Matematik dersinin hızı ve zorluğu öğrencilerin kapasitelerinin çok üzerinde ya da altında olmamalıdır. Aksi halde bıkkınlık duygusunun ortaya çıkışı hızlanmakta, öğrenciler matematik dersinden ve okuldan uzaklaşmaktadır.
- Öğrencilere öz-düzenleyici öğrenme stratejiler öğretilmelidir.
- Okul rehber öğretmenleri ve psikolojik danışmanları tarafından cinsiyete dayalı başarı duyguları farklılığını azaltmak için kız ve erkek öğrencilere çeşitli müdahale eğitimleri uygulanmalıdır.

- Matematik ders kitapları ve öğretim programları kalıplaşmış cinsiyet inançlarından arındırılmalıdır.
- Öğretmen adaylarının kalıplaşmış cinsiyet inançları konusunda bilinçlendirilmesini sağlamak için öğretmen yetiştirme programlarında çeşitli eğitimler düzenlenmelidir.
- Merkezi sınavların öğrenciler üzerinde yarattığı olumsuz duygu durumlarını ve ailelerin öğrenciler üzerinde yarattığı baskıyı azaltabilmek için öğretmen, öğrenci ve veli diyaloğu sürekli etkin tutulmalıdır. Bu konuda okul rehberlik servislerinde gerekli seminerler düzenlenebilir.
- Öğretmenlerin öğretim stillerine etki eden bir faktör olarak öğretmen duyguları da dikkate alınmalı ve konuda çeşitli araştırmalar yapılmalıdır.
- Matematik başarı duyguları, matematik öz-yeterliği ve öğrenme stratejileri arasındaki sebep ve sonuç ilşikisinden bahsedebilmek için ayrıca deneysel bir çalışma yapılmalıdır.
- Nicel araştırma yöntemlerinin yanı sıra nitel araştırma yöntemlerinden de yararlanılmalı: gözlem, farklı gruplarla mülakat ve fizyolojik ölçümler gibi değişik yöntemler kullanılmalıdır.
- Haz, gurur, kaygı, kızgınlık, bıkkınlık, umutsuzluk ve utanç gibi başarı duygularının yanı sıra başka başarı duyguları da araştırılmalıdır.
- Çalışma ortaokul öğrencileriyle ve matematik konu alanıyla sınırlı kalmamalı farklı eğitim seviyelerine ve konu alanlarına genişletilmeldir.
- Kesitsel çalışmanın yanı sıra öğrencilerin matematik başarı duyguları üzerinde boylamsal bir çalışma da yapılmalıdır.
- Araştırma sadece Ankara merkez ilçeleriyle sınırlı kalmamalı ve Türkiye'deki farklı yerleşim yerlerinde de uygulanmalıdır.
- Okul türü ve başarı amaçlarını da değişken olarak içeren ayrıca bir araştırma yapılmaldır.
- Başarı duygularının (Temel Eğitimden Ortaöğretime Geçiş) TEOG gibi merkezi sınavlarda elde edilen başarıyla ilişkisini araştıran farklı çalışmalar yürütülmelidir.

Appendix D. TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☐

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : ÇALIK

Adı : BAŞAK

Bölümü : EĞİTİM PROGRAMLARI VE ÖĞRETİM

TEZİN ADI (İngilizce) : The Relationship between Mathematics Achievement Emotions, Mathematics Self-Efficacy, and Self-Regulated Learning Strategies among Middle School Students

TEZİN TÜRÜ : Yüksek Lisans ☐ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. ☐

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: