INVESTIGATION OF MIDDLE SCHOOL MATHEMATICS TEACHER EMOTIONS AND THEIR STUDENTS' MATHEMATICS ACHIEVEMENT EMOTIONS: A MIXED-METHODS STUDY

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ABSTRACT

INVESTIGATION OF MIDDLE SCHOOL MATHEMATICS TEACHER EMOTIONS AND THEIR STUDENTS' MATHEMATICS ACHIEVEMENT EMOTIONS: A MIXED-METHODS STUDY

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The purpose of the study was three-fold. First, the study aimed to investigate the relationship between mathematics teachers' emotions, self-efficacy, and burnout. Second, it was aimed to examine the relationship between mathematics teachers' emotions and their students' mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and mathematics achievement emotions. Third, the reasons for and relevant processes behind students' emotions were uncovered by considering the learning process and student-teacher interactions. The study employed a mixed-methods research design. Accordingly, 222 public middle school mathematics teachers and 5475 seventh and eighth-grade students in İstanbul selected through cluster sampling participated in the quantitative phase. Next, 14 teachers selected through the maximum variation and convenience sampling participated in the qualitative phase. Teacher and student questionnaires and teacher interviews were utilized. Single and multilevel structural equation modeling and content analyses were performed.

According to the results, personal accomplishment predicted teacher self-efficacy dimensions. Teacher self-efficacy for student engagement was negatively related to emotional exhaustion. Besides, teacher self-efficacy dimensions made significant contributions to explain teacher enjoyment, anger, and anxiety. Students' perceptions of teachers' supportive presentation style and excessive lesson demands, and mathematics self-efficacy predicted students' mathematics enjoyment, anger, and anxiety. Perceived teacher affective support was negatively related to student anger. There was no significant relationship between mathematics teachers' anger, anxiety, enjoyment, and students' anger, anxiety, and enjoyment in mathematics. Interviews with teachers revealed the main themes as types of student emotions in mathematics learning and teaching, sources of emotions, consequences of emotions, and strategies to regulate emotions.

Keywords: Achievement Emotions, Teacher Emotions, Mathematics Self-Efficacy, Teacher Self-Efficacy, Teaching Quality

ÖZ

ORTAOKUL MATEMATİK ÖĞRETMEN DUYGULARININ VE ÖĞRENCİLERİNİN MATEMATİK BAŞARI DUYGULARININ İNCELENMESİ: KARMA YÖNTEM ÇALIŞMASI

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Bu çalışma üç aşamadan oluşmaktadır. İlk olarak, matematik öğretmenlerinin duyguları, özyeterliği ve tükenmişliği arasındaki ilişkinin incelenmesi amaçlanmaktadır. İkinci olarak, matematik öğretmenlerinin duyguları ve öğrencilerinin matematik özyeterliği, algılanan öğretimin niteliği, öğretmen yapıcı duyusal desteği ve matematik başarı duyguları arasındaki ilişkinin araştırılması amaçlanmaktadır. Üçüncü olarak, öğrencilerin matematik duygularının nasıl şekillendiği ile ilgili süreçler öğrenim ve öğretmen-öğrenci etkileşimi kapsamında ortaya konulmuştur. Karma yöntem deseni kullanılan araştırmanın nicel boyutuna, İstanbul devlet ortaokullarında görev yapan 222 matematik öğretmeni ve 5475 yedinci ve sekizinci sınıf öğrencisi küme örnekleme yoluyla seçilerek katılmıştır. Araştırmanın nitel boyutuna maksimum çeşitlilik ve kolay ulaşılabilir durum örneklemesi yoluyla seçilen 14 öğretmen katılmıştır. Öğretmen ve öğrenci anketleri

ve öğretmen görüşmeleri yoluyla toplanan verilerin analizi tek ve çok düzeyli yapısal eşitlik modellemesi ve içerik analizi ile yapılmıştır.

Nicel bulgular, öğretmenlerin kişisel başarılarının özyeterlik boyutlarını yordadığını göstermektedir. Öğretmenlerin öğrenci katılımına dönük özyeterlik inançları ile duygusal tükenmeleri arasında negatif bir ilişki bulunmuştur. Ayrıca, öğretmen özyeterlik boyutlarının öğretmenlerin zevk, öfke ve kaygı duygularını yordadığı görülmektedir. Öğrencilerin, öğretmenlerinin destekleyici sunuş biçimi ve aşırı ders talepleri kullanımlarına dönük algıları ve matematik özyeterlikleri, öğrencilerin matematik dersine duydukları zevk, öfke ve kaygı duygularını açıklamaktadır. Ayrıca, öğrencilerin algılanan öğretmen yapıcı duyusal desteği ve matematiğe dönük öfkeleri arasında negatif bir ilişki bulunmuştur. Matematik öğretmenlerinin öfke, kaygı ve zevk duyguları ile öğrencilerinin matematiğe yönelik öfke, kaygı ve zevk duyguları arasında ise anlamlı bir ilişki bulunmamaktadır. Nitel bulgular kapsamında öğrencilerin matematik duygularının nasıl şekillendiğini açıklamak için ortaya çıkan temalar sırasıyla, öğrencilerin matematik öğrenme ve öğretimindeki duygu çeşitleri, duyguların sebepleri, duyguların sonuçları ve duyguları düzenleme stratejileridir.

Anahtar Kelimeler: Başarı Duyguları, Öğretmen Duyguları, Matematik Özyeterlik, Öğretmen Özyeterlik, Öğretimin Niteliği

To the people who never lose their dreams, passion, and perseverance,

and

to my new life, hopefully

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LIST OF ABBREVIATIONS

AEQ: Achievement Emotions Questionnaire
AEQ-M: Mathematics Achievement Emotions Questionnaire
ANOVA: Analysis of Variance
CFA: Confirmatory Factor Analysis
CFI: Comparative Fit Index
EFA: Exploratory Factor Analysis
MBI: Maslach Burnout Inventory
MBI-EF: Maslach Burnout Inventory- Educators Form
MCAR: Missing Completely at Random
ML-SEM: Multilevel Structural Equation Modeling
MoNE: Ministry of National Education
NCTM: National Council of Teachers of Mathematics
NNFI: Non-Normed Fit Index
PISA: Programme for International Student Assessment
PTAS: Perceived Teacher Affective Support
PTQ: Perceived Teaching Quality
OECD: Organization for Economic Co-operation and Development
RMSEA: Root Mean Square Error of Approximation
SEM: Structural Equation Modeling
SESRL: Self-Efficacy for Self-Regulated Learning
SPSS: Statistical Package for the Social Sciences
SRMR: Standard Root Mean Square Residual
TES: Teacher Emotions Scale
TIMMS: Trends in International Mathematics and Science Study
TLI: Tucker Lewis Index
TSES: Teachers' Sense of Efficacy Scale

CHAPTER 1

INTRODUCTION

"Every day for us something new
Open mind for a different view
And nothing else matters"
Metallica (1991)

This chapter precisely provides information about the background and purpose of this study. It lays the groundwork for its significance and addresses the research questions and the definitions of the essential constructs, which are examined throughout the study.

1.1. Background of the study

"Everyone has experience of the passions within himself, and there is no necessity to borrow one's observations from elsewhere in order to discover the nature" (Descartes 1649/1689, as cited in Solomon, 2008, p.4). Descartes asserted that every person inherently possesses affective characteristics and perceives the world by combining their own cognitive, affective, and behavioral perceptions and thoughts. In this regard, affect plays a critical role in explaining human thoughts and behaviors. The term "affect" was neglected in education for quite a while due to the heavy influence of behaviorism despite great time philosophers' recurring ideas in history. Affect was viewed as an imaginary construct, and its presumable effects on education were also discarded (Hannula, 2011; McLeod 1992). However, as time passed, this term was studied in different domains by many researchers, and affect as an umbrella term was specified to encompass non-cognitive constructs such as beliefs, attitudes, moods, values, and emotions. Still, the classification of these constructs has been highly debated for a long time. They have labeled alike that created the jingle fallacy in education. To clarify this speculation, McLeod (1992) divided affect into three main categories: attitude, beliefs, and emotions. De Bellis and Goldin (2006) added a new category to this classification and entitled this category as values/morals/ethics in their tetrahedral model to describe the subdomains of affect (Figure 1.1).

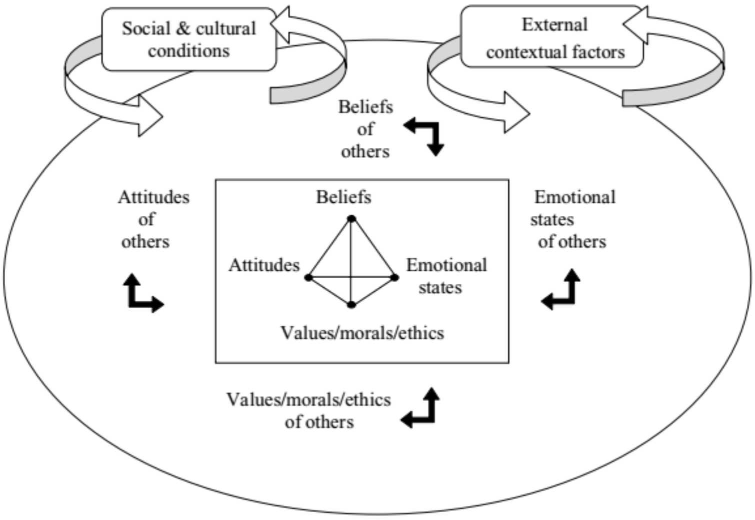

Figure 1.1.

De Bellis and Goldin's tetrahedral model for affect
Note. Adapted from "Effect and Meta-Affect in Mathematical Problem Solving: A Representational Perspective" by De Bellis, V. A. and Goldin, G. A., 2006, *Educational Studies in Mathematics*, *63*, p. 131-147. Copyright 2006 by Springer.

According to this model, these constructs were differentiated from individuals' perceptions according to their stability and structure. From this perspective, first, *beliefs* are conceptualized as the attributions of the truths to some sort of cognitive understanding that they are highly stable and structured. Second, *attitudes* incorporate individuals' general predispositions and feelings toward the relevant issue or context; they are less stable and structured than the beliefs. On the other hand, *values/ morals/ ethics* address individuals' truths facilitating their decision-making processes. Following its definition, values are stable and structured as well (De Bellis & Goldin, 2006; Hannula, Evans, Philippou & Zan, 2004). In decreasing order of stability but increasing intensity, emotions are the changing feeling states of people in a particular context (Linnenbrink, 2006). By closely looking at this tetrahedral model, it would be observed that each vertex has an apparent relationship with other vertices ascribing a dynamic nature to the model. At the simplest level, individuals' emotions are influenced by their own beliefs, attitudes, and values in addition to other people's beliefs, attitudes, and values.

Among the classification toward the system of affect and the interaction among each component, emotions, nowadays, are of top priority in education. There is still scant evidence on emotions in educational research as it was concerned as destructive, primitive (Sutton & Wheatley, 2003), irrelevant and bothersome in scientific research (Frenzel & Stephens, 2013). However, nowadays, there is a high interest in emotions in different fields of study, such as economics, neuroscience, anthropology, and the humanities (Linnenbrick-Garcia & Pekrun, 2011; Pekrun & Linnenbrick-Garcia, 2014). Notwithstanding, the prevalence of emotional research in education has been relatively lower than many other disciplines until very recently (Pekrun, 2009). Except for test anxiety (Zeidner, 1998, 2007), there was a need to explore how emotions take part in teaching and learning processes for different disciplines. As a reaction to this situation, from 1990 onwards, much emphasis has been put on academic emotions in education research at leading international conferences organized by American Educational Research Association (AERA) and European Association for Research on Learning and Instruction (EARLI) (Linnenbrink, 2006; Linnenbrick-Garcia & Pekrun, 2011; Pekrun & Linnenbrick-Garcia, 2014; Schutz & Lanehart, 2002).

Learning environments, classrooms, mainly, are the places where students and teachers being the critical components of education, are inherently in a close relationship. Although teaching includes rational and affective activities, the affective stance of teaching is often underestimated (Schutz & Zembylas, 2009). Teachers' content and pedagogical knowledge and skills, such as their competency and perseverance to cope with classroom management issues, and the presence of highstake tests, their interaction with students, parents, colleagues, school administrators, and also other people who are involved in the environment that teachers socially and culturally be a part of might induce teachers to experience distinct emotions in an ordinary school day. Accordingly, teaching was considered one of the most stressful professions in the 21st century (Day & Qing, 2009), so describing teaching as an emotion-laden job becomes an undeniable reality.

Teacher emotions are, in fact, interrelated with many other different cognitive and affective constructs. These are teachers' pedagogical content-knowledge formation (Brigido, Couso, Gutierrez, & Mellado; 2013), their identity formation (Bair, Bair, Mader, Hipp, & Hakim, 2010), well-being, teaching satisfaction, and burnout (Chang, 2009), and teaching quality (Frenzel, 2014; Frenzel, Becker-Kurz, Pekrun & Goetz, 2015; Frenzel, Goetz, Stephens & Jacob, 2009; Frenzel, Pekrun, Goetz, Daniels, Durksen, Becker-Kurz & Klassen; 2016; Hagenauer & Volet, 2014; Klassen, Perry, & Frenzel, 2012; Sutton, 2005; Sutton & Wheatley, 2003, Taxer & Frenzel, 2015; Trigwell, 2012). Burnout holds a critical role in teachers' emotional exhaustion and job satisfaction levels when the emotional endeavor and the teaching profession's stressful nature is thought. Under the heavy influence of burnout, they might confront health problems, depression, aggression, and a kind of alienation from their identity. This process might end up dropping out of the profession, which is called attrition. According to the findings of several reports in the U.S. (Alliance for Excellent Education, 2004), teacher attrition becomes a significant problem mostly for the beginning teachers as 50% of the beginning teachers tend to drop out their job within five years of their profession. Unlike the U.S. and some other developed countries, teachers' attrition rate in Turkey was contended to be 0.2% of the total teacher workforce between 2000-2012 years (Özoğlu, 2015). This might be related to several conditions. First, teachers in Turkey are selected and appointed to the public schools after accomplishing sequential and complicated processes. The demanding nature of such processes might prevent teachers from quitting their professions. Second, according to civil servants' regulations, teachers could be fired from their jobs if and only if they engage in any activity that is considered shameful. Third, the teaching profession's job-market alternatives are generally less than the other professions (Özoğlu, 2015). For those reasons, teachers in Turkey less likely to drop out of their job. However, this situation does not mean that teaching is an emotion-free job or teachers do not experience stress or burnout in Turkey (e.g., Çağlar, 2011; Durak & Seferoğlu, 2017; Karakelle & Canpolat, 2008; Seferoğlu, Yıldız & Avcı Yücel, 2014). Teachers might confront with the burnout syndrome due to the organizational and transactional factors. While role conflict, role ambiguity, work overload, classroom climate, decision-making, and social support status are factors related to organizational sources (Byrne, 1999), the transactional factors influence teacher self-efficacy and emotion-regulation strategies. In other words, teachers' beliefs in their capabilities to successfully carry out actions in specific tasks might affect removing the stress in the teaching profession to some extent (Durr, Chang, & Carson, 2014). Leiter (1993, as cited in Yu, Wang, Zhai, Dai, & Yang, 2015) also described burnout as teachers' self-efficacy crisis because repeated failures would reduce teacher self-efficacy. That might also increase the risk of emotional exhaustion when considering physiological or affective arousal as a common source of self-efficacy (Bandura, 1997). Overexploitation of emotional sources (Maslach, 2003) or extreme arousal might cause a feeling of tiredness that may also diminish teacher self-efficacy. Therefore, the link between teacher burnout and teacher self-efficacy seems critical to coping with the problems related to emotional exhaustion, displaying cynical attitudes or alienation from the work. The reduced self-efficacy level might yield negative feeling states, indicating a vicious cycle for teachers' academic lives and professional careers.

The contagion effect of burnout (Dorman, 2003; Girgin, 2010; Maraşlı, 2005; Seferoğlu et al., 2014), on the other hand, necessitates questioning the reflection of this syndrome on other educational agents, especially on students. This reflection might distinguish itself from the probable interaction between students and teachers, triggered by emotional states of these sides. Regarding the teacher's side, teacher emotions have a remarkable impact on student learning, quality of education (Schutz

& Zembylas, 2009), and teaching quality more explicitly because teacher emotions are closely related to employed instructional methods and strategies in their classrooms. Accordingly, teachers with more positive and less negative emotions tend to use more flexible and less rigid strategies. Contrary to this, teachers with more negative and less positive emotions are more likely to adopt conventional methods, which, in return, have a substantial effect on student-teacher relationships and students' social-emotional behaviors (Frenzel, 2014). This relationship is consistently studied on educational psychology theories and could not be reduced only to the employed methods and strategies in classrooms. According to Bronfenbrenner's (1977) ecological systems theory, the full development of a child could be understood if they are studied within multiple environments nested within others. When the child is in the center, their relationship with their immediate environment is explored in a microsystem encompassing the child's connection to their parents, peers, and teachers. The bi-directional relationship among these groups of people would undoubtedly contribute to the development of the child. Among these people, the student-teacher relationship's quality holds a critical role in students' academic, motivational, and social development (Wentzel, 2009). In addition to Bronfenbrenner's (1977) theory, Ryan and Deci's (2000) self-determination theory confirms that teachers who develop emotionally supportive, secure, and trustful relationships with their students would presumably contribute to the increase in students' motivation, engagement in learning, and academic and social competencies (Wentzel, 2009). In this regard, teaching quality involves both cognitive and affective support of teachers, which might be directly or indirectly related to school-related outcomes.

In this perspective, student emotions could be considered while thinking about student-teacher relationships, especially those school-related outcomes. Students, as mentioned for teachers, experience different emotions in educational environments no less frequently than teachers. Pekrun (2006) defines the achievement emotions term in his control-value theory as the "emotions tied directly to achievement activities or achievement outcomes" (p.317) based on the corollaries and implications of Weiner's

(1985) attribution theory, emotions resulting from expectancy-value models (Turner & Schallert, 2001), transactional stress model (Folkman & Lazarus, 1985), and perceived control theory (Patrick, Skinner & Connell, 1993). In this perspective, not only the emotions resulting from achievement outcomes, but also the emotions experienced by students during studying a course or doing their homework are under high consideration (Pekrun, 2006, 2009; Pekrun, Frenzel, Goetz & Perry, 2007; Pekrun, Goetz, Titz & Perry, 2002a, 2002b). The control-value theory subsumes a dynamic relationship between antecedents and the consequences of achievement emotions fed by feedback loops in the model. Accordingly, emotions are caused by distinct individual and environmental antecedents. At the same time, those emotions also impact students' cognitive resources, motivation to learn, the use of learning strategies and self-regulation of learning, and their academic performances. (Pekrun, 2006).

According to the individual antecedents, achievement emotions are directly caused by individuals' interpretations of the relevant situation. This interpretation is entitled as an appraisal (Frenzel & Stephens, 2013; Jacob, Frenzel & Stephens, 2017). Herein, subjective control and subjective value appraisals are specified to influence the arousal of achievement emotions. Subjective control refers to people's beliefs on how effectively they control over the situations; in other words, how effectively they obtain the desired outcomes and keep themselves from the undesired ones (Frenzel & Stephens, 2013; Pekrun, 2006; Pekrun et al., 2007; Pekrun et al., 2002a). Self-efficacy beliefs, students' expectancies toward achievement, and the causal attributions of school-related outcomes could be classified under this type of appraisal. Self-efficacy was rooted in Bandura's (1977) social cognitive learning theory. It is a crucial determinant of the arousal of achievement emotions that influence people's cognitions, behaviors, and the environment, which is also influenced by these elements mentioned above (Bandura, 1997). This interwoven structure becomes apparent when considering the sources of self-efficacy. Accordingly, people's physiological or affective arousal tends to influence people's self-efficacy such that stress, distress, and anxiety would reduce their capability judgment in accomplishing the designated task (Usher & Pajares, 2008; Pajares, 2005). From this perspective, inquiring the structure of the association between self-efficacy and emotions would be meaningful in questioning the appraisal and emotion relations. Although self-efficacy development begins with infancy, students' competency beliefs in accomplishing something decline with schooling years (Schunk & Pajares, 2009). This fluctuation might influence the emotional experiences of students on the relevant subject domains across the years. The perceived significance of actions and the outcomes, on the other hand, is conceived under the subjective value appraisals. Students' values, indeed, might be intrinsic or extrinsic. While the intrinsic values point out the appreciation of the actions or outcomes regardless of instrumental utility, extrinsic values draw attention to the utility of those actions or outcomes (Pekrun, 2006; Pekrun et al., 2007).

Taking a closer look at the control-value theory of achievement emotions model, social environment, including the elements of cognitive and motivational quality of instruction, has a considerable impact on control and value appraisals, and accordingly adds the arousal of achievement emotions (Frenzel & Stephens, 2013; Pekrun, 2006, 2009). Particularly, if the clarity and the difficulty level of the instruction mismatch with students' competencies, student self-efficacy might diminish correspondingly. Such fluctuations in students' control appraisals due to teaching quality problems might influence their academic emotions for the course (e.g., Becker, Goetz, Morger, & Ranellucci, 2014; Goetz, Keller, Lüdtke, Nett, & Lipnevich, 2019; Goetz, Lüdtke, Nett, Keller, & Lipnevich, 2013). That might also be considered that students' interpretations of the learning environments' cognitive and motivational quality would influence their feelings in the relevant subject domain.

In line with the motivational quality of the lessons, teacher attention and enthusiasm, their caring for students' interests and feelings, their use of positive verbal and non-verbal language, and displaying their sincerity will be undisputedly effective in forming a healthy teacher-student relationship (Brophy, 2000; Leon, Medina-Garrido,

& Nunez, 2017). Such affective support behaviors would increase the motivational quality of the lessons, which, in return, would trigger students' positive academic emotions as denoted in the achievement emotions model of the control-value theory. Although teachers' use of cognitive and affective support strategies was thoroughly depicted to influence the arousal of student emotions and achievement-related outcomes, teacher emotions were not included in the achievement emotions model. However, teacher emotions are critical on student-teacher interactions and student-related outcomes, including student emotions. As expressed in the contagion effect of burnout, teacher emotions might be reflected in student emotions. According to emotion contagion theory, teachers may consciously or unconsciously convey their emotions, or students might mirror their teacher emotions in the relevant subject domain through the use of empathy (Hatfield, Cacioppo & Rapson, 1994). From this perspective, teachers with more positive academic emotions might have classes, including students with less unpleasant emotions. In contrast, teachers with more negative emotions might have classes with less pleasant emotions as well. Such emotional transmission between teachers and students might affect student motivation and achievement-related outcomes (Frenzel, Becker-Kurz, Pekun, Goetz & Lüdtke, 2017). Besides, this interaction might be utilized to foster teaching and learning environments for various subject domains.

Several studies are examining the domain-specificity of emotions in different subject domains (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010; Goetz, Frenzel, Pekrun, & Hall, 2006; Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007; Goetz, Frenzel, Hall, & Pekrun, 2008; Frenzel, Pekrun, & Goetz, 2007b; Frenzel, Pekrun, & Goetz, 2007c, Frenzel, Thrash, Pekrun, & Goetz, 2007a; Kleine, Goetz, Pekrun, & Hall, 2011; Tulis & Ainley, 2011). In this sense, it would be better to focus on the possible association between teachers' academic and students' achievement emotions and the reasons behind achievement emotions through a domain-specific perspective.

1.2. Purpose of the Study

The purpose of the current study was to investigate the relationship between mathematics teachers' emotions, self-efficacy, and burnout. In addition, it aimed to explore the relationship between mathematics teachers' emotions and their 7th and 8th-grade students' mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and their achievement emotions in mathematics. In doing so, the possible relationships between teacher and student emotions in mathematics classes were examined through single and multilevel modeling. For this aim, The Teacher Emotions Scale (TES) (Frenzel et al., 2016) and the items related to perceived teaching quality (Goetz et al., 2013) were translated and adapted to the Turkish language within the scope of this study. The hypothesized conceptual models were presented in Figure 1.2, Figure 1.3, and Figure 1.4.

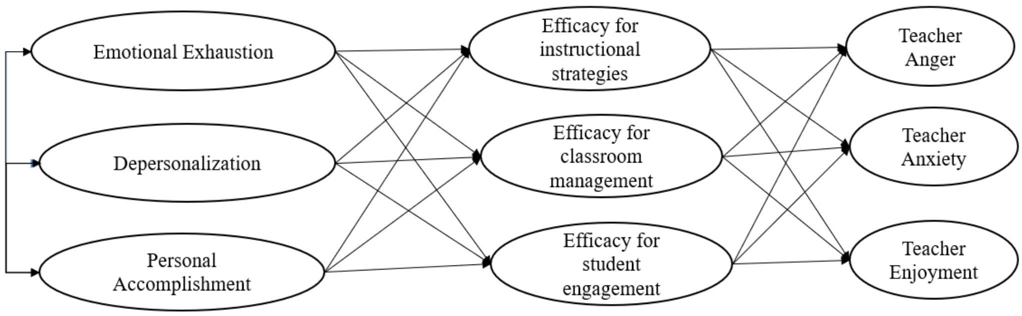

Figure 1.2.

The hypothesized structural model of teacher emotions in mathematics

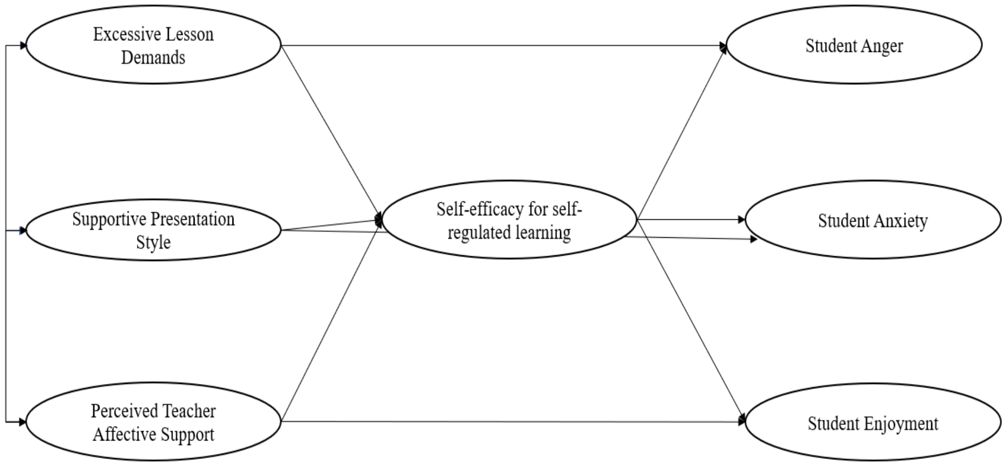

Figure 1.3.

The hypothesized structural model of student emotions in mathematics

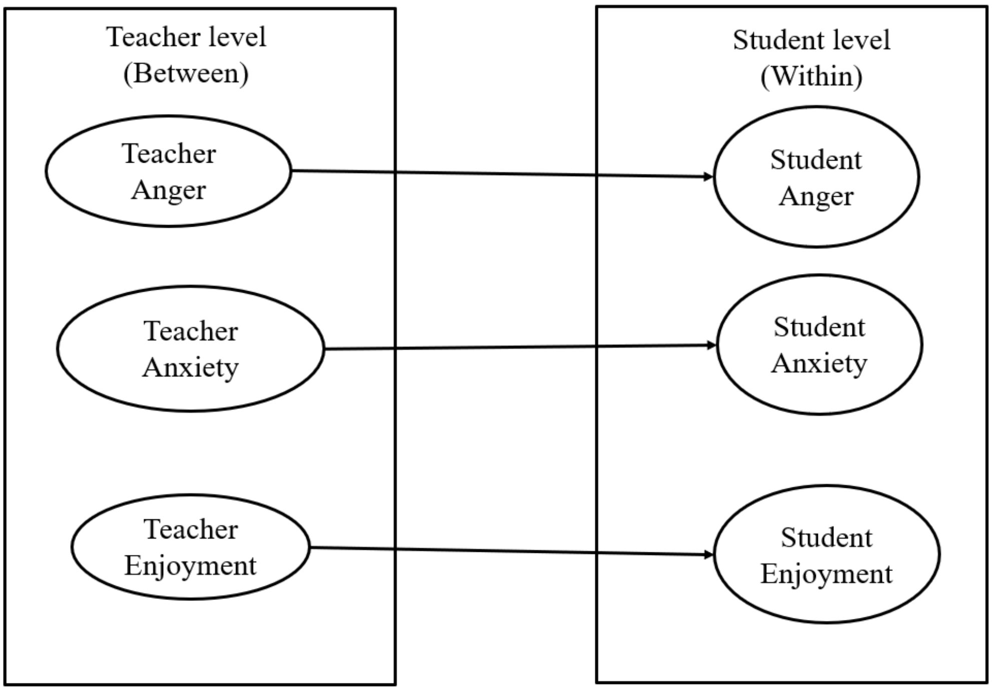

Figure 1.4.

The hypothesized structural model of student and teacher emotions in mathematics

After investigating the possible association between students' and teachers' academic emotions in mathematics classes, this study also attempted to inquire about the possible reasons for the arousal of students' mathematics achievement emotions by considering the teaching and learning process and student-teacher interactions in the middle school mathematics classes. Therefore, the study adopted a mixed-method design by employing both quantitative and qualitative methods.

1.3. Research Questions

Drawing upon the purpose, the following main and sub-research questions guided this study:

1. How do middle school mathematics teachers' self-efficacy beliefs and the feeling of burnout relate to those teachers' academic emotions?
2. How do seventh and eighth-grade students' mathematics self-efficacy beliefs, teaching quality perceptions, and their mathematics teachers' academic emotions relate to their mathematics achievement emotions?
    a. How do seventh and eighth-grade students' mathematics self-efficacy beliefs and teaching quality perceptions relate to their mathematics achievement emotions?
    b. How do seventh and eighth-grade students' mathematics achievement emotions relate to their mathematics teachers' academic emotions?
3. What are teachers' perceptions of how their students' mathematics achievement emotions are shaped through the learning process and interactions with their mathematics teachers?

1.4. Significance of the study

'Up to the present, test anxiety, the reasons, and the ways to remove it have been extensively studied in the literature (Hembree, 1988; Zeidner, 1998). However, students' emotional states are not solely related to the exams or high stakes testing because students might experience some other emotions like enjoyment, shame, hope, pride, hopelessness, anger, boredom, and relief during each phase of the teaching and learning process (Pekrun, 2006). Therefore, focusing merely on the test anxiety would be incomprehensible while studying students' affective characteristics.

Except for examinations in the educational system, middle school students experience distinct physiological and psychological changes due to the puberty period. Therefore, they usually experience different emotions in those years. Although the universality of achievement emotions across education levels and the culture were specified, the dispersion of the valence and the intensity of those emotions could change considering the grade levels and the students' culture (Pekrun, 2006). This situation is also valid for different domains of study. Pekrun's (2006) control-value theory of achievement emotions asserts the domain-specificity of emotions due to the domain-specific nature of the antecedents. Therefore, it should be better to study students' achievement emotions regarding different subject domains. In this perspective, mathematics takes precedence over many other disciplines in Turkish educational settings. Before examining the possible reasons, the definition of mathematics, the association of this subject domain with other fields, and the middle school Turkish mathematics curriculum's goals and objectives should be carefully specified that selecting this subject domain for the current study would be better understood.

In the book "A Mathematician's Apology," Hardy (1992) described a mathematician as "like a painter or a poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas" (p.84). The metaphoric definition of the mathematician also ascribed a metaphorical description to mathematics as the science of patterns. Van de Walle, Karp, and Bay-Williams (2016) provided a more comprehensive definition of this discipline, supporting this metaphorical description. Accordingly, mathematics and mathematics teaching enclose finding out differential problem-solving strategies, applying those strategies to the problem situations to see the extent of their effectiveness, providing connections to real-life, and helping students find out the regularity and order in this process. This definition brings a kind of dynamic perspective to this discipline. Besides, teachers are ascribed to the role, which is more than explaining the knowledge and expecting students to receive this knowledge passively.

In a general view, mathematics has a universal language and the only product of human beings, among other science branches (Ülger 2006). As mathematics has its systematic language with confessed abstractions of the human brains, each student might experience different things and feel different emotions while studying in this abstract world. More specifically, although mathematics is highly interrelated with science, statistics, and even with arts, the arousal of the enjoyment and the interest level is unfortunately deemed to be less in this domain of study than many other disciplines (Tulis & Ainley, 2011). The reasons for this situation were reviewed in the literature, especially for mathematics anxiety, as many of the emotions except for anxiety were disregarded in the literature for quite an extended period. Still, these reasons may pave the way to figure out why students experience negative emotions in this subject domain. According to Byrd's (1982) classification, students experience anxiety in mathematics due to the nature of the discipline, the quality of mathematics teaching, and mathematics teachers' characteristics and student-related factors. More specifically, mathematics has its language and symbols within sequential and cumulative order. Considering Piaget's cognitive development stages (Woolfolk, 2017), students are in the concrete operational stage, especially for the beginning of middle school years. Hence, they are more likely to experience difficulties while understanding the abstractions in this subject domain. Second, the content and the pedagogic knowledge of teachers, the employed methods and strategies during mathematics teaching, the utilized assessment criteria, communication style of teachers and their attitude and behaviors toward their students, and also students' previous unfortunate experiences with their teachers were contended to be teacher and instruction related factors of mathematics anxiety and fear (Bekdemir, Işık & Çıkılı, 2004; Frank, 1990; Jackson & Leffingwell, 1999). Third, factors related to students and their environment might induce anxiety and fear toward mathematics.

Indeed, students tend to equate their mathematics-related experiences with their self-concept more than other disciplines (Middleton & Spanias, 1999), so the ascribed value to this subject domain might be more extreme than the others. In addition to the mathematics-related beliefs, learning strategies and the parents' influence might be critical in this category. The abovementioned classification harms students' mathematics learning such that they might create false beliefs supporting the idea that mathematics could only be known by intelligent or genius people (Bekdemir et al., 2004; Özyıldırım Gümüş, Acar, & Yetkin Özdemir, 2015). That is a fixed mindset that might be harmful to students' beliefs, and most probably, they fall behind on their potentials (Dweck, 2016). As a result, students learn temporarily and mostly deal with learned helplessness in the long run. Accordingly, this study inquired about the reasons for students' emotions not only for anxiety but also for other distinct emotions, including positive ones. As discussed beforehand, students may experience many positive and negative emotions during learning and interacting with others, so the reasons behind these emotions in mathematics would provide teachers an opportunity to improve the cognitive and affective quality of their instruction and design effective mathematics teaching environments to fulfill their students' cognitive and affective needs in mathematics. Besides, teachers may develop some strategies for feeding the interaction with their students during mathematics teaching.

In Turkey, mathematics a fearful subject domain with the increase in the level of education (Birgin, Baloğlu, Çatlıoğlu, & Gürbüz, 2010; Çalık, 2014; Yamac, 2014), which might be related to mathematics competencies of students. Having supported this fact with the results of the Programme for International Student Assessment (PISA), mathematics scores of Turkish students were below the international average between 2003-2018 years. Among the participated countries, Turkey was ranked 35th, 43rd, 43rd, 44th, 49th, and 42nd (Organization for Economic Co-operation and Development (OECD) (OECD, 2004, 2007, 2010, 2013, 2016, 2019), respectively. Similarly, eighth-grade students' mathematics scores were below the average of Trends in International Mathematics and Science Study (TIMMS) results; Turkey was ranked 24th among the participated countries (Ministry of National Education [MoNE], 2014). In line with these findings, students' potency and mathematics competence from elementary to high school levels were attempted to be increased with the help of the mathematics curriculum changes.

According to the latest educational reform in Turkey (4+4+4), elementary, middle, and high school curricula were changed in 2012. According to this middle school mathematics curriculum, students were attempted to be educated as mathematics literate people with necessary mathematics knowledge, skills, and attitude that might be used in higher education levels and real lives. The promotion of mathematical reasoning, conceptual learning, problem-solving skills, communication in mathematical language, and valuing of mathematics was also supported. The mathematics curriculum was particularly framed under five main categories: problem-solving, process skills, psychomotor skills, information and technology skills, and affective skills. Within the scope of affective skills, students were aimed to develop positive attitudes and efficacy toward mathematics and promote their level of confidence, interest, and enjoyment while lessening their anxiety in doing, thinking, and learning mathematics (MoNE, 2013). By following the educational reform in 2012, the mathematics curriculum was re-changed in 2018 for elementary, middle, and high school education levels. The latest curricula were organized regarding the Basic Law of the Ministry of Education (MoNE), Quality Framework of the Ministry of Education, and Turkey Qualifications Framework, which was designed according to the European Qualifications Framework. Among eight basic competencies, mathematics competency was specified in the Turkey Qualifications Framework, which draws attention to developing mathematical reasoning, representation, and application skills (MoNE, 2017). Even though the development of students' positive attitudes toward mathematics and their level of confidence in approaching mathematical problems were stated to be one of the specific aims of the new mathematics curriculum, the affective domain's objectives were unfortunately underemphasized. In addition to this, 2011 and 2015 TIMMS results pointed out the need for studying the affective aspects in mathematics teaching and learning since students with higher mathematics love, confidence, and interest had significantly higher mathematics achievement than the rest of the population (MoNE, 2016). According to PISA results, students' mathematics self-efficacy and anxiety scores were found to be below and above the OECD average, respectively (Education Reform Initiative, 2013). Therefore, examining the current mathematics achievement emotions and self-efficacy of the seventh and eighth-grade students would seem prominent in making interpretations toward utilizing the affective domain in mathematics, especially focusing on the emotions and beliefs to improve students' performances in mathematics. As well as seeking out the role of emotions, through inquiring students' self-efficacy in mathematics classrooms, this study would also provide an opportunity to evaluate the extent of the drawn attention on the affective aspect under the scarcity of affective objectives within the scope of the new mathematics curriculum. Therefore, this study remarks attention to a neglected area and a neglected construct in the mathematics curriculum. This study examined the 7th seventh, and eighth 8th -grade students' mathematics achievement emotions and their relations with some environmental and cognitive antecedents based on the control-value theory. More specifically, examining the association with students' anxiety, anger, and enjoyment with their mathematics self-efficacy, perceived teaching quality, and teacher affective support provided an opportunity to test control-value theory assumptions. In this theory, teaching and motivational quality were contended to be environmental antecedents of achievement emotions, which also influence cognitive and value appraisals. Therefore, students' perceptions toward teaching quality and the affective support provided by teachers revealed how these cognitive and affective factors are related to students' emotions in mathematics. While thinking about the prescribed model's dynamic aspect, the potential relationships were crucial for designing emotion-sensitive mathematics learning environments. Environmental antecedents and self-efficacy as a control appraisal were also included in this study, corroborating Pekrun's (2006) achievement emotions model. Inclusion of self-efficacy would also uncover how students' judgments over their capabilities were related to their perceptions toward teaching quality and their teachers' affective support, and their own emotions in mathematics. As discussed beforehand, the investigation of the relationship between self-efficacy and achievement emotions revealed appraisal-emotion linkage in the current middle school mathematics curriculum, especially for the seventh and eighth-grade students. That is prominent in making sound arguments on how to draw on this relationship to increase students' mathematics performances as indicated in 2011 and 2015 TIMMS results and supported with control-value theory. As well as seeking out the role of emotions, through inquiring students' self-efficacy in mathematics classrooms, this study would also provide an opportunity to evaluate the extent of the drawn attention on the affective aspect under the scarcity of affective objectives within the scope of the new mathematics curriculum.

While examining the mathematics curriculum's affective side from students' perspective, teachers being the curriculum practitioners should also be stressed. Since the teaching profession requires forming high quality social and interpersonal interactions with students, teachers should possess specific qualities, especially for the 21st century. Among these characteristics, having high self-efficacy and confidence in teaching, being positive, enthusiastic, humorous, active, flexible, patient, mild, and tolerant were specifically mentioned (Akın, 2017; Hotaman, 2012). As teaching is an emotion-laden job, teachers experience various distinct emotions in line with their characteristics. The emotions experienced during teaching and learning processes undeniably impact teachers' teaching satisfaction and their beliefs to succeed in their professions. Especially TIMMS results support the idea that as teachers' satisfaction and confidence toward teaching mathematics increased, their students' mathematic achievements were influenced positively (MoNE, 2014, 2016). Therefore, affect in mathematics should also be studied from the teachers' perspectives. The truth of the transmission of teachers' mathematics anxiety to their students (Bayder & Bulut, 2002; Bulmahn &Young, 1982) corresponding to the emotion-contagion theory (Hatfield et al., 1994) necessitates investigating the relationship between student and teacher emotions to be able to comprehensibly explain the possible antecedents and consequences of student emotions not only for anxiety but also for many other emotions. While thinking about student-teacher relationships across grade levels, middle and high school teachers were mentioned to put less emphasis on this relationship than elementary level and early-childhood teachers (Sakız, 2017). Therefore, this study would provide an opportunity to understand student-teacher relationships in terms of questioning how well middle school mathematics teachers are aware of their academic emotions and how their emotions are related to their students' achievement emotions. Emotional transmission or emotion contagion is a newly emerging era in education, and the number of studies is minimal even in the international literature. Hence, this study would be a pioneer in the national literature. This study cross-sectionally explored the potential relationship between teacher and student achievement emotions in mathematics, unlike the current research studies. Therefore, the findings would also bring a different perspective to emotion transmission literature in education. Besides, emotional transmission results may highlight the role of affective support and the classrooms' motivational quality one step forward while considering control-value theory elements because teacher emotions were not explicitly specified in the model.

Besides the interaction between student and teacher emotions, teacher emotions should also be explored from different perspectives. In doing so, the potential factors behind teacher emotions might be uncovered as well. Teaching is a more stressful job than several decades ago in today's conditions, and teachers have to deal with many distractors in their professional lives. Therefore, burnout is a not reality shock anymore, but the reality itself, so many teachers tend not to lose their satisfaction and enthusiasm toward their work. Yet, their beliefs or convictions to improve their students' learning might be unstable across the years. Such fluctuations may also influence their teaching practices and their efforts in designing appropriate learning environments, which may yield distinct emotions. This study would clarify how burnout and teacher self-efficacy are related and how teacher self-efficacy is linked to teachers' academic emotions in mathematics. Exploring such association would be essential to understand how to shape mathematics-related classroom practices under teachers' beliefs and, most importantly, their emotions.

The studies on the relationship between student and teacher emotions are mostly carried out in individualist cultures such as Germany and the U.S. In contrast, there is a lack of research on this issue in the national literature. Therefore, this study would shed light on teachers' and students' emotional experiences in a collectivist culture, Turkey, based on Hofstede's (1980) classification and provide an opportunity for further research to make cross-cultural comparisons about the emotional display and sources of emotions. In this perspective, this study would contribute to both national and international literature based on the findings of the nature of the emotions experienced by teachers and students and the reflections of these emotions on the teaching quality. In so doing, the Teacher Emotions Scale (TES) and Perceived Teaching Quality Scale were adapted to the Turkish language.

Finally, a single-level model and a multilevel proposed model were tested within the scope of the quantitative phase of the study. The nested data structure was ensured to correctly analyze the relationship between matched teacher and student groups for the multilevel model. Qualitative measures were also utilized to inquire about the possible sources and the reasons for student emotions regarding the learning and teaching process and student-teacher interaction. Therefore, this study would contribute to both national and international literature in terms of the research problem, the variety of the participant groups (i.e., students and teachers), and the employed data analysis methods to respond to these research questions.

1.5. Definition of Important Terms

Emotion is defined as "An awareness of four elements that we usually experience at the same time: (a) an appraisal of a situation, (b) changes in bodily sensations, (c) the free or inhibited display of expressive gesture, and (d) a cultural label applied to specific constellations of the first three elements." (Hochschild, 1990, p. 118-119).

Achievement or academic emotion refers to “Emotions tied directly to achievement activities or achievement outcomes” (Pekrun, 2006, p.317).

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

Anxiety refers 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 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).

Self-Efficacy is defined as “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 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).

Teacher self-efficacy refers to “judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated” (Tschannen-Moran & Woolfolk Hoy, 2001, p.783).

Burnout is defined by Maslach, Schaufeli, and Leiter (2001) as “an erosion of engagement that what started out as important, meaningful, and challenging work becomes unpleasant, unfulfilling, and meaningless” (p. 416).

Teacher burnout is defined by Schwab and Iwanicki (1982) as “a perceived state of physical and emotional exhaustion, negative attitudes toward students, and lack of personal accomplishment” (p.5).

Teaching quality is defined by Darling-Hammond (2010) as “strong instruction that enables a wide range of students to learn. Such instruction meets the demands of the discipline, the goals of instruction, and the needs of students in a particular context” (p. 3).

CHAPTER 2

LITERATURE REVIEW

"A modern teacher educates children to value their emotions."
Haim Ginott

In this chapter, the review of the literature was presented in several sections. First, emotion as an affective construct was scrutinized by considering both students and teachers within the adopted theoretical framework's scope. For this aim, the control-value theory was explained in terms of stating the antecedents and consequences of achievement emotions in learning environments. The current research on the possible relationships between teacher and student emotion was then discussed in an elaborative manner. Second, self-efficacy and its potential sources were explained within the scope of social cognitive learning theory. Afterward, the studies concerning the relationship among teachers' and students' emotions and self-efficacy beliefs were presented. Third, teaching quality was conceptualized from students' perspectives by incorporating teachers' cognitive and affective support. According to the control-value theory, the current research on the relationship between self-efficacy, teaching quality, and achievement emotions was carefully reviewed. Fourth, burnout was described by stating the primary sources and their effects on teachers' professional lives. Consequently, the research on the relationship between teacher burnout and teacher self-efficacy was presented. Lastly, a concise summary of the literature review provided a brief overview of the chapter.

2.1. Emotions

"Affect" refers to non-cognitive constructs, including moods, beliefs, and emotions (Boekaerts, 2007; Pekrun & Linnenbrink-Garcia, 2014); however, these terms are used interchangeably in many empirical and conceptual studies (Linnenbrink, 2006). To clarify these constructs" classification, Rosenberg (1998) made a hierarchical arrangement of "affect" into two different categories: affective traits and affective states. Affective traits include people's personality characteristics, and they are more stable predispositions preserving a threshold toward the arousal of several emotional situations. In contrast, affective states are unstable and changeable across time and the case itself. Herein, emotions could be classified into the second category of affective states addressing short-term and intense psychological processes (Linnenbrink, 2006).

Emotion is a controversial and complex construct. Although several scientific and constitutive definitions were proposed in the literature, people are still continuously debating emotion research to define emotions. They consider several aspects while describing this construct. According to the constitutive definition of emotion, it is characterized by the Cambridge English Dictionary (2020) as "a strong feeling such as love or anger, or strong feelings in general." More comprehensively, as Rosenberg (1998) stated, emotions are "acute, intense, and typically brief psychophysiological changes that result from a response to a meaningful situation in one's environment" (p. 250).

On the other hand, Scherer (2005) described emotion as "an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism" (p. 697). Similarly, Hochschild (1990) postulated a more extensive definition addressing the critical elements, respectively. Accordingly, emotion could be thought of as "an awareness of four elements that we usually experience at the same time: a) an appraisal of a situation, b) changes in bodily sensations, c) the free or inhibited display of expressive gesture, and d) a cultural label applied to specific constellations of the first three elements" (p. 118-119). Individuals" subjective expressions of their experiences and their reflection in different ways are the general points for the descriptions mentioned above.

Based on the core elements of emotions, Pekrun (2006) came across a more recent definition for the construct that emotion was redefined "multi-component, coordinated processes of psychological subsystems including affective, cognitive, motivational, expressive, and peripheral physiological processes" (p. 316). Therefore, there are five essential components of emotions: affective, physiological, cognitive, expressive, and motivational (Frenzel & Stephens, 2013). For instance, test anxiety might give rise to uneasiness and stress on students (affective) and a kind of worry toward test failure (cognitive). Test anxiety may also increase on hearth and sweating rate (physiological), a high passion for escaping from the position within (motivational). Finally, students may reflect facial expression for the experienced anxiety (peripheral) (Pekrun & Linnenbrink-Garcia, 2012, 2014). According to this example, the affective component implies a kind of affective experience that might trigger the relevant emotion's arousal.

> "What kind of an emotion of fear would be left if the feeling neither of quickened heart-beats nor of shallow breathing, neither of trembling lips nor of weakened limbs, neither of goose-flesh nor of visceral stirrings, were present, it is quite impossible for me to think … I say that for us emotion dissociated from all bodily feeling is inconceivable." (James, 1950, p. 379)

As mentioned in William James's (1890; as cited in James, 1950) theory of emotions, physiological and bodily changes intertwined by the hormonal, autonomic nervous system and skeletomuscular system are necessary conditions in emotion arousal (Ellsworth, 1994). People tend to reflect facial, vocal, and visceral expressions by adapting their physical behaviors, depending on their subjective experiences (Feldman Barrett, 2012). For instance, the changes in the hearth, breathing, and sweating rate, the temperature of the skin, limb activity, and the activation of the digestive system and different parts of facial muscles could be given as the most common physiological changes in people's bodies under the arousal of several emotions (Nummenmaa, Glerean, Hari, Jari & Hietanen, 2013).

Although some of the expressions were universal as in demonstrated in studies of Ekman and Izard (Matsumoto, Keltner, Shiota, O'Sullivan & Frank, 2008), emotional expressions hold a distinguished pattern in an individualist and collectivist societies as the level of integration into a group seem to differ for these cultures. Accordingly, people in individualist cultures value people's uniqueness and autonomy while favoring the authentic expressions of their feelings. People in collectivist cultures, on the other hand, appreciate the harmony and the responsibility within the group (Woolfolk- Hoy, 2013; Oyserman, Coon & Kemmelmeimer, 2002) that might be influential on reflection of their feelings.

According to Schacter and Singer (1962), emotion is such a combination of the physiological and cognitive processes of individuals that how the appraisals are interpreted are also invaluable in arousal of the emotions (Ellsworth, 1994), so emotions could be viewed as socially constructive and subjective interpretations (Feldman Barrett, 2012). As well as the physiological changes, emotions might also trigger several cognitive and behavioral changes in people, such as an increase in task engagement, empathetic thinking, demand for taking responsibility, and the promotion of problem-solving ability under positive emotional states (Isen, 2008). Ensuing research also indicates the critical role of emotions in motivation and learning outcomes (Pekrun, 2009). Therefore, denying emotions' influential role in learning and teaching environments seems to be inconceivable.

In this regard, the control-value theory as the main theoretical framework of the current study brought a broad perspective in explaining how students' academic feelings relate to many other cognitive, affective, motivational, and behavioral factors. This theory was presented in an elaborative manner in the next section.

2.1.1. Student Emotions

In emotion research, the bulk of the studies are generally related to anxiety (Zeidner, 2007), implying other emotions' ignorance. However, Pekrun, Goetz, Titz, and Perry's (2002a) research explored university students' feelings. The findings of this research revealed that students experience different emotions. These are interest, enjoyment, boredom, hope, pride, frustration, and anger, and there is still no agreement on the number of primary emotions experienced in learning settings. From this perspective, Pekrun (2006) developed the control-value theory to explain students' emotions in academic settings.

2.1.1.1. Control-Value Theory of Achievement Emotions

Control-value theory was grounded on expectancy-value theory (Eccles, Adler, Futterman, Goff, Kaczala, & Meece et al., 1983), attribution theory (Weiner, 1985), the transactional theory of stress and coping (Folkman & Lazarus, 1985), achievement goal theory (Elliot & McGregor, 2001), and perceived control theory (Patrick, Skinner & Connell, 1993). Drawing upon the corollaries and basic assumptions of the abovementioned theories, Pekrun (2006) postulated a new term, "achievement emotions." Accordingly, achievement emotions are "Emotions that are tied directly to achievement activities or achievement outcomes" (Pekrun, 2006, p. 317). In this definition, students' outcome related emotions and their learning-related feelings are stressed (Pekrun, 2006; Pekrun, Frenzel, Goetz & Perry, 2007; Pekrun et al., 2002a, 2002b; Pekrun & Linnenbrink-Garcia, 2012, 2014). In other words, both outcome-related and activity-related emotions are taken into account in this model.

2.1.1.1.1. Classification of Achievement Emotions

The prevalence of emotions might lead people to question this construct's temporal generality (Pekrun, 2006). From this perspective, emotions are generally distinguished through being momentary or habitual emotions called "state emotions" and "trait emotions," respectively (Frenzel & Stephens, 2013). If the feelings are experienced at a specific time point over a given situation, they might be called "state emotions." On the other hand, emotions could be habitual for people in particular conditions called "trait emotions" (Frenzel & Stephens, 2013; Peixoto, Sanchas, Mata & Monteiro, 2016; Pekrun, Goetz, Perry, Kramer, Hochstat & Molfenter, 2004).

Except for the given classification, emotions might be related to on-going academic activities or their outcomes (achievement emotions). They might be induced by engagement in novel activities or tasks (epistemic emotions). Emotions might also be related to learning material covered in the classroom (topic emotions), and emotions related to other people (social emotions) (Boekaerts & Pekrun, 2016; Pekrun & Linnenbrink-Garcia, 2012). The multifaced nature of emotions, especially for achievement emotions, calls for the necessity to divide them based on an appropriate taxonomy.

Achievement emotions are subsumed under three-dimensional taxonomy according to the control-value theory (Pekrun, 2006). These dimensions are valence, activation, and object focus. Valence refers to the classification of emotions into being positive or negative. In this regard, hope, pride, relief, and enjoyment are positive or pleasant emotions, while hopelessness, anger, shame, boredom, and anxiety are negative or unpleasant emotions. The activation dimension stresses the multipolar nature of emotions that might be categorized as 1) positive activating emotions (joy, hope, enjoyment, gratitude, and pride), 2) positive deactivating emotions (relief, relaxation), 3) negative activating emotions (shame, anxiety, frustration, and anger) and 4) negative deactivating emotions (hopelessness, sadness, disappointment, and boredom). Regarding this classification, positive activating emotions foster motivational engagement, using more flexible learning strategies. In contrast, negative deactivating emotions impair people's motivational engagement and perceptions toward their abilities and restrict individuals from using creative learning strategies. On the other hand, negative activating emotions reduce intrinsic motivation, lead people to adopt avoidance approaches, and utilize rigid and more detail-oriented learning strategies like the simple rehearsal. Last, positive deactivating emotions induce people to slow down their learning process but reinforce long-term motivation (Chiang & Liu, 2014; Pekrun, 2009; Pekrun & Linnenbrink-Garcia, 2012).

In control-value theory, Pekrun (2006) also proposed an object focus dimension to classify achievement emotions as being “activity emotions” or “outcome emotions.” Emotions such as satisfaction, enjoyment, anger, and boredom related to ongoing activities belong to the former group. On the other hand, anxiety, hope, shame, pride, relief, and hopelessness resulting from any relevant activity outcomes could be classified into outcome emotions (Pekrun, 2006; Pekrun, Frenzel, Goetz, & Perry, 2007). Time was taken as a reference point for outcome emotions, and these emotions had two categories: prospective and retrospective emotions (Pekrun, 2006; Pekrun & Stephens, 2010; Pekrun et al., 2002a). The classification of emotions concerning three-dimensional taxonomy was given in Table 2.1.

Table 2.1.

Classification of Achievement Emotions

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

Note. [a]Positive=positive emotion; [b]Negative=negative emotion; [c]Anticipatory joy/relief. “Achievement Emotions: A Control-Value Approach” by R. Pekrun ve E. J. Stephens, 2010, *Social and Psychology Personality Compass*, *4*, p. 239. Copyright 2010 by The Authors Journal Compilation, Blackwell Publishing.

According to the given classification, the control-value theory attempts to explain the potential antecedents and consequences of achievement emotions. Shortly, the model is a dynamic system through positive and negative feedback loops (Figure 2.1).

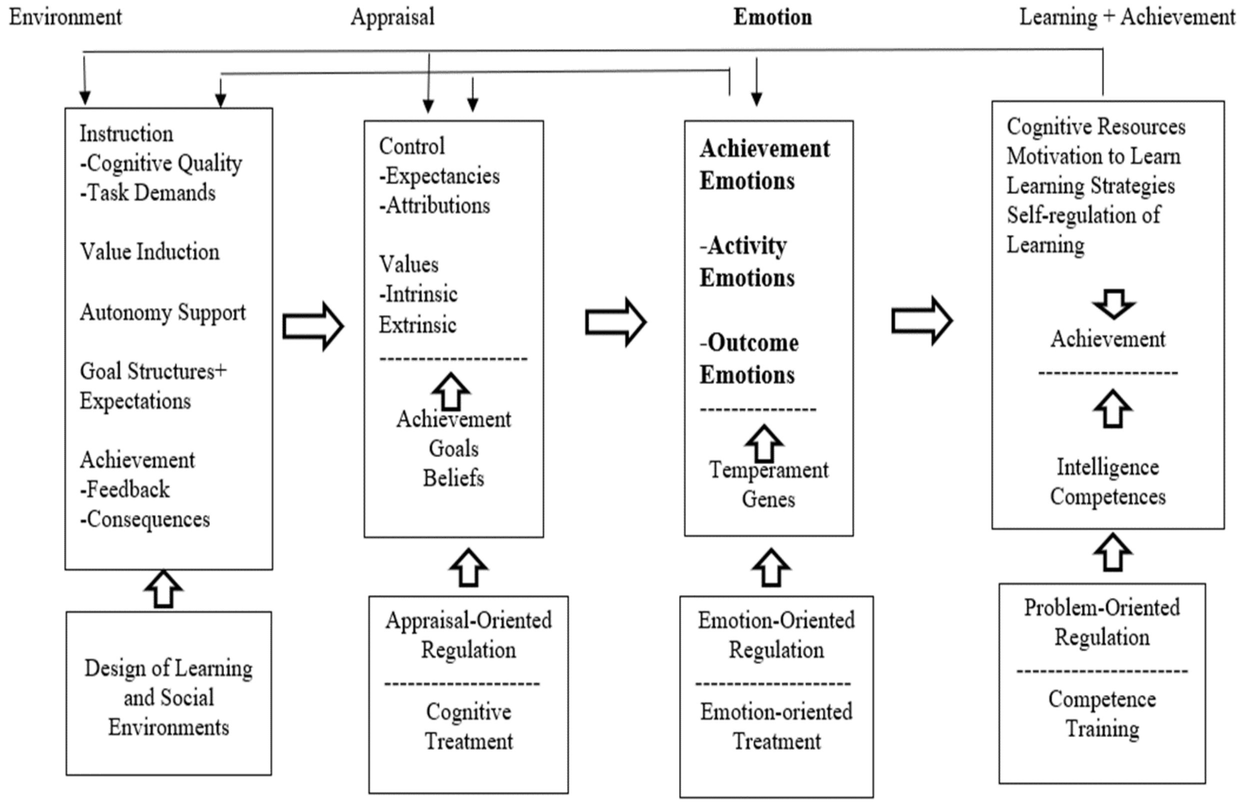

Figure 2.1. The control-value theory model. Adapted from "The Control-Value Theory of Achievement Emotions: Assumptions, Corollaries, and Implications for Educational Research and Practice" by R. Pekrun, 2006, *Educational Psychology Review, 18,* p. 328. Copyright 2006 by Springer Science + Business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

2.1.1.1.2. Antecedents of Achievement Emotions

The antecedents of achievement emotions could be categorized into cognitive, individual, and environmental determinants. Among those, cognitive appraisals comprised of subjective control and subjective value have a notable impact on achievement emotions' arousal.

2.1.1.1.2.1. Control and Value Appraisals

Perceived controllability of achievement-related activities tends to change across causal expectancies and causal attributions (Pekrun, 2006; Pekrun, Frenzel, Goetz & Perry, 2007). Causal expectancies, involving action-control, action-outcome, situation-outcome, and total-outcome expectancies, examine relations between causes and future impacts of these causes, such as the effect of a student's current effort on his future performances (Pekrun, 2006). In line with expectancy-value theory (EVT), students' control appraisals stem from their expectancies for success, and the attributions made for their performances (Wigfield, Rosenzweig & Eccles, 2016).

Action-control expectancies address people's anticipations toward initiation and continuity of any action. In this regard, people's self-efficacy beliefs could be subsumed under action-control expectancies because self-efficacy is described as people's beliefs toward accomplishing any designated task (Bandura, 1997). Accordingly, the control-value theory asserts a positive relationship between people's positive emotions and their self-efficacy. In contrast, the relationship may become negative between self-efficacy and negative emotional states of people. Action-outcome expectancies, on the other hand, refer to people's anticipations toward reaching desired outcomes such as students' expectancies toward attaining high grades contingent upon their efforts or keeping themselves from undesired results, which is closely related to their internal control (Pekrun, 2006; Pekrun et al., 2007).

Situation outcome expectancies denote the probability of receiving positive or negative outcomes regardless of their invested efforts and actions. Last, total outcome expectancies are closely related to the expectancies described above. Accordingly, action-control, situation-outcome, and action-outcome expectancies would be high for positive outcomes, resulting in increased total outcome expectancies. Action-outcome and action-control expectancies would be low, and situation-outcome and total outcome expectancies would be high for adverse outcomes such as failures. (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2014; Pekrun & Stephens, 2010). Except for causal expectancies, causal attributions explore possible reasons for failure and success in people's actions, external conditions, and others. External attributions are related to situation-outcome expectancies, while internal attributions are related to action-outcome expectancies or action-control expectancies.

Value appraisals refer to the perceived value of actions or outcomes. Subjective value appraisals are divided into two classes, which are intrinsic and extrinsic values. From this perspective, intrinsic values pertain to appreciation of any activity or outcome intrinsically, whereas extrinsic values point out valuing any action or result that might help reach out to a long-term goal (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2014). This interpretation is similar to the denotation of task values in EVT. Intrinsic value addresses the feeling of enjoyment gained through the participation of a task, which was also defined as intrinsic value. Extrinsic value in the control-value theory could be thought of as questioning the usefulness of participated activity for students' future goals that might be known as utility value in EVT. For instance, a student might study his math course regardless of grade concern because he is satisfied with studying mathematics, pointing out the intrinsic value assigned to this course. However, the same student might learn math to receive high grades that might ease getting acceptance from a prestigious school and beneficial for his career pathway or getting appreciation from his teacher, parents, or peers. This example is directly related to the extrinsic value ascribed to a mathematics course by the student.

As stated beforehand, control and value appraisals would influence the arousal of activity emotions, prospective, and retrospective outcome emotions. From this perspective, activity emotions tend to change regarding perceived controllability and the ascribed value to the activity. Suppose a student successfully meets the requirements (high perceived control) and assigns a high value to the activity. In that case, this student may experience enjoyment, whereas if the student gives a low value, anger might be induced. On the other hand, if the activity requirements are beyond students' capacities, they may attribute low value to this activity, resulting in a boredom experience at the end. For prospective outcome emotions, students generally focus on the likelihood of failure and success situations. If the outcome's controllability is perceived high or low, enjoyment and hopelessness would be evoked, respectively.

On the other hand, anxiety and hope would be triggered if there is a lack of control toward the corresponding success or failure states. Retrospective outcome emotions might arise according to possible success and failure circumstances, and the causes of these emotions might be related to individuals' actions, external factors, or other people. For instance, if people ascribe the reasons for their success and failures to their efforts, pride and shame might be experienced, while gratitude and anger might be triggered due to attribution of success and failure states to other people around (Pekrun, 2006; Pekrun & Linnenbrink-Garcia, 2014; Pekrun & Stephens, 2010).

2.1.1.1.2.2. Individual and Environmental Factors

Individual and environmental factors are critically important on achievement emotions, which is also influential on these factors due to the model's dynamic nature. Accordingly, cognitive quality of instruction, motivational quality of instruction, autonomy support, goal structures, expectations, feedback, and consequences could be given as individual and environmental factors directly related to antecedents of achievement emotions.

Cognitive quality is strongly related to the teaching and learning environment's structure, clarity, and stimulating role of the presented learning tasks. This element also affects students' perceptions toward the controllability of the relevant activity or assessment and the perceived value attributed to these tasks. For example, improvement of the instruction structure and clear presentation of the study positively impact students' perceived control, which is closely related to pleasant emotions. Besides, the congruency among students' capabilities and expectations seems critical to their subjective control and subjective values. Students more likely experience boredom if they possess very high and low expectations toward teaching, forming maladjustment between their expectations and capabilities (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012, 2014; Pekrun & Stephens, 2010).

As argued by control-value theory, peers, parents, and teachers give direct and indirect messages to students about achievement values through their behaviors and the assigned roles. Students' academic interests and values could be promoted by arranging learning environments, structuring learning materials, and assigning roles to fulfill students' interests. In this regard, the likelihood of the experience of positive activity emotions (i.e., enjoyment) would increase. Besides, teachers' and parents' enthusiasm to engage in the relevant tasks might allow students to internalize the achievement values with vicarious learning experiences (Bandura, 1997) and emotional contagion (Hatfield, Cacioppo & Rapson, 1994). This internalization might induce pleasant emotions (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012, 2014; Pekrun & Stephens, 2010).

On the other hand, autonomy support refers to providing students support for organizing their learning processes that might contribute to their perceived control beliefs. This support might offer the opportunity to increase the experience of positive emotional states. Unless students are given appropriate autonomy support during coping with the challenges, students' control appraisals would be influenced accordingly. This influence would trigger negative emotions such as shame, hopelessness, and anxiety (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012,2014; Pekrun & Stephens, 2010).

For feedback and achievement outcomes, students would have an opportunity to evaluate their achievement outcomes through feedback based on their success and failure states. The received feedback would have a noticeable impact on students' retrospective outcome emotions, as well. Besides, feedbacks would keep students informed about the likelihood of their future success and failures, which, in return, affect students' control appraisals and prospective outcome emotions. To illustrate this fact, students frequently experience anxiety and hopelessness if they insistently experience a failure. This experience would also diminish their control appraisals. Therefore, feedback could be tailored to point out failure as a learning opportunity (Pekrun, 2006). Except for the given feedbacks, students' perceptions toward success would be influential on their subjective values. For instance, the likelihood of success might provide students with career opportunities in the long run. This success would trigger their hope, whereas the possibility of a failure states might create negative feelings toward their career pathways that would also increase the experience of anxiety and hopelessness (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012,2014; Pekrun & Stephens, 2010).

As a distal antecedent, achievement goals have a direct effect on control and value appraisals. Besides, achievement goals have indirect effects on achievement emotions through feedback loops in the control-value theory. Within the scope of achievement goals, individuals tend to reach for accomplishment or avoid failures. In this regard, four types of achievement goals are discussed in the literature (Elliot & McGregor, 2001). These are mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance. Mastery-approach goals increase the likelihood of experiencing positive-activity-related emotions by putting students' interests and attention on the relevant tasks to develop their competencies. On the other hand, performance-approach goals emphasized competing with others and outperforming them (Graham & Weiner, 2012) that might induce hope and pride under the positive value of outcomes and high perceived controllability. In contrast, students with performance-avoidance goals might avoid their failures under the negative value of the results and high perceived uncontrollability. They may experience shame, hopelessness, and anxiety (Linnenbrink-Garcia & Barger, 2014; Pekrun, 2006; Pekrun, Elliot & Maier, 2006, 2009; Pekrun & Linnenbrink-Garcia, 2012,2014; Pekrun & Stephens, 2010).

2.1.1.1.3. Consequences of Achievement Emotions

Building on control-value theory, cognitive appraisals, and individual and environmental factors influence achievement emotions. In line with the model, achievement emotions also directly or indirectly affect different cognitive and affective constructs, as explained in this section.

First, positive and negative emotions are critical to cognitive resources. To illustrate this, individuals might focus on their attention on the relevant task. Their performances might increase accordingly with the help of positive emotions, while attention might be distracted away while experiencing negative emotions, which decreases the use of cognitive resources (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia,2014).

Second, achievement emotions also influence students' motivation to learn while considering three-dimensional taxonomy. Accordingly, satisfaction, pride, and hope as positive activating emotions increase students' intrinsic and extrinsic motivation, whereas boredom and hopelessness as negative deactivating emotions seemed to decrease motivation. Except for these, the impacts of negative activating and positive deactivating emotions on learning motivation are generally more complicated to explain (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012). As asserted by Pekrun (2006), anxiety might diminish a student's intrinsic motivation. Still, this student might pursue to avoid a possible failure that his extrinsic motivation would be increased accordingly.

Achievement emotions also appeared to have substantial influences on the use of learning strategies. In this regard, positive emotions facilitate the employment of more creative and flexible learning strategies. In contrast, negative emotions may influence individuals to use more rigid techniques such as simple rehearsal (Pekrun, 2006; Pekrun & Linnenbrink-Garcia, 2012). Considering three-dimensional taxonomy, enjoyment as a positive activating emotion may pave the way for using more creative and intense learning strategies such as critical thinking, elaboration, and organization. In contrast, anxiety and shame as negative activating emotions may induce the use of basic strategies. Except for these, people experiencing any kind of deactivating emotion like boredom and relief may adopt cursory information processing systems (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia,2012). A bundle of cross-sectional and longitudinal research with high school and college-level students revealed that positive emotional states are in a positive relationship with the use of critical thinking, organization, elaboration, and meta-cognitive learning strategies. At the same time, there is an inverse relationship with simple learning strategies. Additionally, students with negative emotional states seemed to employ more rigid techniques and less creative learning strategies (Ahmed, Van Der Werf, Kuyper & Minnaert, 2013; Artino & Jones, 2012; Pekrun et al., 2002a, 2011; Villavicencio, 2011).

Self-regulated learning should also be thought about the impacts of achievement emotions. Self-regulating learning briefly explains how individuals set their goals, control learning processes, and evaluate the learning outcomes (Pekrun ve Linnenbrink-Garcia, 2012). From this perspective, self-regulated learning addresses the link between individual, behavioral and environmental processes in a cycle (Zimmerman, 2000). Self-regulated learning is one of the possible outcomes of achievement emotions. For instance, positive feelings seemed to correlate with students' self-regulated learning positively. However, students may need external guidance from teachers or parents if they experience negative emotions (Pekrun, 2006; Pekrun et al., 2002a; 2007; Pekrun & Linnenbrink-Garcia,2012). As stated in the control-value theory, there is a dynamic system working through feedback loops. Therefore, the arousal of enjoyment, pride, and hope would be more probable for self-regulated learners. However, students would more likely experience anxiety and anger if they were guided by external agents (Pekrun & Linnenbrink-Garcia,2012).

As well as direct influences of achievement emotions, there are also indirect effects shown in Figure 2.1. In this sense, achievement could change across the reciprocal relationship between the subject’s nature, task or assignment, learning strategy use, and cognitive and motivational quality. Besides, neither positive emotions always lead to positive or negative emotions that yield adverse learning outcomes (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012, 2014). Accordingly, positive activating emotions usually keep students’ attention and interest in the learning task, promote their intrinsic motivation, foster creative and flexible learning strategy use, and facilitate their self-regulated learning, resulting in higher achievement. On the other hand, positive deactivating emotions distract students’ attention and reduce their intrinsic motivation, whereas they may also re-adapt to the situation. As a result, they may adopt more superficial information processing and problem-solving strategies, so the effects of these emotions on students’ performances could be more complicated to explain clearly. The impacts of negative activating emotions are in a changing nature. For instance, students with higher anxiety may use their cognitive sources for off-task behaviors, and their attention may be easily distracted. In this case, although intrinsic motivation seems to display a declining trend, the student may put a substantial effort into the learning task to avoid failure, which may increase extrinsic motivation. Therefore, the achievement profile of students might change accordingly. Negative deactivating emotions also distract students’ attention from the task and reduce their both intrinsic and extrinsic motivation so that achievement might be influenced negatively (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia,2012, 2014; Pekrun & Stephens, 2010).

2.1.1.1.4. Feedback Loops in Control-Value Theory

There is a reciprocal relationship among the antecedents and consequences of achievement emotions through positive and negative feedback loops in control-value theory. Thus, the model has ascribed a dynamic nature, as shown in Figure 2.1.

Moving forward, as learning environments are full of emotions, both students and teachers are always in need of employing necessary strategies to transform the classrooms into fruitful learning settings (Jacobs & Gross, 2009). To this end, the accruing role of emotion-regulation should be considered while drawing on emotion power in education. However, the complicated nature of emotions and their influence on individuals' behaviors might make things difficult to refer to emotion-regulation goals. Management of emotions does not solely refer to increasing the positive and decreasing negative emotions because unpleasant emotional states sometimes result in positive learning outcomes. From this perspective, Pekrun's (2006) control-value theory model provides a holistic view to explain the relationship between emotions and emotion-regulation strategies. Four regulation strategies were described in the model. These are appraisal-oriented, emotion-oriented, and competency-oriented regulation and design of learning and social environments. In appraisal-oriented regulation, regulation address modifying individuals' control and value appraisals to change their emotional states. In emotion-oriented regulation, emotions are on the focus and could be regulated by using some meditation techniques. Competency-oriented regulation points out the need for the improvement of competencies regarding success and failure states. Lastly, modifying the learning and social environment is intended through designing learning settings and social environments (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Linnenbrink-Garcia, 2012, 2014; Pekrun & Stephens, 2010).

2.1.1.1.5. Culture and Domain-Specific Nature of Achievement Emotions

The universality of achievement emotions was thoroughly discussed in the control-value theory. Notwithstanding, the intensity and the frequency of emotions could differ across cultures, gender, and domains of study (Pekrun, 2006). The domain-specific nature of control and value appraisals necessitates dealing with the joint products of those appraisals through a domain-specific perspective as well. In this regard, many researchers in the emotion era put a high effort into exploring students' achievement emotions and their relations with their appraisals (i.e., self-efficacy; Bandura, 1997, self-concept; Goetz, Cronjaeger, Frenzel, Lüdtke & Hall, 2010) through a domain-specific perspective.

Frenzel, Thrash, Pekrun, and Goetz (2007) focused on five distinct emotional states (i.e., enjoyment, pride, anger, anxiety, shame) for cross-cultural comparison of German and Chinese middle school students in the mathematics domain. For this aim, the Achievement Emotions Questionnaire-Mathematics (AEQ-M) were administered to 312 German and 579 Chinese 8th-grade students. The findings pointed out culture-specific differences that Chinese students had higher anxiety, shame, enjoyment, and pride in mathematics than German students. In contrast, the experienced mathematics anger was higher for German students. Compared to German students' negative emotions, Chinese students' negative emotions at home were negatively associated with students' parental expectations and mathematics grades. However, the experienced shame and anxiety in mathematics, regardless of the learning context, were more positively related to failure attributions to Chinese students' lack of effort than their German counterparts. The findings both reflect the culture-specific aspects of achievement emotions.

Goetz, Pekrun, Hall, and Haag (2006) studied the domain-specific nature of achievement emotions. From the German three-track education system's top track, The degree of pride, anger, anxiety, and boredom of the 7th, 8th, 9^{th,} and 10^{th-}grade students for six core subjects (i.e., Latin, German, English, music, sports, and mathematics) were examined. The differential intensity of emotions across different subject domains confirmed the domain-specific nature of emotions rather than generalizing them from one subject domain to other study domains. Yet, anxiety displayed a less domain-specific perspective than the rest of the emotions in the study. This finding also stressed the distinctive nature of emotions among the selected ones.

Similarly, Goetz, Frenzel, Pekrun, Hall, and Lüdtke (2007) investigated the cross-domain versus domain-specific nature of emotions for the 8th and the 11th-grade students. Regarding the salience and the classification of emotions according to their activation and valence, pride, enjoyment, boredom, anxiety, and anger were selected to be examined for mathematics, physics, German, and English subject domains. Multilevel analyses were performed to ascertain the strength of the within and between-domain relations. Although emotion relations seemed to be high for similar subject domains, the relationship strength was not strong to talk about the generality of emotions across different subject domains. Contrary to Goetz et al. ‘s (2006) study, anxiety and enjoyment displayed the lowest domain-general aspect for both grade levels. It might be interpreted that the domain specificity level of each emotion could also change across different contexts.

In another study, Goetz, Frenzel, Pekrun, and Hall (2006) examined the domain-specificity of emotions and the extent of their presumable specificity within each domain. 721 German students from the 7th grade to the 10th-grade participated in the study. Four main academic subjects were included (i.e., mathematics, English, Latin, and German) to analyze the domain-specific nature of enjoyment, anxiety, and boredom. According to the circumplex model (Watson & Tellegen, 1985), the emotions were selected, inquiring the valence and activation degree and their salience in the literature. Confirmatory multitrait-multimethod factor analysis was employed through testing five models to determine whether emotions reflect a habitual nature across domains. For the first model, emotions were classified under a general factor category referring to domain-transcending emotionality. In contrast, the second model considered emotions as three emotion-specific factors implying domain-general emotionality. The third model, on the other hand, focused on four domain-specific factors indicating domain-specific emotionality. The last two models looked at four-domain specific factors by considering the impact of emotion-specific factors called the correlated uniqueness model. The achievement scores of students were included in the last model. Results revealed the fit of the fourth and fifth models that might be explained as the studied emotions' domain-specific nature. Besides, multilevel analyses were performed to determine the extent of the emotions' domain-specificity within each domain. Corroborating the findings of Goetz et al.'s (2007) study, enjoyment was the most domain-specific emotions preceding boredom and anxiety, respectively.

Differently, Goetz, Frenzel, Hall, and Pekrun (2008) adopted Pekrun's (2006) control-value theory and Marsh's internal/external frame of reference to explain between-domain relations of emotions, within-domain and between-domain relations of achievement and emotion relationship on mathematics and language classes. For this aim, 1380 students between 5 and 10-grade levels from the German three-track system took part in the study. Learning-related enjoyment was selected to investigate the experienced emotions in mathematics and language classes. In line with the cited literature findings, students' learning-related enjoyment and the achievement-emotion relationship displayed a domain-specific nature. Namely, students' previous year grade positively predicted their learning-related enjoyment in language classes. In contrast, language classes' achievement scores negatively predicted students' learning-related enjoyment in mathematics, indicating negative between-domain relations.

2.1.1.2. Measurement of Achievement Emotions

Several methods were described to sufficiently analyze people's emotions, including peripheral and physiological measures, functional magnetic resonance imaging (fMRI) and electroencephalography, observation of nonverbal behavior, and prosodic behavior of nonverbal speech (Frenzel & Stephens, 2013; Pekrun, 2009). The experience-sampling method or ecological momentary assessment is also used to measure emotions (Carson, Weiss & Templin, 2010). However, implementing such strategies in a classroom environment might be difficult due to methodological problems (Pekrun & Bühner, 2014) and ethical concerns. Therefore, self-report measures are frequently used in the measurement of achievement emotions.

In the literature, there are a plethora of scales to measure test anxiety (e.g., Brown, 1938; Mandler & Sarason, 1952; Pekrun et al., 2004; Sarason, 1984), boredom (e.g., Daschmannn, Goetz & Stupnisky, 2011; Nett, Goetz & Daniels, 2010), and anger (e.g., Furlong & Smith, 1998; Smith, Adelman, Nelson & Taylor, 1988). However, there is a lack of research measuring the different emotional states at the same time. The number of scales incorporating distinct achievement emotions seems to be lacking in the current literature. Thus, there is a need for psychometrically valid and reliable instruments to measure students' achievement emotions experienced in different learning environments (Pekrun & Bühner, 2014).

Based on the control-value theory and the findings of several quantitative and qualitative research (Pekrun et al., 2002a), Pekrun and his colleagues (2011) developed AEQ to measure the positive and negative emotions. AEQ, as a multidimensional self-report instrument, consists of nine distinct emotions (i.e., pride, enjoyment, relief, hope, hopelessness, anger, shame, anxiety, and boredom). In this scale, students' emotional states were examined in three different learning environments. These were class-related emotions (80 items), learning-related emotions (75 items), and test-related emotions (77 items). Each learning environment represented one section of the scale. Each section is divided into three sub-sections: before, during, and after parts, assessing the relevant time frame's corresponding emotion dimension. Besides, students' domain or course-specific emotions could also be evaluated through AEQ if the instrument's instructions are adapted accordingly.

Considering three-dimensional taxonomy (Pekrun, 2006), emotions are categorized according to valence, activation degree, and the object focus dimensions. From this perspective, as stated before, pride, hope, relief, and enjoyment are positive, while hopelessness, anxiety, shame, boredom, and anger are negative emotions. For activation degree, enjoyment, pride, and hope are classified into positive activating; relief is positive deactivating; anxiety, shame, and anger are negative activating, and hopelessness and boredom are negative deactivating emotions. Last, enjoyment, boredom, and anger are labeled as activity emotions, while relief, hope, anxiety, pride, shame, and hopelessness are labeled as outcome emotions considering object focus dimension (Pekrun, 2006; Pekrun et al., 2002a; Pekrun et al., 2011). To confirm the factorial structure of AEQ, the one-emotion factor model, nine factor-emotions model, and three settings-factors models were proposed and tested through first-order confirmatory factor analyses. In contrast, the emotion x setting factors model was proposed and tested by the second-order confirmatory factor analysis (Pekrun et al., 2011). Of these models, the emotion x setting factors model fitted to the data supporting the idea that as well as differentiation of each emotion type, the experience of the emotion could also differ across the learning environment. The internal consistency estimate of each emotion scale did not fall below .70 as evidence for high reliability (Nunnally, 1978). In addition to the original scale, several adaptations and validation studies were carried out to measure different age groups' achievement emotions (e.g., Dermitzaki & Bonoti, 2016; King, 2010; Paoloni, Vaja & Munoz, 2014; Peixoto, Mata, Monteiro, Sanchas & Pekrun, 2015).

Even though AEQ measures students' emotions, the high number of items, and the scale's distinctive nature lead researchers to develop a new scale for elementary school students. Lichtenfeld, Pekrun, Stupnisky, Reiss, and Murayama (2012) developed Achievement Emotions Questionnaire- Elementary School (AEQ-ES) to measure elementary school students' emotions. The questionnaire included 28 items and three emotions (i.e., enjoyment (9 items), anxiety (12 items), boredom (7 items). As in AEQ, AEQ-ES also measures elementary school students' class-related, learning-related, and test-related emotions. Consequently, students would respond to each item by rating the graphical faces on the scale, reflecting male and female students' emotional intensity. Corresponding to the validation process of AEQ, the one-emotion factor model, the three factor-emotions model, and the emotion x setting model were tested through confirmatory factor analyses. Accordingly, the emotion x setting model seemed to statistically fit the data, and Cronbach's value was .70 and above for each emotion dimension.

In line with the German and the English versions of AEQ, Govaerts and Gregoire (2008) developed the French version of the Academic Emotions Scale to assess students' enjoyment (4 items), pride (3 items), hope (4 items), shame (4 items), anxiety (5 items), and frustration (6 items) on a 7-point Likert scale. Factor analyses were performed to provide evidence on the scale's psychometric characteristics. The results revealed a hierarchical structure of emotions that they were classified as positive and negative emotions as the first step regarding their valence. Consequently, they were classified into distinct emotional dimensions.

Except for elementary students, several scales were also developed to measure students' achievement emotions for different grade levels and disciplines. For instance, Chiang and Liu (2014) developed the Science Academic Emotions Scale to assess university students' academic emotions while learning scientific concepts, attending science classes, and solving problems. The scale included pride, enjoyment, hope, relief, anxiety, shame, anger, hopelessness, social intuition, boredom, outlook, context, resilience, attention, and self-awareness sub-scales. Confirmatory factor analysis results revealed four main categories to classify emotions: positive activating, positive deactivating, negative activating, and neutral emotions. Similarly, Randler, Hummel, Gläser-Zikuda, Vollmer, Bogner, and Mayring (2011) developed the Situational Emotions in Science Education Scale to measure students' science learning emotions. The scale addressed three different emotional states (i.e., interest, well-being, boredom) with a total of nine items. The scale could also measure middle school, high school, and university students' emotions in science learning.

To measure students' mathematics achievement emotions across different age groups and grade levels, Pekrun, Goetz, and Frenzel (2005) developed Achievement Emotions Questionnaire-Mathematics (AEQ-M). There are 60 items with seven distinct emotion states (i.e., enjoyment (10 items), anger (9 items), pride (6 items), anxiety (15 items), shame (8 items), boredom (6 items), and hopelessness (6 items). There are three sections in the instrument. These sections measure students' learning-related (19 items), class-related (18 items), and test-related (23 items) emotions in mathematics. Each section has three sub-sections that assess students' mathematics achievement emotions by taking the time frame as a reference for the corresponding section. Students' activity, prospective and retrospective outcome emotions are measured by responding to the items under before, during, and after parts of the related section. As well as having German, English, and Chinese versions, the Turkish version of AEQ-M is also present in the current literature (Çalık & Çapa Aydın, 2019). AEQ-M was used in a bulk of studies to measure mathematics achievement emotions of middle school students (Frenzel, Pekrun & Goetz, 2007; Frenzel, Thrash, Pekrun & Goetz, 2007; Goetz, Frenzel, Pekrun, Hall & Lüdtke, 2007; Goetz, Cronjaeger, Frenzel, Lüdtke & Hall, 2010) and high school students (Frenzel et al., 2007; Goetz et al., 2007, Goetz et al., 2010). On the other hand, the instrument could also be used to measure achievement emotions in different disciplines by replacing the name of the relevant domains of study with the word "mathematics." In this context, the instrument was also used in several studies to measure students' achievement emotions in physics, English, and German as a foreign language course for different grade levels (e.g., Goetz et al., 2010; Goetz et al., 2007; Kök, 2017; Starkey-Perret, Deledalle, Jeoffrion & Rowe, 2017).

Except for the emotions discussed in the current literature, there is also a need for the scales measuring different achievement emotions experienced by students in other disciplines. Considering individual and cultural differences, the cross-cultural studies in this era would lend themselves to examine the cultural and language equivalence of those scales (Pekrun & Linnenbrink-Garcia, 2014).

2.1.2. Teacher Emotions

Pestalozzi mentioned that teaching is a combination of the head, hearth, and hand. In other words, teaching is a combination of cognitive, affective, and psychomotor dimensions (Bognar & Dubovičk, 2012). Therefore, teachers' affective states are conspicuously crucial in educational settings, emphasizing the teaching's emotion-burden nature. Bahia, Freire, Amaral, and Estrela's (2013) work to identify the emotions experienced by Portuguese teachers in classrooms revealed approximately one hundred and sixty emotions. Most of them were positive, including joy, love, sadness, fear, anger, and surprise.

Similarly, Prosen, Smrtnik Vitulic, and Poljšak Škraban (2014) examined primary school teachers' experienced emotions through an observation scheme. Corroborating the findings of Bahia et al. (2013) study, teachers expressed positive and negative emotions; however, negative emotions outweighed the positive ones. More specifically, anger was the most frequently voiced emotion. Disappointment, fear, sadness, shame, and guilt followed anger. Among pleasant emotions, joy was the most salient one, followed by pride and surprise. Likewise, O'Tole, Ogier-Price, and Hucks (2010) examined fifteen tertiary teachers' emotions through a diary study. On five days, one hundred and thirteen negative emotions were noted by tertiary teachers constituting the more significant portion of the total number of emotions. For negative emotions, anger was the most frequently expressed one in Prosen et al. (2014) study, while happiness and joy were the most salient positive emotions. As well as teachers, teacher candidates may experience distinct emotions. For instance, Anttila, Phyältö, Soini, and Pietarinen (2016) explored the spectrum of teacher candidates' academic emotions. Enthusiasm, satisfaction, interest, disappointment, and inadequacy were described as the most frequent ones. Maverach and Maskit (2015), on the other hand, incorporated pre-service and in-service teachers in their study to examine the intensity of emotions related to the teaching profession and the emotions related to participants as being teachers. Results revealed that pre-service and in-service teachers experienced mixed emotions (i.e., commitment, responsibility, stimulation, stress) with changing rates in line with the teaching profession. Along with the number of listed emotions in both studies, Fredrickson (2008) proposed a 3:1 ratio of emotions on the side of pleasant ones in her broaden and build theory. According to this ratio, individuals should experience positive emotions three times the negative ones to maintain a psychological balance.

Considering teacher-student, teacher-parent, teacher-colleague, and teacher-school administrator interactions, it is evident that teachers may experience various emotions during their professional careers; however, the intensity and the valence of those emotions may differ across different circumstances. Accordingly, emotions experienced due to teacher and student interactions might have the utmost importance regarding teaching processes. To illustrate, a teacher may experience anger as a result of students' disruptive behaviors. In contrast, the same teacher may get satisfied with the students' peak experiences on the relevant topic. The teacher feels enjoyment if the class's objective directly addresses their interests and enthusiasm to teach.

Teacher emotions are also given to be related to many cognitive and psychological constructs. These are teachers' pedagogical content-knowledge formation (Brigido, Couso, Gutieres, & Mellado, 2013), teachers' well-being (Day & Qing, 2009), teacher enthusiasm (Kunter, Frenzel, Nagy, Baumert & Pekrun, 2011), and teacher burn-out (Chang, 2009), identity formation (Bair, Bair, Mader, Hipp, & Hakim, 2010). Teaching quality (Chen, 2019; Frenzel, Becker-Kurz, Pekrun & Goetz, 2015; Frenzel, Goetz, Stephens & Jacob, 2009; Frenzel, Pekrun, Goetz, Daniels, Durksen, Becker-Kurz & Klassen; 2016; Hagenauer & Volet, 2014; Klassen, Perry, & Frenzel, 2012; Sutton, 2005; Sutton & Wheatley, 2003, Taxer & Frenzel, 2015; Trigwell, 2012), and teacher-student interactions (Becker, Goetz, Morger, & Ranellucci, 2014; Chen, 2019;

Hagenauer, Hascher & Volet, 2015; Prosen, Smrtnik & Poljsak Skraban, 2011; Yan, Evans & Harvey, 2011) are also mentioned to be related to teacher emotions.

Frenzel and her colleagues (2009) built a model to explain teacher emotions' antecedents based on the appraisal-theoretical framework and attribution theory. Accordingly, emotions arise due to interpretations of the situations or circumstances called appraisals (Frenzel & Stephens, 2013; Jacob, Frenzel & Stephens, 2017). These are goal congruence, goal conduciveness, coping potential, accountability, and goal significance (Frenzel et al., 2009). In a more elaborative manner, goal congruence refers to consistency between the goals and the situations under consideration. Goal conduciveness points out the controllability of the situation to attain the purpose. Coping potential, on the other hand, indicates possessing relevant sources in achieving the defined goal. Accountability appraisal is about the perceived responsibility toward the attainment/non-attainment of the purpose. Lastly, goal significance lays stress out evaluating any condition that would affect the intensity of teachers' expressed emotions. Frenzel et al.'s (2009) model of the appraisal-theoretical framework to explain antecedents has many similarities with Pekrun's (2006) control-value theory. Control and value appraisals were specified as two main antecedents of student emotions in Pekrun's (2006) model. Subjective control pertains to how well students work toward attaining the desired outcomes and keep themselves from undesired ones, corroborating coping potential appraisal in Frenzel et al. (2009) model. On the other hand, the subjective value reflects the assigned value to a designated task in line with goal congruence and importance appraisals.

Frenzel (2014) indicated four themes under the categories of teachers' classroom goals and teachers' perceptions of student behaviors that influence appraisal formation. These are cognitive, motivational, social-emotional, and relational themes. First, the cognitive theme points out the attainment of subject-specific qualities. Second, the motivational theme is related to motivational engagement in learning content. Third, the social-emotional theme emphasizes the development of competencies and abilities to function well in a social group. Fourth, a relational theme aims at forming a good relationship between students and the teacher. Overall, the stated themes are thought to influence teacher goals and their perceptions of their students' behaviors. As shown in the model, teacher appraisals were assumed to mediate the relationship between teacher emotions and student behaviors. A teacher may experience anxiety if their coping potential toward students' disruptive behaviors was relatively low, and students' actions were incongruent with teachers' goals. The revised version of the teacher's emotions model denoting causes and effects was presented in Figure 2.2.

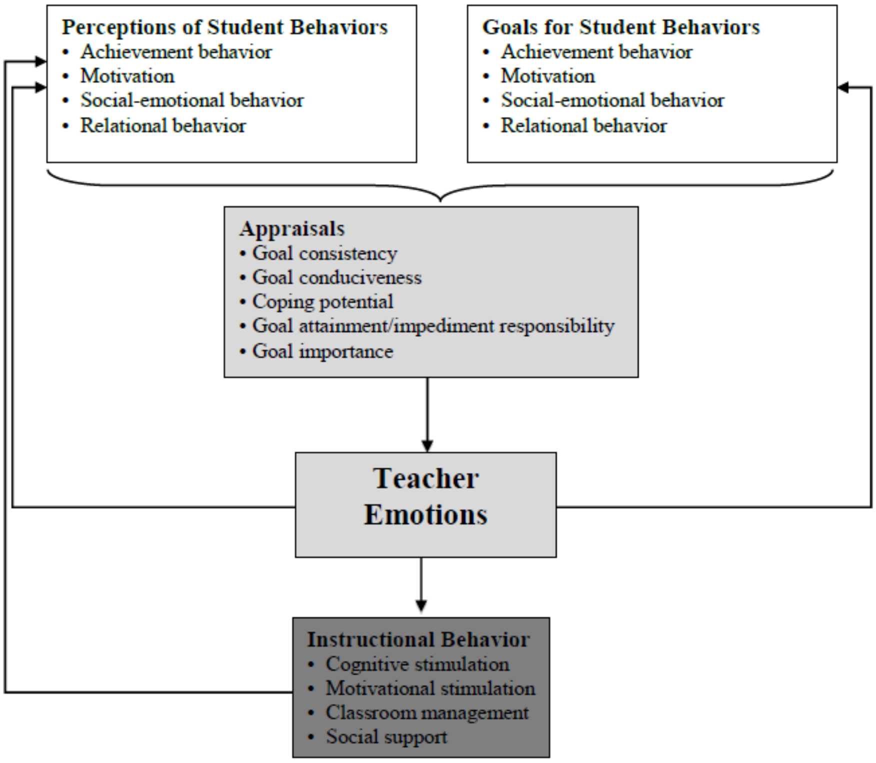

Figure 2.2. Frenzel's (2014) revised model for teacher emotions. Adapted from "Teacher Emotions" by A. C. Frenzel, 2014, *International Handbook of Emotions in Education*, (pp. 494-519). Copyright 2014 by Routledge.

Given that there are several sources of students' achievement emotions, there are also fundamental sources of teachers' academic emotions. Accordingly, teachers may experience enjoyment as a result of positive teacher-student relationships, high student motivation, engagement and accomplishment (Becker, Keller, Goetz, Frenzel & Taxer, 2015; Cubukcu, 2012; Hagenauer et al., 2015; Hosotani & Imai-Matsumura, 2011; Khajavy, Ghonsooly, Fatemi & Frenzel, 2018; Prosen et al., 2011; Sutton & Wheatley, 2003); pride as a result of students' expected or unexpected accomplishments, positive feedbacks received from students (Cubukcu, 2012; Khajavy, et al., 2018); anxiety due to lack of preparation to teach the class, inability to respond student questions or being a novice in the profession (Khajavy et al., 2018; Mevarech & Maskit, 2014; Sutton & Wheatley, 2003); anger due to classroom management problems, student disengagements, unsupportive behaviors of colleagues (Becker et al., 2015; Chang, 2009; Hagenauer et al., 2015; Hargreaves, 2000; Hosotani & Imai-Matsumura, 2011; Khajavy et al., 2018; Prosen et al., 2011; Sutton & Wheatley, 2003); sadness due to inability to provide classroom management, student failure (Hosotani & Imai-Matsumura, 2011); shame regarding the feeling of responsibility toward student failure (Khajavy et al., 2018), and boredom as a result of student disengagement and demotivation (Khajavy et al., 2018).

Teacher emotions may also be influential in numerous teacher-related outcomes. For instance, teachers' attributions, intrinsic motivation, self-efficacy, and instructional behaviors may be affected by triggered emotions in teaching environments (Sutton &Wheatley, 2003; Woolfolk Hoy, 2005). According to Frenzel's (2014) model, a particular emphasis was given to teachers' instructional behaviors resulting from distinct emotions. From this perspective, Frenzel et al. (2009) scrutinized the findings of empirical studies. The aim was to unveil the relationship between teacher enjoyment, anger, and anxiety with mathematics teachers' possible teaching behaviors and their eighth-grade students. The results disentangled the relationship among teachers' self-reported emotions and teaching quality from their students' perceptions. More specifically, teachers who expressed enjoyment tended to teach math more elaboratively and comprehensively with high enthusiasm and provide high autonomy support to their students. Besides, students were given more support after their failures by teachers with high enjoyment. However, teachers who were experiencing anger and anxiety were quite distant from using such flexible instructional strategies. Typically, teachers who felt negative emotions preferred rote memorization and simple rehearsal (Frenzel, 2014).

Similarly, Chen (2019) explored the relationship between primary school teachers' emotions and their teaching approaches in Hong Kong and China. The model supported the idea that positive emotions such as love and joy induced teachers using more student-centered practices. In contrast, negative emotions such as fear and anger increased using knowledge transmission as a teacher-centered approach. The elicited relationships also necessitate using accurate measures to assess teacher emotions; otherwise, it is impossible to produce sound arguments on antecedents and consequences of emotions.

Several scales were developed or adapted to different languages to measure teachers' academic emotions. In this regard, Frenzel, Pekrun, Goetz, Daniels, Durksen, Becker-Kurz, and Klassen (2016) developed the Teacher Emotions Scale (TES), adopting a trait-based and discrete approach. To decide which emotions to include the scale, the authors considered the frequency and saliency of the experienced emotions in real life. Accordingly, the scale consisted of three-emotion dimensions (i.e., anxiety, anger, and enjoyment). Frenzel et al. (2016) tested the single-emotion factor model, the two-factor (positive vs. negative affect), and the three-factor (anxiety, anger, and enjoyment) model. The factor analyses supported the three-distinct emotions factor model with appropriate internal consistency estimates for each emotion dimension (above .70).

Likewise, Hong, Heddy, Ruan, You, Kambara, Nie, and Monobe (2016) revised the TES scale by including two distinct emotions (pride and frustration). The revised scale was validated with Japanese and Korean teachers. Unlike the hypothesized structure, frustration items cross-loaded with anger dimension and displayed low reliability, so the revised scale resulted in a four-factor emotion scale. As in Hong et al. (2016) validation study, Chen (2016) developed the Teacher Emotion Inventory and validated it in Asian contexts. Accordingly, emotions of love, sadness, anger, and fear were included in the inventory based on primary and secondary emotions classification (please, see Parrott's (2001) tree structure). Exploratory and confirmatory factor analysis yielded five-factor emotion dimensions for primary school teachers in which positive emotions were mostly related to teacher interactions with students and colleagues. In contrast, negative emotions were associated with the educational policy and the difficulty of preserving a balance in teachers' lives. Besides, the Cronbach alpha values of each emotion dimension were within acceptable ranges.

2.1.3. Research on the Relationship between Teachers' and Students'Academic Emotions

Bearing in mind that teachers' emotions are related to student-teacher interactions and teachers' instructional behaviors, teachers' academic emotions may also be connected to student-related outcomes. Of these outcomes, students' emotions may be emphasized because students are generally cognizant of their teachers' emotions, and this awareness might be reflected in their emotions accordingly (Sutton & Wheatley, 2003). This reflection is called emotion contagion theory. It is described as "The tendency to automatically mimic and synchronize facial expressions, vocalizations, postures and movements with those of another person and, consequently, to converge emotionally" (Hatfield, Cacioppo & Rapson, 1994, p. 5). Regarding emotional contagion theory, people's psychological states and emotions might be consciously or unconsciously conveyed through empathy (Hatfield, Cacioppo & Rapson, 1994). In the literature, crossover (e.g., Westman, 2001) and emotional transmission (e.g., Frenzel, Goetz, Lüdtke, Pekrun & Suton, 2009; Frenzel, Becker-Kurz, Pekun, Goetz & Lüdtke, 2017) are used interchangeably to explain the phenomenon of affective interaction between different agents. However, emotional contagion often occurs unintentionally and unconsciously, whereas crossover of affect mostly likely appears with a conscious intention (Harter & Page, 2009). This theory's intriguing part might be studying dyadic relationships and interaction between a teacher (an individual) and students. For instance, Bakker (2005) explored the crossover of enjoyment, absorption, and intrinsic motivation of music teachers to their students' enjoyment, absorption, and intrinsic motivation, specifically their flow experiences. Findings confirmed the crossover of teacher enjoyment into students; in other words, enjoyment, absorption, and intrinsic motivation of music teachers were positively linked to their students' flow experiences. Therefore, studying emotional transmission between students and teachers might be invaluable for advancing learning and teaching processes (Frenzel et al., 2017).

Strikingly, this era is nascent that there is a lack of research exploring the relationship between student and teacher emotions in different subject domains. The studies mostly employed the experience-sampling method or intraindividual approaches in longitudinal designs. In this manner, Frenzel, Goetz, Ludtke, Pekrun, and Sutton (2009) examined whether teacher enjoyment is transmitted to student enjoyment in mathematics after controlling for the previous year's mathematics enjoyment. Accordingly, many middle school students and their mathematics teachers' enjoyment were examined in 7^{th} and 8^{th}-grades in Germany. Results confirmed the hypothesis toward the relationship between students' and their mathematics teachers' enjoyment such that mathematics teachers' enjoyment was positively linked with their students' mathematics enjoyment. Based on these findings, Frenzel, Becker-Kurz, Pekrun, Goetz, and Ludtke (2017) revised their model by reciprocally looking at the relationship between student and teacher enjoyment. Data were collected from the middle and high track secondary schools in Germany. According to the findings, teacher enjoyment was positively associated with student enjoyment. Teachers' perceived student class engagement and students' perceived teacher enthusiasm mediated the proposed relationships. Accordingly, student enjoyment was positively linked to the teacher's perceived student engagement, which also induced more teacher enjoyment. Besides, teacher enjoyment was positively associated with student perceived teacher enthusiasm, which was also translated into student enjoyment in mathematics.

Similarly, Becker, Goetz, Morger, and Ranellucci (2014) compared the interrelation between teacher and student emotions through an experience sampling approach. Participants' momentary feelings on a given case were considered by recording their responses through relevant devices. After controlling students' mood and domain types, the relationship between students and their teachers' emotions was investigated. Ninth-grade students from upper-track schools in Switzerland participated in the study. Results pointed out the consistent interaction between students and perceived teacher emotions across different subject domains. Besides, a considerable portion of the variance in students' emotions was explained by teachers' emotions, and the most substantial relationship was given for enjoyment, followed by anger and anxiety.

In another longitudinal study, Keller, Goetz, Becker, Morger, and Hensley (2014) focused on whether teacher enthusiasm is related to students' interest in English, French, German, and mathematics in high achieving track secondary schools in Switzerland. Data were collected from teachers and their ninth-grade students through self-report instruments. Findings implied that teachers who showed enthusiasm during teaching seemed to trigger students' enjoyment and intrinsic value toward the subject. Differently, Becker, Goetz, Frenzel, and Taxer (2015) utilized an intraindividual approach to investigate the relationship between secondary school students' discipline, motivation, and teachers' enjoyment and anger in mathematics. Data were collected from ninth and tenth-grade students and their mathematics teachers from the highest achievement track secondary schools in Germany. Both students and teachers were given diaries, including the relevant scales' selected items, to measure their motivation. Findings pointed out that the triggering role of student motivation in teacher enjoyment and anger. The authors also examined teacher appraisals' mediating role regarding the Frenzel et al.'s (2014) model. Of these appraisals, goal conduciveness and coping potential were addressed in this study. Results revealed that the relationship between teacher emotions and student motivation was mediated by goal conduciveness and coping potential appraisals. Namely, these appraisals seemed to mediate student motivation's effects on teacher enjoyment and anger in mathematics.

In a similar design, Keller, Becker, Frenzel, and Taxer (2018) tested teacher enthusiasm's interrelation with students' enjoyment and boredom in mathematics through a diary study. For this aim, ninth and tenth-grade students and their mathematics teachers from the highest achievement track secondary schools in Germany attended the study. The goal was to obtain information from 5 to 10 mathematics classes for one teacher, so diary questionnaires were given for each participant to fill out for three weeks. Corroborating Keller et al.'s (2014) study findings, students experienced enjoyment more and boredom less in mathematics classes where teachers had high enthusiasm.

Kunter, Klusmann, Baumert, Richter, Voss, and Hachfeld (2013) examined the association between teachers' professional competence in their pedagogical content knowledge, enthusiasm, beliefs, self-regulation, and several student-related outcomes in a total of 194 secondary schools in Germany. Mathematics teachers and their tenth-grade students were the participants of the study. Given the influence of the relationship between student enjoyment in mathematics and teacher enthusiasm, students' ninth-grade achievement and motivation were used as covariates. According to the results, a notable increase was seen in mathematics enjoyment for students whose teachers experienced a high enthusiasm for their work.

Overall, the studies were generally of quantitative nature that explored teacher emotions' predictive role on students' emotions. The studies examining the reciprocal relationship among the variables mentioned above are scarce in the literature, implying this field's developing nature.

2.2. Self-Efficacy

Many behaviorist theories asserted the precursory role of biological factors in human development. Unlike these theories, social cognitive learning theory dwells on people's thoughts, beliefs, and feelings in shaping their behaviors. As Bandura (1986) stated, "what people think, believe, and feel affects how they behave" (p. 25) to stress the influential role of people's beliefs on their perceived control and actions, people undisputedly become both the producers and the outcomes of their settings (Pajares, 1996).

Society and the environment in which people live contribute to their development. Therefore, both personal, behavioral, and environmental factors are crucial in human development. These factors are represented in the "triadic reciprocal causation" or "reciprocal determinism" model (Bandura, 1997, p.6). As denoted in the name, each factor in the model is reciprocally and dynamically related. Besides, each element in the model upholds differential weights over others, and those factors influence human functioning regarding the relevant conditions and the events.

Self-efficacy is a personal factor described by Albert Bandura (1997) in his "Self-Efficacy: The Exercise of Control" book as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). According to this definition, self-efficacy influences people's action choices, thought patterns, self-regulation, stress, and depression during dealing with the adversities, and the resilience and perseverance degree toward the challenges and the likelihood of failures (Bandura, 1977, 1982, 1997). Efficacious people diligently cope with the challenging situations, work hard, persist longer even they face with the adversities. They also attribute their failure to internal factors. On the other hand, inefficacious people could have problems struggling with the challenges. Accordingly, their resilience and persistence might fall behind. They are more likely to give up the job they pursue. Besides, they attribute their failures mostly to external factors such as difficulty leading up stress, anxiety, and depression (Bandura, 1982, 2006; Pajares, 1996).

Virgil claimed that “they are able who think they are able,” although they might have encountered several rejections or failures at the beginning of their work. Corroborating to this assumption regarding efficacious people’s typical characteristics, Thomas Edison had experienced failures for 999 times, but firmly continued to test and finally invented the lightbulb on his experiment for the thousandth times. Joanne Kathleen Rowling, the novelist of Harry Potter as the bestseller of all times, was rejected by many publishers in England before the first edition of her masterpiece was published and gained an unpredictable eminence. As the well-known author of many science fiction books, Stephen King was rejected thirty times with negative comments on his literary style; however, he continued to submit his manuscripts before his book was published. Today, copies of his books have been printed more than a thousand times and sold out worldwide, reaching a very high number of audiences.

Similarly, as the prominent of the post-impressionism movement, Vincent Van Gogh could only sell one painting during his lifetime across his 900 oil paintings that have been accepted today as the most valuable paintings of all. These talented people’s most typical characteristics were possessing high levels of effort, resilience, and task persistence. Bandura (1997) mentioned that “people’s level of motivation, affective states, and actions are based on what they believe than on what is objectively true” (p. 2) to differentiate the possible incompatibility between reality and the belief system of people. Thus, people’s accomplishment is predicted broadly by their self-efficacy rather than their former experiences, skills, or knowledge (Pajares, 1996).

Mastery experiences, vicarious experiences, verbal persuasions, and physiological arousal are four sources of self-efficacy. Mastery or enactive experiences depend on people’s accomplishments (Bandura, 1977, 1982, 1997). While successes more likely increase the efficacy beliefs of people, successive failures induce a decline in it.

Therefore, it is the most significant source (Bandura, 1997) on shaping people's self-efficacy judgments, especially for earlier experiences. It should also be noted that the mastery experiences do not much impact on further consequences after a degree of accomplishment and failures (Schunk & Dibedenetto, 2016). Second, vicarious experiences are based on observing and modeling people's behaviors. These experiences could be given another source of self-efficacy. By observing others' behaviors, people generally make normative comparisons by considering how people with similar capabilities cope with threatening situations in similar circumstances. If the observed people experience successes in their work, their self-efficacy beliefs most probably increase since they find similarities in their capabilities. However, the rise in self-efficacy tends to decline under the influence of repeated failures of modeled people. Third, verbal persuasions play a critical role in enhancing people's self-efficacy despite its limited effect compared to previous sources due to lack of authentic experiences. Verbal persuasions are in the form of receiving suggestions, positive feedback, and persuasions from credible people in the field. As a result, their efficacy judgments might enhance (Schunk & Dibedenetto, 2016). Lastly, physiological arousal also influences self-efficacy such that moderate levels of arousal might be favorable for the performance; however, the extreme levels might be detrimental (Bandura,1997).

Self-efficacy may also differ in terms of the level, generality, and magnitude such that the level of self-efficacy refers to be contingent upon the task difficulty. In contrast, generality purports the transference of the beliefs to different activities or tasks. Lastly, the strength of self-efficacy judgments of people might differ as well. As perceived self-efficacy depends on people's capabilities rather than their physical and psychological qualities, the magnitude of perceived self-efficacy on carrying out a specific task or activity might differ for each person (Bandura, 1982). In theoretical literature, self-efficacy has been related to several other constructs, such as self-esteem, self-concept, and outcome expectations (Bandura, 1977, 1997). However, these constructs are differentiated from self-efficacy regarding some essential characteristics. Self-efficacy and self-concept are multidimensional, somewhat hierarchical, and supposed to influence cognition, motivations, emotions, and performances. However, they are differentiated toward their temporal stability, past or future-oriented, and descriptive or evaluative nature (Bong & Skaalvik, 2003; Marsh, Pekrun, Parker, Murayama, Guo, Dicke & Arens, 2019). Accordingly, self-concept is a more stable construct, while people's self-efficacy judgments are more goal-referenced and could change in time, so self-efficacy beliefs are malleable. Second, self-efficacy refers to beliefs of people on their capabilities toward specific domain or task-related issues. It is a future-oriented and descriptive construct; however, self-concept is based on past accomplishments and normative comparisons on more global issues described as a past-oriented and evaluative construct. Self-esteem, on the other hand, refers to people's judgments toward their self-worth. Efficacious people might hold lower self-esteem due to their friends' negative perceptions, while people with higher self-esteem might not feel efficacious about their academic capabilities (Schunk & Dibedenetto, 2016). The discrepancy among self-efficacy and outcome-expectations lies in the difference between performance and outcome terms. While performance stands for accomplishments over tasks, outcome purports to be the consequences of this performance (Bandura, 1997). Accordingly, an outcome expectancy is an individual's estimation of a specific behavior presumed to yield a particular outcome. On the other hand, efficacy expectations focus on people's beliefs on their capabilities to attain the desired results to influence their actual performances preceding the outcomes (Bandura, 1977).

2.2.1. Student Self-Efficacy

It is plausible to talk about different self-efficacy, such as self-efficacy for learning, self-efficacy for performance, self-efficacy for self-regulated learning, collective efficacy, teacher self-efficacy, and collective teacher self-efficacy. Among those self-efficacy beliefs, students' self-efficacy has an extensive spectrum of defining students' capability judgments on a given learning task, performance, and self-regulation. For instance, self-efficacy for performance refers to the efficacy beliefs of people to perform previously learned behaviors. In contrast, self-efficacy for learning points out people's perceived capabilities to learn novel skills, strategies, and behaviors. On the other hand, self-efficacy for self-regulated learning implies people's judgments and beliefs to build up thoughts, feelings, and behaviors to attain the intended learning goals (Zimmerman, 2000). By practicing self-regulated learning, students establish goals, participate in the activities, employ several learning strategies to reach predetermined goals, self-evaluate their progress, and make necessary adjustments to their learning (Schunk & Dibedenetto, 2016; Schunk & Usher, 2011).

In assessing self-efficacy, there is no specific scale measuring this construct for both domains of study since Bandura (2006) supported the idea that "the one measure fits all" would be detrimental for such scales' explanatory and predictive power. However, more global measures would not be suitable and sensitive since self-efficacy is a domain and task-specific construct. Although omnibus types of scales attempt to measure self-efficacy from a general perspective, domain-specific assessments are preferred (Pajares, 1996). In doing so, the scales were structured in unipolar nature ranging from 0 to maximum strength, usually to 100 points, excluding negative numbers as future-oriented judgments of people in their capabilities for a specific task were questioned (Bandura, 1982, 1997, 2006). Several scales were also developed to measure self-efficacy sources (Kieffer & Henson, 2000; Usher & Pajares, 2009), academic self-efficacy (Jinks & Morgan, 1999), self-efficacy for self-regulated learning (Usher & Pajares, 2008), and students' mathematics self-efficacy (Bettz & Hacketz, 1983; Işıksal & Aşkar, 2003; Usher, 2007).

In Betz and Hacketz's (1983) Mathematics Self-Efficacy Scale (MSES), for instance, college students' self-efficacy toward everyday math problems, math tasks, and math-based college courses were examined. Usher (2007) addressed middle school students' self-efficacy toward solving math problems concerning the National Council of Teachers of Mathematics (NCTM) principles and standards. On the other hand, some scales approached self-efficacy from a more subject-specific perspective. In Işıksal and Aşkar's (2003) study, middle school students' beliefs in using mathematics in daily life, equations, and symmetry subjects were used. Therefore, the scales measured domain-specific and task-specific beliefs of students toward a definite domain of study. There were also ample researches on the adaptation and validation of self-efficacy scales to different cultures (i.e., Çalık, 2014; Çapa-Aydın, Uzuntiryaki-Kondakçı, Temli & Tarkın, 2013; Freed, 2013; Kranzler & Pajares, 1997; Kontaş & Özcan, 2017; Matsui, Matsui & Ohnishi, 1990; Yurt & Sünbül, 2014).

2.2.1.1. Research on the Relationship between Self-Efficacy and Achievement Emotions

Regarding the four self-efficacy sources, physiological arousal and emotional states impact people's self-efficacy substantially. For instance, people's favorable emotional and physiological conditions could improve their self-efficacy. In contrast, stress, fatigue, and anxiety might have a debilitating effect on their self-efficacy through influencing their interpretations over the situations and their experiences (Usher & Pajares, 2008; Pajares, 2006). Compared to other sources, people's emotional and physiological states were curvilinearly related to people's self-efficacy (Usher & Pajares, 2006a, 2006b). This relationship denoted pernicious effects on people's functioning due to too high or too low arousal of emotions (Bandura, 1997). Therefore, exploring the relationship between students' self-efficacy beliefs and their emotional states, achievement emotions, in particular, would be essential to figure out the structure of this association from multiple perspectives.

Mills, Pajares, and Herron (2005) mentioned that anxiety might be antecedent and the outcome of self-efficacy at the same time. Regarding social cognitive learning theory assumptions, Matsui et al. (1990) examined the extent to which the hypothesized sources of self-efficacy contribute to explaining this construct. The participants were freshmen students taking liberal arts courses, social science, or natural science in Japan. The measures to obtain information about students' self-efficacy sources and their mathematics self-efficacy were administered in a psychology course with a one-week interval. Accordingly, the physiological arousal of students significantly accounted for explaining mathematics self-efficacy beliefs of students. Likewise, Lopez and Lent (1992) explored the relationship between mathematics self-efficacy and its sources in a junior-level algebra course for high school students. Students' emotional arousal and previous math-related experiences were deemed influential on their confidence in current math capabilities.

Usher and Pajares (2006a, 2006b) examined sixth-grade students' academic self-efficacy sources. Findings revealed that physiological states seemed to predict students' academic self-efficacy toward learning academic skills, subjects, and self-regulated learning. Furthermore, the physiological state had a quadratic effect on students' academic self-efficacy. Accordingly, self-efficacy would move to the highest point under the decline of the anxiety level. On the other hand, self-efficacy would decrease through the increase in anxiety. Then, self-efficacy became more stable (Usher & Pajares, 2006b). Corresponding to this study, Usher and Pajares (2009) also explored the relationship among sixth and eighth-grade middle school students' mathematics course self-efficacy, mathematics skills self-efficacy, mathematics grade self-efficacy, self-efficacy for self-regulated learning, and four self-efficacy sources at public middle schools in the U.S. According to the results, the relationship between the students' physiological states and mathematics self-efficacy was similar in previous studies.

Qualitative studies were also carried out to reveal the substantial factors in students' development of self-efficacy. Several semi-structured interviews were held with 8th-grade middle school students to portray the essential elements of students' mathematics self-efficacy (Usher, 2009). Consequently, students who had higher mathematics self-efficacy had a high arousal level, which increased their motivation. In contrast, students who had lower mathematics self-efficacy appeared to experience a heightened distress level.

Haciomeroglu (2019) also studied the relationship between self-efficacy sources, anxiety, boredom, and enjoyment in mathematics at fourth-grade students from three public schools in Turkey. According to the findings, the relationships between the physiological state, anxiety, and boredom were significant. In contrast, a substantial portion of the variance in the physiological state was accounted for by anxiety. Indeed, emotional arousal might alter people’s capabilities, so distress, anxiety, and fatigue might also change self-efficacy judgments. Thus, such feelings might be both sources of self-efficacy and the outcomes of people’s capability judgments, as described by Mills, Pajares, and Herron (2005). Considering “triadic reciprocal causation,” personal, environmental, and behavioral factors are in a dynamic relationship. However, personal elements uncovering the cognitive, affective, and biological events possess an inner loop within reflecting that people’s affective states might be the outcomes of self-efficacy. In other words, self-efficacy fluctuations would influence the feeling states of people. Many empirical research pieces in the literature examine the relationship mentioned above for different grade levels; however, they mostly focused on anxiety as an achievement emotion.

Cooper and Robinson (1991) studied on the relationships among mathematics self-efficacy of undergraduate students with their career self-efficacy, mathematics anxiety, mathematics background, mathematics performance, and perceived external support at a public university in the U.S. Students from engineering, computer sciences, applied physics, and mathematics departments participated in the study. Results unveiled a negative relationship between mathematics anxiety and mathematics self-efficacy. Longitudinal studies were also carried out to reveal the association between anxiety and self-efficacy for college-level students. For example, Yerdelen, McCaffrey, and Klassen (2016) examined the relationship between university students’ academic anxiety, self-efficacy for self-regulated learning, and procrastination levels. At the beginning of the semester, students responded to self-report measures on their self-efficacy for self-regulated learning. Students were then asked questions about their academic anxiety and procrastination during eight weeks of the semester with a two-week interval. Thus, they were measured four times during a semester for the stated constructs. Results revealed that self-efficacy for self-regulated learning significantly predicted students' initial anxiety. In other words, students who had a higher level of self-efficacy for self-regulated learning experienced less anxiety. On the other hand, students with a lower self-efficacy level for self-regulated learning experienced anxiety more at the initial measurement period. However, students' initial self-efficacy levels for self-regulated learning did not account for the rate of anxiety change.

The relationship between students' anxiety and self-efficacy was also considered for high school students in several studies. International Programme for Assessment (PISA) is a large scale-assessment in which the data are collected from high school students to unravel their use of reading, mathematics, science knowledge and skills, and several affective constructs for an increased number of countries all around the world. Drawing upon the PISA findings, many researchers also compared studies between different countries toward the relationship between students' anxiety in mathematics or science domains and their self-efficacy beliefs. Accordingly, Yıldırım (2011) inspected the relationship between motivational beliefs and high school students' achievement using PISA 2003 results in Turkey, Japan, and Finland. According to the findings, mathematics anxiety was negatively predicted by mathematics self-efficacy in both countries. At the same time, this relationship was the strongest in Finland than Japan and Turkey. Likewise, Usta (2015) attempted to determine school and student-level factors affecting high school students' self-efficacy beliefs in Turkey, Greece, and China-Shanghai considering PISA 2012 results. The researcher focused on the mathematics domain that mathematics anxiety was negatively related to students' mathematics self-efficacy in Greece and China-Shanghai, whereas this association was positive in Turkey. That is, students who had higher self-efficacy also had higher mathematics anxiety. This finding contradicted the findings of previous studies.

Except for large-scale assessments like PISA, Nie, Lau, and Liau (2011) also focused on the predictor role of academic self-efficacy, task importance, and their interaction on test anxiety of 9th-grade students in Singapore for mathematics and the English. Corroborating many scrutinized studies' findings, test anxiety was negatively predicted by academic self-efficacy in mathematics and English. In line with this study's goal, Catapano (2013) investigated the relationship among tenth-grade students' mathematics anxiety, mathematics self-efficacy, and attitudes toward mathematics in two suburban high schools in New York. Findings again pointed out an inverse relationship between these constructs that any increase in students' mathematics anxiety indicated a decline in their self-efficacy toward mathematics.

McMillian (2017) also examined the relationship between fifth-grade students' self-efficacy, mathematics anxiety, and mathematics achievement in North Carolina. In this study, students' self-efficacy uncovered three main dimensions: academic, social, and self-regulatory self-efficacy in mathematics. The mathematics anxiety scale items attempted to identify the math anxiety level of students in various mathematical situations. Classroom observations and interviews were also done with purposefully selected participants from the quantitative part to support the quantitative findings. There was a significant relationship between mathematics anxiety and self-efficacy. Students with high self-efficacy experienced lower anxiety in mathematics. In contrast, students with low self-efficacy displayed high mathematics anxiety. According to the qualitative findings, students who had higher self-efficacy and lower math anxiety expressed their willingness to participate in mathematical conversations. They also asked more questions and displayed learning readiness. However, students with lower self-efficacy and higher math anxiety were unwilling to take part in mathematical discussions. They seemed to resign from learning, seek help, and take an active and proactive role in the class.

Pekrun's (2006) control-value theory asserted that students experience anxiety and many other emotions such as relief, enjoyment, pride, hope, boredom, frustration, confusion, anger, hopelessness, etc. Herein, the relationship of these emotions with students' self-efficacy beliefs was also addressed in the literature. To examine different emotion types, Pekrun, Goetz, Perry, Kramer, Hochstat, and Molfenter (2004) constructed and validated a test emotions questionnaire comprised of different emotion sub-scales, including joy, relief, pride, hope, shame, hopelessness, anger, and anxiety. The development and the validation of the English and German versions of the scale were carried out in six different phases in two universities in Germany and Canada. The study findings pointed out positive correlations for test pride, hope, joy, and negative correlations for shame, hopelessness, anxiety, anger, with academic self-efficacy.

Similarly, Pekrun, Goetz, Frenzel, Barchfeld, and Perry (2011) tested the influence of the cognitive and value appraisals on achievement emotions based on control-value theory in their scale construction and validation study with several university students in Canada. Accordingly, the relationships between academic self-efficacy and achievement emotions of hope, pride, relief, enjoyment, anger, hopelessness, anxiety, boredom, and shame were examined. In line with the theory, university students' self-efficacy was positively associated with their positive emotions, whereas students' self-efficacy was negatively associated with their negative emotions.

Among the sorted literature, most of the studies sparked an interest in examining the predictive role of self-efficacy on academic emotions by employing correlational designs. For instance, Marchand and Gutiernes (2012) explored the predictors of students' emotions for a graduate-level research methods course. Use of academic learning strategies in different modalities, and some other motivational factors, students' self-efficacy for learning research methods was assumed to be one of the predictors of their academic anxiety, hope, and frustration. Accordingly, data were collected at different time intervals during a semester. The motivational variables, including self-efficacy, utility value, and relevance, were measured. Students' academic emotions were then assessed, and students' learning strategy was measured at last. A path model was proposed to test the presumed relationships that self-efficacy was the most consistent predictor of students' emotions. Furthermore, it was a negative predictor at a moderate level for frustration and anxiety and a positive predictor of hope in both settings.

In a different study with university students, Villavicencio and Bernardo (2013) sought how negative emotions (i.e., hopelessness, anxiety, shame, and anger) moderated the relationships between academic performances in trigonometry courses and their self-efficacy beliefs. Accordingly, the experience of anxiety, anger, hopelessness, and shame moderated the positive effects of self-efficacy on achievement in trigonometry, which means that any decrease in self-efficacy was related to lower achievement with higher anxiety, anger, hopelessness, and shame levels. In contrast, increased self-efficacy was linked to higher achievement with lower anxiety, anger, hopelessness, and shame levels. Villavicencio and Bernardo (2016) also examined the relationship between engineering students' academic emotions (i.e., enjoyment, anxiety, pride), self-efficacy, self-regulation, and trigonometry achievement. According to the results, pride and enjoyment were positively associated with self-efficacy toward trigonometry learning after controlling anxiety.

Heckel and Ringeisen (2019) adopted both social cognitive learning theory and control-value theory in their study to understand how university students' control and value appraisals and academic emotions were related to their competence gain and satisfaction in online learning environments. Students participated in the study after completing an online module at a German university. In this study, self-efficacy as a control appraisal and interest as a value appraisal were put in the proposed structural model as antecedents of two achievement emotions, pride, and anxiety that would predict satisfaction and competence gain as learning outcomes. The findings revealed that self-efficacy was positively related to pride. However, self-efficacy was negatively associated with anxiety; in other words, an increase in students' self-efficacy beliefs would correspond to an immediate rise in pride and a decrease in students' anxiety levels and vice versa.

Artino, La Rochelle, and Dunning (2010) carried out longitudinal research to explore the relationship between achievement emotions, motivational beliefs, and medical students' academic achievement. Participants completed an online survey, including items related to self-efficacy and task value. They also filled out another online survey, including course anxiety, enjoyment, and boredom toward the second semester's end. According to the results, the relationship direction between self-efficacy and anxiety was in line with Bandura's (1997) contention toward social cognitive learning theory and Pekrun's (2006) control-value theory. Accordingly, self-efficacy was negatively related to students' anxiety levels. Students who were more confident in their learning abilities experienced less course-related anxiety. Yet, no significant relationship was found between self-efficacy, enjoyment, and boredom.

Among the literature, Gonzalez, Carrera, Fernandez, and Paoloni (2017) also investigated the predictor role of self-efficacy, instrumentality on high school students' academic emotions, and the effects of the given variables on students' problem-solving strategies and performances in physics classes. Data were collected from eleventh-grade students in Spain to test the proposed structural model. The results confirmed the predictor role of self-efficacy for emotions. Any increase in students' self-efficacy corresponded with increased students' hope and decreased anxiety levels in physics classes. In this model, hope and anxiety mediated the relationship between instrumentality, problem-solving strategies, and self-efficacy. In contrast, hope, anxiety, and problem-solving strategies mediated the relationship between instrumentality, students' performance, and self-efficacy. Accordingly, students with high levels of hope and self-efficacy and low anxiety levels tended to receive higher physics grades. Interestingly, the researchers proposed a different model in the same study that inquires whether self-efficacy could influence emotions. According to the new model, students who had higher self-efficacy experienced less anxiety and more hope in physics classes than students who had lower self-efficacy.

Differentiating from the previous study's purpose, Putwain, Sander, and Larkin (2013) examined the predictor role of academic self-efficacy on university students' academic emotions and achievement across two semesters. The study was held with first-year students at two different universities in the United Kingdom. The learning-related section of the Achievement Emotions Questionnaire was employed to measure academic emotions. Academic self-efficacy was measured at the beginning of the first semester, while academic emotions were assessed at the beginning of the second semester. Results unraveled substantial relations between learning-related emotions and self-efficacy toward study-related skills and behaviors. Students who had higher self-efficacy in study behaviors and study skills experienced enjoyment, pride, and hope and less likely to experience anxiety, boredom, shame, and anger.

Lu, Ng, Lee, and Aye (2016) examined the mutual relation of eighth-grade students' mathematics emotions, self-efficacy, and value. Accordingly, both value and self-efficacy being the cognitive appraisals were jointly associated with students' mathematics achievement emotions. Mathematics self-efficacy was positively related to pride and enjoyment and was negatively associated with anxiety and boredom. Similarly, Zhen, Liu, Din, Wang, and Liu (2017) explored the relationship between middle school students' academic self-efficacy, competence, relatedness, autonomy, satisfaction, positive and negative academic emotions, mathematics engagement, and learning. A longitudinal design was employed. According to the findings, students' academic self-efficacy positively predicted student pride and enjoyment while negatively predicted anxiety, boredom, anger. An increase in students' self-efficacy toward mathematics, Chinese, and English corresponded to a rise in pride and enjoyment and a decline in boredom, anger, and anxiety.

Vongkulluksn, Matewos, Sinatra, and Marsh (2018) attempted to understand students' self-efficacy pathway between the third and the sixth grades during a design-based maker space course; self-efficacy changes according to their positive and negative achievement emotion experiences. In this course, students would describe a real-world problem and prepare a project by addressing this problem by utilizing STEM concepts. A mixed-methods research design was employed. Students were given surveys three times during a semester. Accordingly, they were given self-efficacy items and demographics at the beginning of the semester. Besides, items measuring students' excitement, frustration, curiosity, and confusion were asked at mid-semester. Class observations and interviews were held to triangulate the findings. As in the previous studies, students' self-efficacy was positively associated with their positive emotions while negatively related to their negative emotions. The interviews' findings also supported the quantitative results that students with a high level of positive emotions expressed their confidence in their competencies.

Overall, the current research mostly considered anxiety, but students experience distinct emotions during their academic lives. Exploring the relationship between achievement emotions and self-efficacy was critical, considering social cognitive learning theory and control-value theory. The current literature focused on the form and the direction of the relationship between the given constructs, and differential findings were obtained for the proposed association. However, the studies were mostly in one-directional that the reciprocal relationship between academic emotions and self-efficacy was discarded. The non-recursive or bi-directional perspective could be adopted to elaborate on the structure of the association between these constructs and confirm the dynamic aspects of the theoretical models.

2.2.2. Teacher Self-Efficacy

In education, teacher self-efficacy is prominent for teacher effectiveness (Bray-Clark & Bates, 2003). In the literature, Guskey and Passaro (1994) defined teacher efficacy as "teachers' belief or conviction that they can influence how well students learn, even those who may be difficult or unmotivated" (p. 4). In the current literature, teacher self-efficacy was given to be related to both teacher and student-level characteristics such as student achievement (Gibson & Dembo, 1984; Ross, Hogaboam-Gray & Hannay, 2001), student motivation (Thoonen, Sleegers, Peetsma & Oort, 2011), teacher burnout and quitting intentions (Brouwers & Tomic, 2000; Wang, Hall & Rahimi, 2015), teacher affect (Ashton, 1984), and psychological well-being of teachers (Zee & Koomen, 2016). Teachers with a higher self-efficacy put an increased effort into their teaching and goal setting processes (Ashton, 1984; Tschannen-Moran, Woolfolk-Hoy & Hoy, 1998; Woolfolk-Hoy & Burke- Spero, 2005). These teachers utilize effective classroom management strategies (Emmer & Hickman, 1991; Woolfolk-Hoy & Hoy, 1990; Woolfolk-Hoy, Rosoff & Hoy, 1990). They also kindly welcome changes and implement new methods and strategies (Allinder, 1994; Guskey, 1988). They persevere more when faced with challenges and difficulties (Gibson & Dembo, 1984) and provide more constructive feedback to struggling students (Gibson & Dembo, 1984). These teachers are less likely to refer children to special education (Meijer & Foster, 1988; Soodak & Podell, 1993). Moreover, teacher self-efficacy was argued to be critical for in-service teachers' professional development, influencing students' learning and achievement (Bray-Clark & Bates, 2003).

Regarding Rotter's (1966) locus of control theory, teacher self-efficacy was studied for the first time by RAND Corporation in the Change Agent Study to examine whether the reinforcement of teachers' efforts was in their control or outside of their control (Guskey & Passaro, 1994; Tschannen-Moran & Woolfolk-Hoy, 2001). Accordingly, two items were asked to assess teacher self-efficacy. Of these items, the expectations of teachers toward the consequences of their teaching were labeled as teaching efficacy and measured by "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environments." Teachers' judgment toward their teaching competence was named as personal teaching efficacy and assessed by "If I really try hard, I can get through to even the most difficult or unmotivated students." Although the sum of these two items reflected teachers' total self-efficacy scores, these dimensions were independent of each other. The first item just considered the external restraints rather than the resources. In contrast, the second item focused on the strengths and neglected teachers' challenges (Tschannen-Moran &Woolfolk-Hoy, 2001).

Parallel to the RAND study findings, Bandura's (1977) social cognitive learning theory focused on the multidimensional structure of teacher self-efficacy. According to social cognitive learning theory, outcome expectations and efficacy expectations would influence individuals' behaviors. In this context, outcome expectations refer to people's judgments about their behaviors' possible consequences just as teaching efficacy dimension in the RAND Study. On the other hand, efficacy expectations purport people's beliefs about their capabilities to accomplish a designated task, corresponding to the personal teaching efficacy dimension (Guskey & Passaro, 1994; Soodak & Podell, 1993; Woolfolk-Hoy & Hoy, 1990). Based upon the RAND Study and Bandura's (1977) conceptualization toward self-efficacy, Gibson and Dembo (1984) constructed a teacher self-efficacy scale with 30 items to measure teacher self-efficacy. Factor analyses yielded two factor-structure in which the first factor was named personal teaching efficacy, while the second factor was named teaching efficacy. However, there were some problems with the clarity and the interpretation of the items on the scale. For instance, the personal teaching efficacy dimension included positive statements starting with the "I" pronoun, which focused on the internal locus. In contrast, the teaching efficacy dimension items consisted of negative items beginning with "teachers," indicating an external locus (Guskey & Passaro, 1994). In this context, the scale's factor structure could be interpreted as internal versus external locus rather than personal teaching versus teaching efficacy dimensions. Considering the scale's problematic nature, Soodak and Podell (1996) shortened Gibson and Dembo's (1984) Teacher Efficacy Scale to 16-items and added 18 new items to the revised version. The factor analyses of the modified version yielded a three-factor structure. Factors were labeled personal efficacy, outcome efficacy, and teaching efficacy, reflecting the multidimensional structure of teacher self-efficacy.

Several instruments were developed by many other researchers to measure teacher efficacy. Accordingly, Teacher Self-Efficacy Scale, including 30 items on a 9-point scale ranging from “nothing” to “a great deal,” was developed by Bandura. The scale consisted of seven sub-scales that focused on measuring teachers’ efficacy in influencing decision-making, influencing school resources, disciplinary efficacy, instructional efficacy, efficacy in forming a positive school climate, community involvement, and parental involvement. The scale attempted to measure teachers’ efficacy with a more global perspective, yet there was no evidence on the instrument’s psychometric properties (Tschannen-Moran, Woolfolk-Hoy, 2001; Tschannen-Moran et al., 1998). Likewise, Tschanen-Moran and Woolfolk-Hoy (2001) developed a new instrument to measure teacher efficacy by asking more specific questions on teachers’ teaching competence. Accordingly, both long and short versions of the Ohio State Teacher Efficacy Scale or also called as Teachers’ Sense of Efficacy Scale (TSES) was proved to be a valid and reliable instrument to assess in-service and pre-service teachers’ self-efficacy on three distinct dimensions: self-efficacy for student engagement, self-efficacy for classroom management, and self-efficacy for instructional strategies. Despite the predominant efficacy measures, attempts to develop proper measures to assess teacher self-efficacy have still been continuing. In this regard, Dellinger, Bobbett, Olivier, and Ellett (2008) developed Teachers’ Beliefs System-Self Form (TEBS-Self) to measure teacher self-efficacy to perform specific teaching and learning tasks in their classrooms successfully. The final TEBS-Self consisted of 30-items on a four-point scale ranging from “very weak belief in my capabilities” to “very strong belief in my capabilities” with a changing factorial structure in each study results of three different studies.

Teacher efficacy is a subject and task-specific construct. To clarify subject-matter specifications, teachers might feel competent while teaching a subject area or working with a specific group of students. In contrast, they might feel less capable while studying other subject areas or working with other students. From this perspective, many scales were developed or adapted to several different languages to measure teacher self-efficacy in various subject domains. These domains, for example, were science (Enochs & Riggs, 1990), literacy (Tschannen-Moran & Johnson, 2011), and mathematics (Alkhateeb, 2004; Cetinkaya & Erbas, 2011; Enochs, Smith & Huinker, 2000; McGee & Wang, 2014). The majority of the efficacy measures were grounded on Bandura's (1977)'s conceptualization of self-efficacy.

In line with social cognitive learning theory, Bandura (1997) set forth four sources of self-efficacy expectations: mastery experiences, vicarious experiences, social persuasion, and physiological arousal. Out of four sources, mastery experiences were the most potent source to predict teacher self-efficacy. It depends on teachers' actions that teacher self-efficacy would raise if they considered their teaching performance successful. In contrast, their self-efficacy would decline if the teaching were perceived as a failure. Vicarious experience, on the other hand, regards the modeling behavior of the observer. That is, if the observer witnesses competent teaching, the efficacy expectation of the observer would increase. Still, suppose the model taught poorly, or the model could not find any common point with the model regarding his gender, experience, race. In that case, the observer's efficacy expectations could not be promoted. Third, teacher self-efficacy could be influenced by social or verbal persuasions as well. Verbal persuasions could be in the form of specific feedback or advice from colleagues and school administrators or students' evaluations, including their enthusiasm for teacher performances. Lastly, physiological and emotional arousal is deemed to be invaluable in forming efficacy expectations of teachers. If teachers experience positive feelings of joy, excitement, and pleasure from their teaching, their self-efficacy would be enhanced. However, if teachers experience negative emotions, such as fear, anxiety, or stress, self-efficacy could be lowered. This situation might lead to incompetency toward their teaching capabilities (Tschannen-Moran &Woolfolk-Hoy, 2007; Tschannen-Moran et al., 1998; Woolfolk-Hoy & Spero, 2005). Therefore, the current literature was reviewed in the following section to understand how teacher self-efficacy and emotions were related to each other.

2.2.2.1. Research on the Relationship between Teacher Self-Efficacy and Academic Emotions

Empirical studies to uncover the possible association between teacher self-efficacy beliefs and their academic emotions were mostly performed with pre-service teachers to improve teaching quality. Although most of the research was in correlational nature, several studies included qualitative aspects for in-depth understanding. For example, Gresham (2009) investigated the relationship between mathematics anxiety and self-efficacy of pre-service teachers. One hundred fifty-six pre-service teachers participated in the study after completing at least two university-level mathematics courses and one elementary grade mathematics content course. To examine the relationship mentioned above, the Mathematics Teaching Efficacy Beliefs Instrument, including two subscales (i.e., personal mathematics teaching efficacy and mathematics outcome expectancy) and Mathematics Anxiety Rating Scale, were administered. Although the combined score of mathematics teaching efficacy was negatively and moderately related to pre-service teachers' mathematics anxiety, no relationship was found between pre-service teachers' mathematics outcome expectancy beliefs and mathematics anxiety. The stated negative association in the first finding might stem from the relationship between mathematics anxiety and personal mathematics teaching efficacy. It was confirmed with the study findings that there was a negative and moderate relationship between pre-service teachers' mathematics anxiety and their personal mathematics teaching efficacy beliefs. That might be interpreted as pre-service teachers who had firm beliefs in their abilities to teach mathematics had lower mathematics anxiety than pre-service teachers who had fewer firm beliefs in their effective mathematics teaching abilities.

In a similar study, Isiksal (2009) inspected the relationship between mathematics anxiety, mathematics teaching efficacy, and mathematics self-concept through a modeling study. Accordingly, 276 elementary school pre-service teachers from two universities in the southwest of Turkey completed the Mathematics Teaching Efficacy Belief Scale and The Abbreviated Mathematics Anxiety Scale. The Mathematics

Teaching Efficacy Beliefs Scale focused on pre-service teachers' mathematics teaching outcome expectancies and mathematics teaching efficacy, like Gresham's (2009) study. The Abbreviated Mathematics Anxiety Scale aimed to determine pre-service teachers' feeling state during a mathematics-related event, including learning mathematics anxiety and mathematics evaluation anxiety sub-scales. According to the results, there was an indirect negative effect of learning mathematics anxiety on pre-service teachers' mathematics teaching efficacy beliefs through their self-concept scores. The relationship was mediated through their lower-self-concept scores. Contrary to the literature, a positive relationship was found between pre-service teachers' mathematics test anxiety and their beliefs about mathematics teaching outcome expectancy.

Swars, Daane, and Giesen (2006) also investigated the relationship between elementary pre-service teachers' mathematics anxiety and mathematics teacher efficacy and pre-service teachers' perception with varying mathematics anxiety levels toward effective mathematics teaching abilities. The participants should have completed an undergraduate mathematics methods course and college mathematics courses before attending the study. Accordingly, 28 elementary pre-service teachers participated in the quantitative part of the study that they were requested to fill out the Mathematics Teaching Efficacy Beliefs Instrument and Mathematics Anxiety Rating Scale. Afterward, pre-service teachers with the highest and the lowest degree of mathematics anxiety were selected for semi-structured interviews for the qualitative part of the study. There was a moderate negative relationship between mathematics teacher efficacy and mathematics anxiety scores of pre-service teachers. The findings were in line with Gresham's (2009) study when examining mathematics anxiety's relationship with each sub-scale of mathematics teaching efficacy. Accordingly, a moderate negative relationship was inspected for pre-service teachers' mathematics anxiety with their personal mathematics teaching efficacy beliefs. That is, pre-service teachers who had lower levels of mathematics anxiety were more likely to have firmer beliefs in their abilities to teach mathematics effectively than pre-service teachers with weaker beliefs in their abilities to teach mathematics. Besides, there was no relationship between pre-service teachers' anxiety and their mathematics teaching outcome expectancies. According to the interview findings, pre-service teachers were more confident and optimistic about mathematics teaching. They portrayed their efficacy toward using real-life situations in their mathematics teaching practices.

Jablon-Stoehr, and Olson (2015) utilized quantitative and qualitative aspects to figure out pre-service teachers' mathematics-related experiences regarding their self-efficacy and anxiety in mathematics. The qualitative research involved semi-structured interviews with three pre-service teachers regarding their mathematics anxiety understood through their mathematic autobiographies. On the other hand, the quantitative study included 53 pre-service teachers selected through teacher education courses. Participants responded to the relevant scales related to mathematics teaching efficacy and mathematics anxiety. Results indicated the significant contribution of mathematics anxiety to explain mathematics teaching efficacy. Accordingly, mathematics anxiety of pre-service teachers was negatively related to their mathematics teaching efficacy. Although preservice teachers expressed low self-efficacy in teaching mathematics, the qualitative study participants mentioned how important it is to help students with high mathematics anxiety. Such kind of teachers was defined as ideal.

Except for mathematics, the possible association between pre-service teachers' self-efficacy and their experienced emotions were also inquired in different disciplines. In this regard, Borrachero, Brigido, Costillo, Bermejo, and Mellado (2013) surveyed how pre-service teachers' self-efficacy and emotions are linked in secondary education physics. For this aim, 178 pre-service teachers in Spain participated in the study. A total of 12 positive and 12 negative emotions were examined in this study. Teacher candidates were asked to indicate whether they would experience pride, confidence, fun, attraction, gratification, joy, enthusiasm, pleasure, motivation, satisfaction, tranquillity, and sympathy as positive emotions. They were also asked to indicate whether they experience anxiety, boredom, anger, concern, fear, depression, frustration, nervousness, hate, pessimism, uncertainty, and sadness as negative emotions during teaching physics. Results showed that pre-service teachers who viewed themselves as qualified enough to possess the necessary physics teaching skills mostly experienced positive emotional states. On the other hand, participants who viewed themselves as less capable of retaining the required skills to teach physics mostly expressed negative emotions.

Likewise, Brigido, Borrachero, Bermejo, and Mellado (2013) focused on the presumable relationship between pre-service teachers' self-efficacy and emotions in teaching science in Spain. Differently, the science was divided into categories of nature and hard sciences. Nature sciences included biology and geology, while hard science comprised of physics and chemistry. Accordingly, pre-service teachers who had higher self-efficacy recalled more positive and less negative emotions in nature sciences and more negative and less positive emotions in hard sciences from their previous experiences. While the relationship was inquired, pre-service teachers who had less self-efficacy experienced more negative emotions in teaching hard sciences. Pre-service teachers who had higher self-efficacy experienced more positive emotions in teaching physics or chemistry.

Chen (2018) modeled the relationship between pre-service teachers' self-efficacy, experienced emotions, and their practicum performances in China. Pre-service teachers completed the Teachers' Sense of Efficacy Scale and the Teacher Emotion Inventory, including two positive and three negative emotional states. Unlike the previous studies, anxiety was not examined in this study that pre-service teachers were asked to identify to what extent they have experienced joy, love, sadness, anger, or fear during their practicum. Confirming the hypothesized relationships, pre-service teachers who had higher self-efficacy for instructional strategies and classroom management tended to have higher scores on their practicum performances by experiencing more positive emotions. In contrast, pre-service teachers who had lower self-efficacy beliefs for the instructional strategies dimension tended to have lower practicum scores through a high level of anger. Furthermore, pre-service teachers who had lower self-efficacy levels for student engagement had lower practicum scores by experiencing high anger, fear, and sadness as negative emotions.

Similarly, Hasher and Hagenauer (2016) explored the relationship between pre-service teachers' openness toward theory, self-efficacy, emotions, and degree of autonomy during their practicum. Accordingly, 117 pre-service teachers studying at an Austrian university took part in the study. The researchers considered pre-service teachers' self-efficacy in general teaching practices. Two different emotional scales, including joy, anxiety, satisfaction, calm, disappointment, and frustration, were employed to examine the experienced emotions during practicum. Results pointed out the experience of enthusiasm and interest as pleasant and nervousness, anxiety, and worry as unpleasant emotions. Furthermore, pleasant emotions were positively predicted by pre-service teachers' self-efficacy beliefs, while pre-service teachers' self-efficacy negatively predicted negative emotions.

De Mauro and Jennings (2016) also studied the relationship between pre-service teaches' self-efficacy and their emotions on 303 pre-service teachers at a public university in the U.S. Teacher Sense of Efficacy Scale was used to measure pre-service teachers' self-efficacy. Furthermore, The Depression Anxiety Stress Scale, including the emotional states of depression, anxiety, and stress, were employed to measure their emotional distress level. Results displayed a significant and negative relationship between pre-service teachers' self-efficacy beliefs and their anxiety and the level of depression during student teaching. In contrast, no significant association was found for stress. As a next step, the predictor role of pre-service teachers' emotions on their self-efficacy was also examined. When pre-service teachers' self-efficacy decreased, they felt more stress and depression. Although anxiety was negatively related to self-efficacy, it did not contribute to explaining pre-service teachers' self-efficacy, which might be due to the close relation of this emotional state to the depression controlled in the regression analyses.

Except for pre-service teachers, ample research is done considering the possible association of self-efficacy and in-service teachers' academic emotions. Regarding the four primary sources of self-efficacy, physiological and affective arousal is essential for in-service teachers' self-efficacy beliefs. Several research pieces were also carried out to understand how self-efficacy sources impact the formation of teacher self-efficacy. From this perspective, Ramirez (2015) examined the factors influential on elementary teachers' mathematics and mathematics teaching self-efficacy in the U.S. The study had included quantitative and qualitative parts, respectively. Participants responded to the items related to their mathematics teaching and mathematics self-efficacy beliefs for the quantitative portion. A group of teachers having high self-efficacy in mathematics and mathematics teaching was selected to be interviewed according to the quantitative findings to understand the contributing factors of self-efficacy. Accordingly, physiological states were influential in teachers' mathematics self-efficacy and vicarious experiences and social persuasions. Under this source category, teachers mentioned their fear of disappointing others and their feelings of belongingness as drivers for motivation during mathematics.

Corroborating the research design of Ramirez's (2015) study, Williams (2009) adopted a mixed-methods design to explore how in-service teachers' self-efficacy was formed through considering their emotions and some other factors. For this purpose, 202 randomly selected primary school teachers in New Zealand participated in the quantitative part and responded to the closed and open-ended questions. Afterward, eight teachers took part in semi-structured interviews for in-depth exploration. The study revealed that teachers' mastery experiences seemed to trigger positive emotional states, which, in turn, contributed to teacher self-efficacy beliefs.

In another study, Buric and Macuka (2017) investigated the bi-directional relationship among in-service teachers' work engagement, academic emotions, and teacher self-efficacy beliefs. One hundred eighteen subject teachers were selected in Croatia; relevant scales were applied to them at different time points. Accordingly, teachers responded to the items related to their work engagement and the experience of love, joy, pride, hopelessness, anger, and fatigue toward their students at two-time points with a six-month interval. At the same time, their self-efficacy was measured at once. Results confirmed several cited literature findings that self-efficacy positively predicted both positive emotions and negatively predicted negative emotions. It might be interpreted as an increase in teacher self-efficacy, corresponding to positive emotions and decreased negative emotions.

Warren and Dowden (2012) also examined the relationship between U.S. elementary school teachers' emotions and self-efficacy. The Depression Anxiety Stress Scale was used to assess teachers' experienced anxiety, stress, and depression levels, and the General Self-Efficacy Scale was used to measure teachers' perceived efficacy. As in previous studies, significant and negative relationships were found between teachers' general self-efficacy beliefs and their level of anxiety, stress, and depression.

In Stephanou, Gkavras, and Doulkeridou's (2013) research, the researchers extended the focus of their study through exploring the relationship between elementary school teachers' emotions, self, and collective self-efficacy, job satisfaction, and the influential role of self and collective efficacy on teachers' experienced emotions and job satisfaction. For this aim, 268 elementary school teachers in Greece took part in the study. Participants responded to relevant items related to job satisfaction and self and collective efficacy. Teachers were asked to specify whether they feel distinct emotions during the school year. These emotions were angry-not angry, anxiety, boredom-not boredom, calmness, cheerfulness, competence, confidence, enthusiasm, encouragement, excitement, happiness, hope, flow- not flow, irritated-not irritated, nervousness-not nervousness, pleasure, and pride. According to the results, as teachers' self-efficacy tended to increase, they had higher collective self-efficacy, higher job satisfaction, and experienced more positive emotions. Moreover, self-efficacy seemed to predict the best confidence, happiness, hope, boredom-no boredom, irritation-no irritation, encouragement, and pleasure among the assessed emotions.

Differently, Etheridge (2016) examined whether mathematics anxiety and mathematics self-efficacy account for elementary grade teachers' mathematical teaching efficacy. Accordingly, 51 elementary level mathematics teachers completed The Mathematics Self-Efficacy Scale, Mathematics Teaching Efficacy Scale, and the Revised Version of the Mathematics Anxiety Rating Scale. Contrary to many studies' findings, mathematics anxiety and mathematics self-efficacy did not significantly explain teachers' mathematics teaching self-efficacy.

2.3. Teaching Quality

As echoed in the definition of communication, teaching requires at least two people to convey knowledge and skills from the one who teaches the one who learns. However, the ways to bring this knowledge may differ that each form demands a changing level of support, competence, energy, and effort from teachers (Fenstermacher & Richardson, 2000). In this regard, plenty of attention may be required to examine teacher quality and teaching quality with a critical lens. Darling-Hammond (2010) asserted that teacher quality might be considered a correct balance between traits, skills, and conceptions people bring to teaching, expectations, and goals reached at the end of the teaching process. In this sense, a qualified teacher needs to know the subject matter and how to transfer it to their students, so they should have a strong sense of competence on what (subject matter expertise) and how to teach (pedagogy) (Cochran Smith, 2003). In line with the definition of teacher quality, teaching quality, on the other hand, could be thought of as fulfilling the needs of students in terms of instructional goals, discipline, and some different requirements that may have a high priority among students. Although teaching quality seems to be highly influenced by teacher quality, there may be times that a high-quality teacher may not provide quality teaching due to the differential demands of the situation. These might be related to the supply of relevant curriculum materials and equipment, provided support, class sizes, and allocated time on teaching (Darling-Hammond, 2010). Therefore, teaching quality has a critical impact on students' learning and achievement (Cochran Smith, 2003) beyond the essential aspects of teacher quality.

In addition to cognitive outcomes such as learning and achievement, affective outcomes could also be shaped by teaching quality, especially when considering the design of learning environments and tasks and employed instructional methods in classrooms (Bieg, Goetz, Sticca, Brunner, Becker, Morger & Hubbard, 2017; Schukajlow, Rakoczy & Pekrun, 2017). The instruction's structure and delivery regarding clarity, difficulty, pace, understandability, teacher enthusiasm, amount of illustration, expectation level, and fostering attention may influence students' control and value appraisals. Each element would induce distinct emotions (i.e., Becker, Goetz, Morger & Ranellucci, 2014; Goetz, Keller, Lüdtke, Nett & Lipnevich, 2019; Goetz, Lüdtke, Nett, Keller & Lipnevich, 2013). In this regard, students' interpretations of their learning environments are influential in their academic emotions (Pekrun, 2006).

In the literature, Klime, Pauli, and Reusser (2009) classified instructional quality into three basic or deep structure dimensions. These are supportive climate, classroom management, and cognitive activation. Through cognitive activation, teachers may provide challenging tasks to their students, facilitate connections with prior knowledge, and promote active participation in tasks. Therefore, students may engage in constructive and higher-order thinking processes. Classroom management is another dimension of instructional quality. According to this dimension, teachers should provide well-structured learning environments guided by clear classroom rules and expectations, which would foster students' academic performance and motivation. Lastly, instructional quality also depends on providing a supportive classroom climate in which positive student-teacher interactions, high tolerance for learning errors, teacher caring, supportive teacher feedback, and constructive manner toward students' learning are undergirded (Brophy, 2000; Klieme et al., 2009)

Given the influence of teacher-student interactions, Hagenauer, Hasher, and Volet (2015) stated that the teacher-student relationship is a multidimensional construct comprised of affective and support dimensions. While support refers to the professional relationships between teachers and students to provide a supportive teaching and learning environment, the affective dimension maintains trustful and warm relationships between these agencies. Therefore, the communication behaviors of teachers become substantially essential to form such relationships. In this regard, teacher immediacy and teacher communication competence are crucial for healthy relationships. Teacher immediacy implies teachers' nonverbal behaviors, including facial expressions, gestures, mimics, voice tone, and eye contact. On the other hand, teacher communication competence refers to the degree of appropriateness and effectiveness of teachers' communication. If teachers effectively convey and receive messages, the likelihood of students' negative emotional experiences would decrease, accordingly (Titsworth, McKenna, Mazer & Quinlan, 2013).

Teacher enthusiasm could also be considered an essential element for instructional quality to provide supportive classroom climates. The literature definitions to explain teacher enthusiasm seem to converge with Keller, Woolfolk Hoy, Goetz, and Frenzel's (2016) description that they classified teacher enthusiasm into experienced and displayed enthusiasm. In displayed enthusiasm, teachers tend to use dynamic and motivating instructional strategies blended with humor and reflect their enthusiasm through facial expressions. For experienced enthusiasm, teachers feel frequent excitement and enjoyment in teaching environments. Regarding this classification, both enthusiasm types are considered essential for effective and high-quality teaching.

From this perspective, a supportive classroom climate is grounded on self-determination theory, which argues for the satisfaction of three basic psychological needs: autonomy, competence, and connectedness (Deci & Ryan, 2012). In line with control-value theory, autonomy refers to students' volitional control and full endorsement of their learning processes, flourishing students' engagement, well-being, and positive emotions. Unless students are given appropriate autonomy support while coping with the challenges beyond their capacities, students' control appraisals would be influenced accordingly, triggering negative emotions (Pekrun, 2006). In addition to autonomy support, teachers may give informative feedback considering students' progress on their goals and competencies rather than demonstrating the performance. They may also provide an optimal level of challenge regarding students' current skills and knowledge (Perry, Turner & Meyer, 2006; Schweinle, Meyer & Turner, 2006). Teachers' guidance and scaffolding attempts to bring children from their current states to the ideal state correspond to Vygotsky's idea of the zone of proximal development, closely related to competency support. Through competency support, students may utilize learning errors and misconceptions as an opportunity for learning (Schweinle et al., 2006). Also, there should be no mismatch between the classroom expectations and students' current knowledge and skills (Linnenbrink-Garcia, Patall & Pekrun, 2016). Scaffolding students' learning might not be as effective as providing competence support in an autonomy-supportive manner that might also emphasize the interaction of the psychological needs (Reeve, Ryan & Deci, 2018).

Connectedness or relatedness is indicated as a psychological need to be accepted and valued by others in self-determination theory. From the perspective of instructional quality, this could be achieved by uncovering the relevance of the topics to real-life situations and students' goals. This approach would also foster students' interpretations toward the utility of the relevant task or activity directly related to their value appraisals argued in the control-value theory (Becker et al., 2014). Besides, teacher caring, use of humor, encouraging cooperation rather than competition may increase students' engagement to the task, their situational interests, and positive affect, particularly positive emotions (Schweinle et al., 2006).

Other than Klime, Pauli, and Reusser (2009), Pianta and Hamre (2009) presented the Classroom Assessment Scoring System (CLASS) as a framework for classroom quality and teacher-student interactions. According to this framework, CLASS is comprised of classroom organization, instructional support, and emotional support dimensions. Elaborating more, emotional support intends to provide a safe and trustful environment for students to increase their motivation and connection. The literature also points out the inspiring role of learning environments on academic learning, so teachers are responsible for providing safe, relaxed, and welcoming learning environments for everyone (Maulana, Helms-Lorenz & Grift, 2017). For this aim, the emotional support dimension addresses teacher sensitivity, positive classroom climate, and teacher regard for students' perspectives. Second, instructional support both focus on the curriculum and the way of effective implementation of the curriculum. To do this, teachers may strive to give timely process feedback to students and regard their higher-order thinking skills. Third and last, the classroom organization dimension focuses on developing students' self-regulatory skills to improve their awareness toward attention, behavior, and time in the classroom.

Based on the preliminaries and corollaries of the control-value theory, there should be guidelines that might be considered for high-quality classes and positive learning and effective outcomes. For this aim, Linnenbrink-Garcia and her colleagues (2016) proposed five main instructional principles to improve students' motivation and emotions, respectively. First, competency support should be provided through structured and explicit instruction nourished with well-selected examples, dividing the instruction into smaller steps, struggling students through smartly challenging work, focusing on the learning, and giving constructive feedback (Leon, Medina-Garrido & Nunez, 2017). Under such conditions, students may experience mastery and feel that they accomplish something beyond their current skills and knowledge. However, as Brophy (2000) asserted, the tasks should be on students' zone of proximal development; otherwise, they may take on too much burden that may result in frustration or confusion on students' minds. Second, students should be given opportunities to take responsibility for their learning and decision-making processes. While providing autonomy support to students, teachers should also consider students' negative feelings and encourage students to reappraise their negative emotions and develop coping strategies (Leon et al., 2017). For this aim, students' choices could be welcomed by giving freedom to decide on the class-related issues such as deciding on with whom and how they would study. Besides, teachers should use a non-controlling language, excluding any pressure or directions during their talk with students (Leon et al., 2017). Third, teachers may address interest and relevancy issues while selecting the learning activities so that students may find connections between the topic and the life itself, which may boost their level of engagement and performances. The authors also mention that such activities may improve students' practices toward mastery goal setting. To do this, teachers may need to adapt their teaching according to learner characteristics. This adaptation may require allocating extra time, pre or re-explain the topics, and employing several different instructional methods (Maulana et al., 2017). In line with this principle, teachers may stress learning rather than the demonstration or competition as the fourth principle. This principle values students' self-improvement more compared to performance display. Therefore, students may be given process feedback continuously by appreciating their strived effort. In this context, Brophy (2000) underlined peers' role in providing constructive feedback to their classmates so that peer-peer interactions may become a tutoring facility among peers. Fifth, the feeling of relatedness or connectedness could be fostered to improve their intrinsic motivation, situational interest, and positive emotions. To illustrate this, teachers' attention or caring to students' interests and feelings, friendliness, and sincerity help students form social and emotional bonds with their teachers (Brophy, 2000; Leon et al., 2017).

2.3.1. Research on the Relationship between Teaching Quality, Self-Efficacy, and Achievement Emotions

Drawing on teaching quality concerns, studies in the literature examined this construct mostly from students' perspectives. For this purpose, students' perceptions toward teaching quality and affective support provided by teachers were regarded. Several research pieces in the literature focused on the relationship between teaching quality, self-efficacy, and students' achievement emotions from K-12 to college.

Sakız, Pape, and Hoy (2012) explored the relationship between middle school students' perceived teacher affective support, academic self-efficacy, academic enjoyment, and academic hopelessness in their mathematics classes. Several teacher characteristics were underlined within the scope of perceived teacher affective support, such as displaying interest, valuing, encouraging, respecting, caring, and setting high expectations for their students. Seventh and eighth-grade middle school students from five middle schools in a Midwestern city of the U.S participated in the study. The findings corroborated the theoretical assumptions that there were positive relationships between perceived teacher affective support, students' academic enjoyment in mathematics, and their academic self-efficacy. In contrast, the abovementioned relationship was negative for students' academic hopelessness in mathematics. Interestingly, there was no significant association between academic self-efficacy and academic enjoyment. This relationship might be suppressed due to the effects of perceived teacher affective support in the proposed model.

Similarly, Sakiz (2017) examined the relationships between perceived teacher affective support, academic enjoyment, hopelessness, anxiety, and academic self-efficacy with science students. Unlike the previous research, Sakiz (2017) tested the hypothesized structural model with the fourth and fifth-grade students in Turkey. Results revealed a positive association between perceived teacher affective support, academic enjoyment, and academic self-efficacy. In contrast, there was a negative relationship between students' academic anxiety and hopelessness in science with their academic self-efficacy and perceived teacher affective support.

In a similar study, Liu, Zhen, Ding, Liu, Wang, Jiang, and Xu (2018) sought the relationship between teacher support, academic self-efficacy, academic enjoyment, and relief in elementary and middle school mathematics classrooms in China.

Regarding teacher support, academic and emotional support dimensions were included in the study. For academic support, students' perceptions toward teachers' care on their learning were considered, while emotion support focused on students' perceptions toward teachers' care on students as human beings. Findings pointed out that teachers' academic and emotional support positively contributed to students' academic self-efficacy, which induced more enjoyment and relief in mathematics. Corresponding to the goals of Liu et al. (2018) study, Sanchez-Rosas and Esquivel (2016) investigated the relationship between self-efficacy, instructional teaching quality, and boredom as a distinct emotion on college students in Argentina. In this study, organization, enthusiasm, support, clarity, illustration/interaction, and rhythm were fundamental components of instructional teaching quality. According to the tested structural model findings, instructional teaching quality was positively related to academic self-efficacy and negatively associated with boredom.

Despite the proposed and tested models for the variables mentioned earlier, most studies considered the relationship between teaching quality and academic emotions. For instance, Sakız (2012) investigated the association between perceived teacher affective support, academic hopelessness, and academic enjoyment in college-level students. Findings corroborated previous research (Sakiz et al., 2012; Sakız, 2017) that perceived teacher affective support was positively related to college students' academic enjoyment and negatively associated with their academic hopelessness.

Ahmed, Minnaert, Van der Werf, and Kuyper (2010) investigated whether perceived social support and mathematics achievement were mediated by middle school students' enjoyment and anxiety. Parent, peer, and teacher provided support were included within the scope of social support. Regarding teacher support, students' perceptions of their teachers' caring, helpfulness, and friendliness were examined with 238 seventh-grade students in Netherland. According to the findings, students' perceptions toward their teachers' provided support in mathematics seemed to positively impact their interest and enjoyment, whereas a negative effect on their math anxiety. Both emotions played a mediating role in the relationship between teacher support and mathematics achievement. Namely, if students viewed their teachers as supportive regarding care, friendliness, and helpfulness, this perception would reflect their emotions, which would also influence their mathematics achievement.

Similarly, Federici and Skaalvik (2014) explored the extent to which middle school students' perceived emotional and instructional support in mathematics were related to their intrinsic motivation, mathematics anxiety, help-seeking, and effort. Emotional and instructional support was given to be separate constructs in the study that emotional support refers to several teacher characteristics such as friendliness, caring, and making empathy. In contrast, instrumental support denotes teachers' more concrete support to facilitate their students' learning. According to the findings, instrumental support was negatively related to math anxiety, whereas emotional support did not significantly explain math anxiety. That might be related to the fact that instrumental support might obscure emotional support's effects on math anxiety. Kunter, Klusmann, Baumert, Richter, Voss, and Hachfeld (2013) examined how teacher-related variables affect instruction and student-related outcomes. More specifically, researchers studied whether teachers' professional competence in terms of their professional beliefs, work-related motivation, self-regulation, and pedagogical content knowledge influence their instruction and student achievement and motivation. Data were obtained from secondary school mathematics classes from a large-scale study in Germany. Accordingly, student perceptions, teacher reports, and task analysis were utilized to assess instructional quality, and student enjoyment was examined as one of the motivational variables under the student-related outcomes. Results indicated higher student enjoyment in mathematics, especially in the classroom of enthusiastic teachers.

Teaching quality was also examined by looking at students' perceptions of teaching behaviors. Accordingly, Goetz, Lüdtke, Nett, Keller, and Lipnevich (2013) explored the relationship between teaching characteristics and students' academic emotions across German, English, physics, and mathematics domains at 8th and 11th-grades in Germany. Students' momentary experiences about their perceptions were grasped at appropriate intervals of class time. Students were asked about their perceptions of eight teaching characteristics. The first four teaching characteristics were labeled supportive presentation style: illustration, enthusiasm, understandability, fostering attention. The rest were labeled excessive lesson demands: difficulty, pace, lack of clarity, and expectation level. Besides, students' enjoyment, anxiety, pride, helplessness, boredom, and anger were assessed. According to the results, supportive presentation style was positively related to pride and enjoyment and negatively associated with helplessness, anger, and boredom. However, there was no relationship between supportive presentation style and experienced anxiety. On the other hand, excessive lesson demands were positively related to helplessness, boredom, and anger while negatively associated with enjoyment and pride. Based on this study, Goetz, Keller, Lüdtke, Nett, and Lipnevich (2019) conducted another study with the same purpose as a different group of participants in another country. Therefore, 9th-grade students from the highest education track in Switzerland participated in the second study. The experience sampling method was applied again in mathematics, English, French and German classes to provide a coherent picture of students' emotions. Accordingly, supportive presentation style was linked to higher enjoyment levels and lower anxiety and boredom levels across each subject domain. Yet, excessive lesson demands were negatively related to student enjoyment and positively associated with boredom and anxiety.

In a different study, Bieg, Goetz, Sticca, Brunner, and Becker (2017) sought the influence of teaching methods on students' discrete academic emotions (i.e., pride, enjoyment, anxiety, boredom, and boredom) in high school mathematics classes. The perceived choice and pace of instruction intervened in the proposed relationships between emotions and teaching methods. For this aim, students' momentary experiences over two weeks in a semester were obtained by the experience-sampling approach. According to the findings, direct instruction was related to a lower level of student enjoyment and a higher level of boredom than working individually and in small groups or pairs. Working individually and in small groups/pairs were linked to relatively higher enjoyment and pride than direct instruction. However, there was no remarkable difference in levels of anxiety and anger regarding those teaching methods. Besides, discrete emotions were also accounted for by the perceived choice and perceived pace of instruction, indicating control-value appraisals' indirect effects. The perceived choice positively predicted positive emotions, while the perceived pace of instruction negatively predicted enjoyment and positively predicted negative emotions. Likewise, Becker, Goetz, Morger, and Ranellucci (2014) employed an experience-sampling approach to examine the relationship between teachers' instructional behavior and their students' academic emotions in four different subject domains, including mathematics. High school students from the most elevated educational track in Switzerland participated in this study. Results unraveled that teachers' instructional behavior was related to their students' anger and enjoyment; however, there was no relationship between teachers' instructional behaviors and students' anxiety.

Lazarides and Buchholzb (2019) also studied the relationship between high school students' perceived teaching quality and their anxiety, boredom, and enjoyment in mathematics. As an extension of the Program for International Student Assessment (PISA) 2003, in Germany, PISA participants are reassessed one year later, and this study is called a PISA-I-Plus study. For this purpose, the researchers examined perceived teacher support, classroom management, and cognitive activation under the scope of perceived teaching quality in 9th-grade students from the PISA-I-Plus study. One year later, students' enjoyment, anxiety, and boredom in mathematics were measured. Multilevel regression analyses were done to understand the proposed relation at the student and classroom level. According to the results, perceived teacher support and classroom management were negatively linked to boredom and anxiety in mathematics at student and class level. Besides, perceived cognitive activation, teacher support, and classroom management were positively related to student enjoyment in mathematics at the class-level.

Frenzel, Pekrun, and Goetz (2007) also studied the relationship between 5^{th} to 10^{th}-grade students' classroom environment perceptions and their academic emotions in mathematics. According to the frequency and salience of emotions in the literature, the researchers focused on enjoyment, anger, anxiety, and boredom. In this study, the perceived quality of mathematics instruction was one of the dimensions of the perceived classroom environment. Corroborating the stated hypotheses, students experienced more enjoyment and less anger and boredom if the instruction quality was high in mathematics classes. Besides, the high quality of math instruction seemed to dampen students' anxiety in mathematics.

Muntaner-Mas, Vidal-Conti, Sese, and Palou (2017) sought the relationship between perceived control, perceived teaching skills, academic emotions, and university students' achievement in Spain. Given the association between perceived teaching skills and academic emotions, teaching skills addressed teaching methodology, the course's design, teachers' attitude, consistency among teaching resources, and the system of information and evaluation. At the same time, enjoyment, hope, anxiety, and shame were studied in this study. Results showed a strong positive correlation between teaching characteristics and enjoyment and hope, whereas no significant relationship was inspected for other negative academic emotions.

2.4. Teacher Burnout

The term "burnout" had been used to define people's drug addiction, especially in the 1960s (Seferoğlu, Yıldız & Avcı Yücel, 2014). In social sciences, Herbert Freudenberger (1974) coined this term for the first time to describe emotional exhaustion of people and described it as "the state of physical and emotional depletion resulting from conditions of work" (p. 160). Also, burnout was described by Christina Maslach (1993) as a "psychological syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment that can occur among individuals who work with other people in some capacity" (p. 20). According to this definition, emotional exhaustion as the hallmark of this syndrome (Maslach, 1993) refers to exploiting emotional resources, drain feeling, and tiredness on people. Depersonalization was viewed as a kind of interpersonal burnout, including physical or emotional isolation from colleagues, friends, and family, displaying cynical attitudes, and viewing people around as objects. Reduced personal accomplishment, on the other hand, is like a feeling of ineffectiveness, inadequacy, and inefficiency that people put fewer efforts into removing challenges on their lives, which, in return, harm their work productivity and considerable influence on the experience of hopelessness toward the overall accomplishment at work (Maslach & Jackson, 1981).

Several models were proposed in the literature to explain the arousal of burnout in detail. First, Golembiewski, Munzenrider, and Stevenson's (1986) Phase Model asserted the differentiation of burnout dimensions toward the low and high spectrums and the occurrence of this syndrome in eight phases or sequences; in other words, people undergo different stages in order when they have been getting burned out. Golembiewski et al. (1986) also specified that although professional detachment is suitable to some degree in a working environment, extreme detachment level turns out to be a depersonalization state keeping people from forming a healthy relationship with others and reduces their sense of accomplishment. Accordingly, emotional exhaustion would occur due to the increased level of depersonalization and decreased personal accomplishment. In Leiter and Maslach's (1988) model, on the other hand, emotional exhaustion occurs first in people and results in an increased level of depersonalization. Contrary to the linkage between these two dimensions, the diminished personal accomplishment level is apt to develop separately in this model. Having built on these two models, Lee and Ashforth's (1993) model had a comparative perspective. Upon considering the relationship between burnout components, emotional exhaustion and depersonalization were positively related to each other. The personal accomplishment dimension was directly influenced by emotional exhaustion and indirectly affected by the depersonalization dimension.

Along with the scrutinized models, several scales in the literature aim to measure the people's burnout degree. Maslach Burnout Inventory (MBI) is the most known scale in the field, comprised of three burnout dimensions: emotional exhaustion, depersonalization, and personal accomplishment. The instrument supports the multidimensional nature of burnout syndrome. The Copenhagen Burnout Inventory, on the other hand, was developed by Kristensen, Barritz, Villadsen, and Christensen (2005) as a criticism of MBI and the model adopted by this instrument. The authors of this inventory differentiated the burnout as general and specific burnout. The Copenhagen Burnout Inventory was composed of three burnout subdimensions: personal burnout (measuring people's physical and psychological exhaustion, six items), work-related burnout (measuring the burnout symptoms of people due to the factors related to their work, seven items), and client-related burnout (measuring the burnout symptoms of people due to the aspects related to the people they work, six items). Although Burnout Measure, which Pines and Aranson (1988) developed, was not grounded on a theoretical framework, burnout was viewed as a multidimensional construct as in the previous scales. According to Pines and Aronson's (1988) view, burnout was regarded as people's physical, emotional, and mental exhaustion state. While physical exhaustion refers to the state of energy deployment, chronic tiredness, and people's fatigue, emotional exhaustion points out the hopelessness and helplessness. Lastly, mental exhaustion underlines people's negative attitudes toward themselves, their work, and life itself.

Considering the models and the scales developed to measure burnout syndrome, people in professions requiring a continuous face-to-face interaction with others like nurses, doctors, police officers, social workers, and teachers are under the high-risk group of this syndrome (Maslach & Jackson, 1981; Schwab & Iwanischi,1982). More specifically, Johnson, Cooper, Cartwright, Donald, Taylor, and Millet (2005) compared people's occupational stress levels among 26 occupations. The findings highlighted the stressful nature of teaching among the six most stressful works (e.g., ambulance workers, police officers, prison officers, social services, call centers, customer services) considering their physical and psychological well-being and job satisfaction. It is not surprising to refer to the fact that many teachers suffer from burnout syndrome and confront its severe physical and psychological consequences when thinking about the teaching profession's emotional and social endeavor. These consequences are the increased level of psychosomatic illnesses, cardiovascular problems, depression, insomnia, aggression, and negative emotions (i.e., anger, frustration, hopelessness, anxiety), the increase in the habits of alcohol use and the smoking behaviors, the feeling of inability, dissatisfaction toward the profession, and a considerable decrease on teaching quality, absenteeism, alienation and negative attitude toward the personal identity, and finally leading attrition of teachers from their jobs (Chan, 2007; Cherniss, 1993; Çağlar, 2011; Frenzel & Stephens, 2013). Teacher burnout stems from several macro and micro-level factors (Cephe, 2010; El Helau, Nabhani & Bahouri, 2016; Kelchtermans & Strittmatter, 1993; Kottler, Zchm & Kottler, 2005; Watts & Robertion, 2011). Along with the current literature, teachers might suffer from burnout due to classroom-related issues such as overcrowded classrooms, discipline problems in classes, students' lower levels of achievement, lack of learning sources, materials and infrastructure (Bümen, 2010; Demirel & Cephe, 2014; Durak & Seferoğlu, 2017; El Helau et al., 2016; Gavish & Friedman, 2010; Hastings & Bham, 2003; Payne McLain, 2005; Özdemir, 2009; Sezer, 2012), school-related factors such as the relationships among school administration, colleagues and parents, excessive work-load and work-hours (Akyüz & Kaya, 2014; Cephe, 2010; Çağlar, 2011; Demirel & Cephe, 2014; Dorman, 2003; El Helau et al., 2016; Girgin, 2010; Kokkinos, 2007; Mahmoodi-Shahrebabaki, 2015; Payne McLain, 2005; Seferoğlu et al., 2014, Zhoucun, 2011), or problems related to curriculum and instruction including pressure of exams, the knowledge deficits upon using textbooks and carrying out classroom activities (Zhouchun, 2011), government-related factors including lack of support for the professional development activities, teachers' living conditions regarding the rate of income and salaries (Akyüz & Kaya, 2014; Cephe, 2010; Demirel & Cephe, 2014; El Helau et al., 2016; Hismanoğlu & Ersan, 2016; Mahmoodi-Shahrebabaki, 2015; Payne McLain, 2005; Zhouchun, 2011). Lastly, individual-related factors might induce teacher burnout. These might be related to their gender (Akyüz & Kaya, 2014; Babaoğlan, 2007; El Helau et al., 2016; Sarıçam & Halis, 2014; Seferoğlu et al., 2014; Sezer, 2012; Yorulmaz & Altınkurt, 2018), marital status (Cemaloğlu & Şahin, 2007; Çağlar, 2011; El Helau et al., 2016; Girgin, 2010; Kırılmaz, Çelen, & Sarp, 2003; Yılmaz & Altınkurt, 2018), teaching experience (Akyüz & Kaya, 2014; Bümen, 2010; Cemaloğlu & Şahin, 2007; El Helau et al., 2016; Gavish & Friedman, 2010; Girgin, 2010; Hismanoğlu & Ersan, 2016; Koruklu, Feyzioğlu, Özenoğlu-Kiremit & Aladağ, 2012; Mede, 2009; Sezer, 2012), grade level and the subject area taught (Arvidsson, Hakansson, Karlson, Björk, & Persson, 2016; Babaoğlan, 2007; Cemaloğlu & Şahin, 2007; Çağlar, 2011; Durak & Seferoğlu, 2017; El Helau et al., 2016; Girgin, 2010; Sarıçam & Halis, 2014; Seferoğlu et al., 2014; Sezer, 2012), professional qualifications of teachers (Akyüz & Kaya, 2014; Kırılmaz, Çelen, & Sarp, 2003), expectations and motivation to teach (El Helau et al. 2016; Girgin, 2010; Kırılmaz et al., 2003), emotional demands of teaching profession (El Helau et al., 2016).

People’s emotions might be transferred to others through facial expressions, postures, and movements considering emotion contagion theory (Hatfield, Cocioppe & Rapson, 1994). Besides, a person might catch another person’s feelings by imagining herself/ himself in the presumed position that is also considered an emphatic concern that teachers might share their colleagues’ or students’ feelings (Bakker & Schaufeli, 2000). As in conveying emotions, the burnout syndrome might hold a contagion effect that might be reflected upon other education agents such as colleagues and students (Friedman & Farber, 1992). Therefore, students of teachers experiencing burnout might be influenced accordingly (Dorman, 2003; Girgin, 2010; Maraşlı, 2005; Seferoğlu et al., 2014).

Consequently, Oberle and Schoret-Reichl (2016) studied the relationship between classroom and middle school teachers' burnout and their students' salivary cortisol levels as physiological indicators of stress. It was hypothesized that the fourth and the seventh-grade students' higher salivary morning cortisol levels would be predicted by their teachers' higher levels of burnout. Students' morning cortisol levels were significantly predicted by their teachers' high emotional exhaustion levels and depersonalization after controlling for the factors related to age, gender, and wakening time, indicating the reciprocal relation between students and their teachers' stress levels.

Bakker and Schaufeli (2000) studied with Dutch teachers to reveal the extent to which the burnout syndrome is transferred to other teachers. The findings pointed out two high-risk conditions that teachers might be emotionally exhausted and experience depersonalization toward their students. Suppose they were highly susceptible to others' emotions, and they were exposed to colleagues' dialogs mostly related to student and work-related problems. In that case, they may be emotionally exhausted and feel depersonalization. In this regard, burnout might also reflect transferable structure among people. The strategies to cope and manage with emotions and teacher self-efficacy might substantially impact teacher burnout as in their academic emotions.

2.4.1. Research on the Relationship between Teacher Burnout and Teacher Self-Efficacy

Burnout was portrayed "as a crisis of self-efficacy"(Leiter, 1993, as cited in Yu et al., 2015) that people's repeated failure at work are generally reflected itself on the reduced efficacy levels (Bandura, 1997), which in return, may increase the risk of being burned out (Friedman, 2003). Since people's physiological and affective states heavily influence self-efficacy, it is plausible to posit that teachers' burnout degrees might be easily influenced by their self-efficacy (Bandura, 1997). Based upon this conception, teacher burnout and teacher efficacy variables were included in many scale development studies to validate the corresponding scale (Schwarzer, Schmitz & Tang, 2000; Skaalvik & Skaalvik, 2007, 2010).

In Skaalvik and Skaalvik's (2007) study, for example, the researchers sought the strength of the relationship between the newly developed teacher self-efficacy scale and teacher burnout and testing the factor structure of this scale on 244 elementary and middle school teachers in Norway. Accordingly, a moderate indirect relationship was found between burnout and perceived collective teacher efficacy which was mediated through teacher self-efficacy. In addition to this study, Skaalvik and Skaalvik (2010) re-examined the recently developed teacher self-efficacy scale factor structure. They explored the relations between collective teacher efficacy, teacher self-efficacy, teacher burnout, job satisfaction, and teachers' perceptions toward school context and teachers' beliefs toward the external factors preventing teacher accomplishments. For this purpose, 2249 elementary and middle school teachers in Norway participated in the study. Regarding the findings, negative relationships were inspected among teacher self-efficacy and emotional exhaustion and depersonalization dimensions of burnout.

The psychometric properties of burnout measures were also examined in different cultures. Accordingly, teacher self-efficacy was included in the relevant studies to provide further validity evidence through the presumed interrelation. For example, Schwarzer, Schmitz, and Tang (2000) cross-validated their findings on burnout measures with teachers from Hong Kong and Germany. According to the results, both Chinese and German teachers with firmer self-efficacy were less burned out. Simultaneously, the relationships were negative for depersonalization, emotional exhaustion and positive for personal accomplishment.

Except for the scale validation studies, various research was conducted to determine the relationship between burnout and teacher self-efficacy. In this perspective, Friedman (2003) studied the interrelationship between burnout and perceived self-efficacy among 322 Israeli teachers. Teacher efficacy consisted of classroom efficacy, including efficacy for instruction, human relations efficacy and discipline control efficacy, and organization efficacy, comprised of interpersonal relations efficacy and organizational task efficacy. Results pointed out that teachers with lower self-efficacy suffered from burnout more. Both dimensions of the organization efficacy made substantial contributions to explain teachers' perceived burnout. In contrast, dimensions related to classroom efficacy did not significantly predict depersonalization, emotional exhaustion, and reduced personal accomplishment dimensions of burnout.

Tabatabaee-Yazdi, Motallebzadeh, and Ashraf (2014) also examined the relationships between English as a Foreign Language teachers' self-efficacy and their burnout in Iran. In their study, teacher efficacy involved the efficacy in influencing decision making, disciplinary efficacy, efficacy to enlist parental and community involvement, instructional efficacy, efficacy to create a positive school climate, and efficacy in influencing decision-making components. Maslach's burnout model was used to assess teacher burnout, including depersonalization, emotional exhaustion, and reduced personal accomplishment dimensions. Based on the correlational analysis results with 616 teachers, both efficacy dimensions were inversely related to teachers' total burnout scores. Total teacher efficacy was also inversely related to emotional exhaustion and depersonalization scores of teachers. In contrast, teachers' personal accomplishment scores positively related to their total efficacy scores. In addition to these findings, linear regression was performed to determine the predictive role of self-efficacy on teacher burnout. Accordingly, teacher self-efficacy was a negative predictor of burnout, accounting for 40% of the variance. Besides, instructional self-efficacy and self-efficacy in creating a positive school climate among teacher efficacy dimensions made the most substantial contributions to explain teacher burnout, respectively.

In another study, Savaş, Bozgeyik, and Eser (2014) investigated the relationship between teacher self-efficacy and teacher burnout in a total of 163 primary and secondary school teachers working in Gaziantep. After controlling for the sex, teaching experience, and age variables, the hierarchical regression analysis findings revealed a negative association between teacher self-efficacy and teacher burnout levels. Teachers were more likely to be burned out as their sense of efficacy beliefs tended to decrease. Corresponding to Savaş et al.'s (2014) study, Bümen (2010) studied for the same purpose and attempted to determine the extent to which the self-efficacy dimensions predict teacher burnout. 179 primary and 622 secondary school teachers in İzmir participated in the study. According to the results, teacher self-efficacy for instructional strategies, self-efficacy for student engagement, and self-efficacy for classroom management were inversely related to depersonalization, emotional exhaustion, and reduced personal accomplishment. In addition to this finding, the personal accomplishment dimension was explained by both efficacy dimensions. In contrast, self-efficacy for student engagement solely accounted for the emotional exhaustion of teachers.

Gastaldi, Pasta, Longobardi, Prino, and Quaglia (2014) also sought the relationship among efficacy and burnout variables, including the perceived level of closeness, conflict, and teachers' dependence, students' achievement, and effort. Thirty-seven primary school teachers in Italy participated in the study. Burnout was measured through MBI, while efficacy was measured by considering efficacy in class context and efficacy in school context dimensions. Findings unraveled a negative relationship between depersonalization and emotional exhaustion dimensions of burnout and class self-efficacy, while the personal accomplishment dimension was positively related to class self-efficacy. This result means that any increase in teacher self-efficacy beliefs in classroom contexts leads them to feel less emotionally exhausted and detached and experience more satisfaction in their jobs. On the other hand, for school self-efficacy, the relationship was significant and positive for only the personal accomplishment dimension.

Evers, Brouwers, and Tomic (2002) also investigated the relationship between the constructs mentioned above from a different perspective. In their study, the researchers tested the hypothesis toward the structure of the relationship between self-efficacy and burnout among teachers who held negative attitudes toward the use of differential instructional practices in their classrooms. In this regard, 490 teachers working in the upper grades of higher general secondary education in Netherland participated. The Dutch version of MBI for teacher and researcher-developed self-efficacy questionnaire and attitude scale to assess teacher attitudes toward the usefulness and the effectiveness of the study-home as an educational innovation was used to collect data. The hierarchical regression analysis was performed to uncover the predictable role of teacher self-efficacy beliefs toward guiding student groups, including students to classroom tasks and employing innovative practices in education. The findings revealed that the efficacy significantly explained the emotional exhaustion after controlling for the sex, age, teaching experience, the number of hours allocated to spend at schools, and the percentage of lesson time set by teachers for teacher-centered practice variables. In contrast, the depersonalization dimension was partly explained by teacher self-efficacy for guiding student groups and using innovational practices. In addition to this, the direction of the relationships was negative for the abovementioned variables. On the other hand, the personal accomplishment dimension was significantly explained by both efficacy dimensions.

Contrary to previous studies, Sarıçam and Halis (2014) investigated the relationship between teacher self-efficacy and burnout among 118 professionals working in special education schools and rehabilitation and special education centers in Turkey. For this aim, the researchers proposed a theoretical model to test the presumed relationship through structural equation modeling. The results yielded a negative relationship between teacher self-efficacy and emotional exhaustion, depersonalization, and teachers' total burnout scores. Besides, personal accomplishment was positively related to teacher self-efficacy. Furthermore, both burnout dimensions were significantly predicted by special education teachers’ self-efficacy beliefs. In contrast, the emotional exhaustion as the strongest dimension preceded the other burnout domains in this prediction.

Similarly, Egyed and Short (2006) examined the relationship between teacher self-efficacy and burnout to decide on the child’s referral for special education placement. One hundred six elementary classroom teachers from urban, suburban, and rural districts in the U.S. participated in the study. The correlational analyses between subscales of burnout and teacher efficacy resulted in negative associations between personal teaching efficacy and depersonalization and teachers’ total burnout scores. Simultaneously, there was a positive relationship between personal teaching efficacy and the personal accomplishment dimension of burnout.

As well as describing the possible relationship between teacher self-efficacy and burnout, the mediator or moderator role of self-efficacy on teacher burnout was also questioned in the literature. In this regard, Yu, Wang, Zhai, Dai, and Yang (2015) attempted to uncover the role of job stress on burnout levels of 387 middle school teachers through assessing the mediator role of their efficacy beliefs. The findings verified the partially mediating role of self-efficacy for the association between job stress and burnout. Namely, teachers with lower self-efficacy tend to make external attributions for their teaching accomplishments, more likely to ignore their ability effort, and employ ambiguous techniques to combat the challenges. As a result of being incompetent in providing classroom discipline, teachers became more anxious. They felt more fear, which, in return, led them to display alienation toward teaching and their students. As a result, they experienced higher levels of depersonalization and emotional exhaustion.

Betoret (2006) focused on perceived self-efficacy and school coping resources, and teachers’ support to fulfill their work on job stressors and burnout. The mediator or moderator role of self-efficacy and school coping resources on the relationship between job stressors and sense of burnout. Data were collected from 247 secondary school teachers in Spain. Teachers' perceived self-efficacy and the presence of school coping resources seemed to moderate job stressors' influence on their burnout levels. Teachers who had high self-efficacy and available equipment and support in qualified school personnel suffered less from burnout or felt less stress. On the other hand, teachers who had low self- efficacy and insufficient coping resources felt more pressure and burnout.

In Lauermann and König's (2016) study, the researchers explored the reciprocal relation between teachers' professional competence and burnout. Teachers' sense of efficacy beliefs and their general pedagogical knowledge were regarded under in-service teachers' professional competence. A total of 119 elementary and secondary school teachers from Germany took part in this study. The mediation analysis revealed the direct and indirect effects of teachers' general and teaching specific efficacy and their general pedagogical knowledge on teacher burnout. Accordingly, general and teaching specific efficacy were negatively associated with depersonalization, emotional exhaustion, and reduced personal accomplishment dimensions of burnout, but teaching specific efficacy was the only significant negative predictor of teacher burnout. On the other hand, teaching specific efficacy mediated the negative predictive effects of general pedagogical knowledge on teacher burnout. More specifically, the findings pointed out the ameliorating role of teaching specific efficacy on teacher burnout.

Khani and Mirzaee (2015) also determined the relationship between Iranian English as a Foreign Language teachers' self-efficacy, burnout, several stressors, and contextual variables. In this study, self-efficacy was used as a moderator variable. The findings yielded negative relationships between self-efficacy for instructional strategies, student engagement, and classroom management with depersonalization and emotional exhaustion dimensions. The correlations between depersonalization and efficacy dimensions were relatively stronger than the emotional exhaustion dimension relationships. As a moderator variable, self-efficacy also reduced the direct effects of stressors and contextual variables on teacher burnout. To sum up, teachers who employed differential instructional strategies in the classrooms were more successful in managing student behavior and learning, resulting in less emotional exhaustion.

There are also longitudinal studies in the literature with pre-service and in-service teachers to portray the possible relationship among the stated variables beforehand. To clarify this, Fives, Hamman, and Olivarez (2007) explored student teachers' development in the southwestern part of the U.S. regarding some background, organizational, and individual characteristics. Data were gathered from 49 student-teachers twice in the same academic semester during their student-teaching practicums. Besides, there was a three weeks gap between the duration of the two implementations. Self-efficacy was assessed in this study to understand the extent of its relationship with burnout. According to the findings, student teachers' self-efficacy for instructional practices and self-efficacy for classroom management was negatively related to their depersonalization at Time 1. Interestingly, self-efficacy for instructional strategies, classroom management, and student engagement were inversely associated with depersonalization and emotional exhaustion at Time 2. In addition to these findings, there was a positive relationship between the personal accomplishment dimension of burnout and self- efficacy for instructional strategies and self-efficacy for student engagement.

Dicke, Parker, March, and Kunter (2014) carried out a longitudinal study with pre-service teachers in Germany. The aim was to investigate the extent to which teachers' emotional exhaustion could be predicted by self-efficacy for classroom management, mediated through classroom disturbances. Second, to what extent did the stated mediation be moderated by self-efficacy levels for classroom management. One thousand two hundred twenty-seven teachers participated in the first study. After one year, a random subsample from the first sample participated in the second study. According to the findings, classroom disruptions regarding their self-efficacy for classroom management significantly predicted pre-service teachers' emotional exhaustion. The mediation was more robust for pre-service teachers with lower levels of self-efficacy. Schwarzer and Hallum (2008) also inquired about lessening burnout's degree, considering initial self-efficacy levels for classroom management. The first part of the study explored to what extent the burnout would be predicted by teacher self-efficacy. Teacher self-efficacy was mediated through job stress. A subsample of teachers from the former stage was selected to examine the same research question longitudinally. The questionnaires were employed to 1203 teachers from Germany and Syria. Teacher self-efficacy and general self-efficacy were specified as the precursors of emotional exhaustion and depersonalization of teachers. At the same time, job stressors mediated self-efficacy, especially for the teachers with lower general self-efficacy. Accordingly, teachers' general self-efficacy beliefs moderated the proposed mediation from teacher self-efficacy to burnout through job stress.

Brouwers and Tomic (2000) collected data from secondary school teachers in Netherland at two different time points to uncover the association between perceived self-efficacy for classroom management and burnout domains. For this aim, 558 secondary school teachers participated in the first phase, and five months later, 243 teachers were re-administered to the questionnaires for the second phase of the study. Accordingly, a conceptual model was tested through structural equation modeling, which yielded a longitudinal effect on the depersonalization dimension and personal accomplishment impact. Besides, teachers' perceived self-efficacy for classroom management was inversely related to their sense of burnout. Contrary to the previous studies, emotional exhaustion significantly predicted teacher self-efficacy for classroom management.

Dicke, Parker, Holzberger, Kunina-Habenicht, Kunter, and Leutner (2015) also conducted a longitudinal study to identify the role of teacher self-efficacy in coping with stressful situations and the structure of the relationship between self-efficacy and emotional exhaustion. Accordingly, teachers from primary schools, vocational high school tracks, and university high school tracks in Germany participated in the study at two-time points. One thousand seven hundred forty teachers who were in their induction years participated in time wave 1. After one year, 362 teachers from the participants of the previous phase participated in time wave 2. Latent change modeling analysis was performed to understand within-person change on the fluctuation of teacher self-efficacy and emotional exhaustion during teachers' induction phase. Between-person change to figure out how emotional exhaustion, teacher self-efficacy, and their differences are related. The findings revealed that teachers displaying substantial emotional exhaustion increases were more likely to display increases or declines in teacher self-efficacy. In contrast, teachers who exposed slight increases or reductions in emotional exhaustion would have substantial self-efficacy increases. On the other hand, initial self-efficacy did not contribute to explaining the changes in emotional exhaustion. However, this case was not valid for the initial emotional exhaustion. It significantly predicted teacher self-efficacy changes, so self-efficacy changes were highly related to emotional exhaustion at time wave 1.

Tang, Au, Schwarzer, and Schmitz (2001), on the other hand, integrated both cross-sectional and longitudinal designs in their study. In the first study, the interrelation between burnout, stress resource factors, and negative mental health was cross-sectionally examined among 269 Chinese teachers. The findings yielded a negative association among burnout, proactive attitude, and self-efficacy as a resource factor in which the given association directly affected negative mental health. The direction of the relationships was re-examined after six months with a different group of participants. The longitudinal study results posited the impact of self-efficacy on only burnout (emotional exhaustion and depersonalization components), not for mental health status variables. Teachers' burnout experiences directly affected negative mental health status.

Contrary to the studies with associational research design, Brown (2012) examined the relationship between teacher self-efficacy and burnout through a systematic review.

Eleven unpublished studies were sought to unfold the nature and structure of this relationship. Accordingly, there was a negative relationship among teacher depersonalization and self-efficacy postulating that teachers with lower self-efficacy would be more detached toward teaching. In contrast, ten of the studies found a negative relationship between teachers' emotional exhaustion and their sense of efficacy beliefs. Out of 11 studies, six studies found a negative relationship between teacher self-efficacy and reduced personal accomplishment. It should be noted that the strength of the relationship was also higher for the depersonalization than the other two burnout dimensions.

Similarly, Aloe, Amo, and Shanahan (2014) focused on the relationship between perceived self-efficacy for classroom management and teacher burnout by conducting a multivariate meta-analysis. For this aim, the researchers searched for the literature to decide which studies to include regarding three essential criteria. Accordingly, studies written in English underlying the relationship between three burnout dimensions and classroom management self-efficacy of in-service teachers would be included. A moderate association was inspected between three dimensions of burnout and classroom management self-efficacy from 16 reviewed studies. Besides, classroom management efficacy was negatively related to emotional exhaustion and depersonalization. Namely, teachers' depersonalization and emotional exhaustion were more likely to increase as their self-efficacy for classroom management tended to decrease. Possessing the strongest relationship among the findings, teachers with higher self-efficacy for classroom management would feel more accomplished in their jobs.

As stated in the theoretical part of the given construct, teachers might quit from their jobs if they experience burnout at the extreme points. Accordingly, Hong (2012) attempted to explore the burnout from stayers' and leavers' perspectives on a qualitative study. In-depth interviews were held with seven teachers and seven former teachers in the U.S. to portray how these two groups were differentiated from each other. Their self-efficacy, beliefs, values, emotions, and how those psychological constructs shaped their decisions to leave their careers were considered. Although both leavers and stayers expressed their internal motivation for being a teacher and the same challenges on the issues related to classroom management and instruction, the former group reported weaker self-efficacy, high stress, and emotional burnout. People in this group attributed their failure to internal factors such as personality. On the other hand, the latter group of teachers had higher self-efficacy and more successfully applied strategies to remove their challenges. This study findings shed light on the prominence of a different construct, emotion, on the arousal of burnout among teachers because the emotional demands placed on teachers might impose a burden on them (Fiorilli, Albenese, Gabola & Pepe, 2017).

Overall, the reviewed researches to portray the relationship between teacher burnout and teacher self-efficacy unveiled an inverse relationship between these two constructs. Although there might be exceptions in the literature regarding the design, group of participants, and employed measures, current research mostly refers to a negative association between depersonalization, emotional exhaustion, and reduced personal accomplishment dimensions of burnout with teacher self-efficacy.

2.5. Summary of Review of Literature

Throughout their academic lives, students feel a range of emotions. From a domain-specific perspective, many students consider mathematics a complicated subject that might trigger the arousal of distinct emotions; however, little is known about such emotions except for anxiety. Pekrun's (2006) control-value theory hypothesized several antecedents of achievement emotions: self-efficacy, or students' beliefs about their academic capabilities (Bandura, 1986), and cognitive and motivational quality of teaching through teacher support. In the literature, studies mostly focused on bidirectional relationships among described variables regarding the valence of emotions. As the teaching quality increased, students' self-efficacy would increase, which would induce positive emotions. However, the decline of teaching quality would decrease students' competency beliefs toward a given task and students experience negative emotions. The findings seemed to be consistent across the studies; however, most of the research was done in individualist cultures such as Germany and the U.S. Therefore, there is a need to seek the relationship between self-efficacy, teaching quality, and achievement emotions in mathematics in different cultures.

In addition to student emotions, teacher emotions are crucial as teachers experience distinct emotions during their professional careers. Regarding the emotion contagion theory, feeling states of teachers may be influential on students' emotions. The studies in this era would provide invaluable insights about student-teacher relationships. However, current research is yet to be developed. Studies mostly focused on specific emotions, and the findings did not give consistent results.

In line with emotion research, the current literature addressed the relationship between teacher self-efficacy and teacher emotions. As in student emotion research, the studies were mostly in bidirectional nature in teacher emotion research. Teachers with high self-efficacy experienced positive emotions more, whereas teachers with low self-efficacy experienced negative emotions. However, it should be noted that there are inconsistent findings among the sorted literature.

Burnout, which was also examined in this study, refers to the emotional exhaustion of people whose professions require a continuous relationship with others and might result in negative physical and psychological consequences. As teaching requires continuous interaction with many others, teachers are at the risk of this syndrome. Experience of teacher burnout might yield reduced teacher self-efficacy that might be detrimental for teacher-related outcomes.

This study would provide an opportunity to investigate the hypothesized relationships through the lens of multiple groups. Accordingly, the goals of the study were three-fold: First, the relationship between middle school mathematics teachers' self-efficacy, burnout, and academic emotions was examined. Second, the relationship among middle school students’ mathematics emotions and their mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and mathematics teachers’ emotions were investigated. Third, the reasons behind student emotions were inquired in detail to bring a holistic understanding of student emotions.

CHAPTER 3

METHOD

This chapter scrutinizes the research methodology by comprehensively depicting the study design and the research variables in the first place. Second, the sampling procedure and the characteristics of the participants are explained in detail. Next, data collection instruments, data collection processes, and data analysis are presented in an elaborative manner. Lastly, the limitations and assumptions of the study are discussed at the end of this chapter.

3.1. Research Design

This study employed mixed-method research as the third research paradigm (Johnson, Onwuegbuzie, & Turner, 2007), covering and synthesizing quantitative and qualitative research qualities. The quantitative research deductively seeks the conditions or relationships to understand the social phenomena, particularly human behavior, based on the objectivist and positivist epistemology (Cohen, Manion, & Morrison, 2018). Unlike the quantitative paradigm, qualitative research based on constructivist and interpretivist epistemology attempts to broadly and inductively describe the social phenomena (Marshall & Rossmann, 2006). However, these genres seem imperfect while addressing the arising problems in today's interdisciplinary, complex, and dynamic research world (Johnson & Onwuegbuzie, 2004). In this regard, mixed-method research as a new paradigm is based on pragmatist philosophy (Tashakkori & Teddlie, 1998) and defined by Tashakkori and Creswell (2007) as "the research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches" (p.3). Therefore, the common qualities and the perspectives of these two approaches are considered in mixed-method research by employing inductive, deductive, and abductive reasoning (Johnson & Onwuegbuzie, 2004).

In the literature, there are different mixed-method design-frameworks to represent the relevant research well. Accordingly, Leech and Onwuegbuzie (2009) proposed a three-dimensional typology regarding the level of mixing (partially or fully mixed), time orientation (concurrent or sequential), and emphasis of approaches (dominant or equal status) dimensions. The current study was a partially-mixed, sequential, and quantitative dominant research study based on this eight-design framework. More specifically, the quantitative phase of the study had a dominant status for the overall research. At the same time, qualitative measures were employed to merely support the quantitative findings to fully describe the nature of the relationship among the variables and elaborate on the reasons behind students' emotional experiences in middle school mathematic classes. Among the distinct purposes of mixed-method research, the quantitative method was used to enable the development of the qualitative method (Greene, Caracelli, & Graham, 1989).

The aim was to investigate the relationship between the middle school students' mathematics achievement emotions, mathematics self-efficacy, perceived teaching quality and perceived teacher affective support, mathematics teachers' emotions, sense of efficacy beliefs, and teacher burnout for the quantitative phase. In this sense, this part was an example of associational research in which the relationship between two or more variables is investigated, and no attempt is made to influence them (Frankel, Wallen & Hyun, 2019). Among the associational research design, the quantitative phase was in correlational nature. Mainly, the correlational research "involves collecting data to determine whether, and to what degree, a relationship exists between two or more quantifiable variables" (Mills & Gay, 2016, p. 234). In a general sense, correlational studies examine the relationship between two or more quantifiable variables without manipulating (Frankel et al., 2019). Therefore, establishing cause and effect relations is not the focus of correlational studies. In line with this aim, the potential relationship between the variables was tested through single and multilevel structural equation modeling (ML-SEM).

For the qualitative phase, on the other hand, the reasons behind the experience of students' mathematics achievement emotions were explored from middle school students' mathematics teachers' perspectives. Therefore, this part corresponded to the phenomenological approach in qualitative research. In the phenomenological approach, people's lived experiences about a phenomenon are extensively described by focusing on their personal stories and histories (Bogdan & Biklen, 2007; Patton, 2002). In this regard, the possible reasons for students' emotional experiences in mathematics classes were examined to figure out the essence of these experiences. The overall research process was depicted in Figure 3.1.

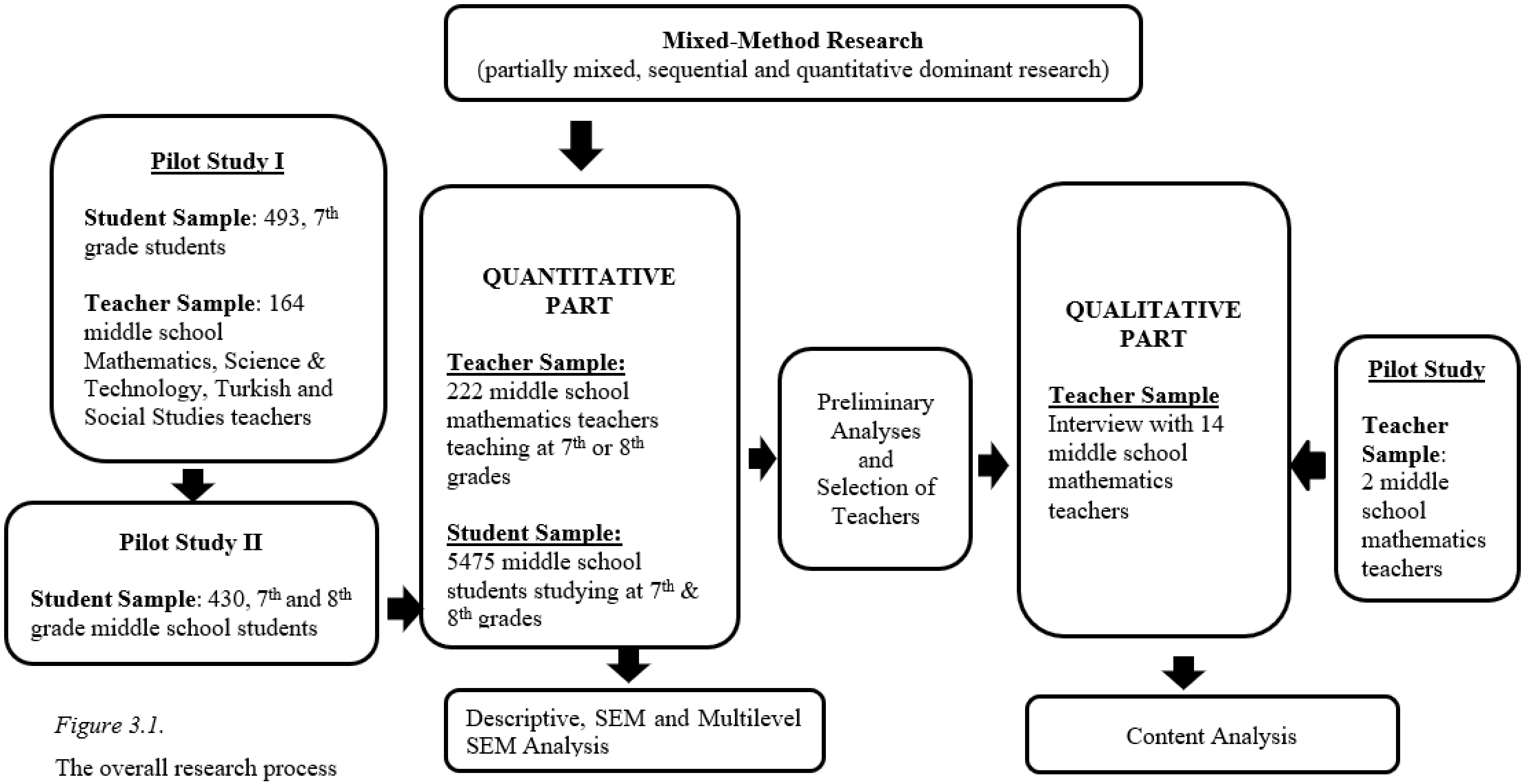

Figure 3.1.

The overall research process

3.2. Quantitative Research Variables

The quantitative research variables are presented below by considering the groups of participants of the study.

3.2.1. Quantitative Research Variables for Teachers

Teacher Emotions: Middle school mathematics teachers' academic emotions were measured by the Turkish version of the Teacher Emotions Scale (TES). The scale consists of three emotion dimensions in two sections; in other words, teacher enjoyment, teacher anger, and teacher anxiety are measured on a general and at a student-group specific level. As the mathematics teachers teaching at 7^{th} and 8^{th}-grade levels were on target, the student group-specific section was used in this study. Higher scores for each emotion dimension indicate high emotional states of teachers for this dimension.

> *Teacher Enjoyment*: This dimension was used to measure teacher enjoyment at a specific group of students for teachers.
>
> *Teacher Anger*: This dimension was used to measure teacher anger at a specific group of students for teachers.
>
> *Teacher Anxiety*: This dimension was used to measure teacher anxiety at a specific group of students for teachers.

Teacher Self-Efficacy: Self-efficacy beliefs were assessed by the Turkish version of Teachers' Sense of Efficacy Scale (TSES). The scale consists of three dimensions: efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management. Higher scores on scales point out a higher sense of efficacy on the corresponding dimension.

> *Efficacy for Student Engagement*: This dimension was used to measure teacher self-efficacy to provide student engagement in their classrooms.
>
> *Efficacy for Instructional Strategies*: This dimension was used to measure teacher self-efficacy to employ various classroom instructional strategies.
>
> *Efficacy for Classroom Management*: This dimension was used to measure

teacher self-efficacy to ensure management in their classrooms.

Teacher Burnout: The feeling of burnout of mathematics teachers was measured by the Turkish version of the Maslach Burnout Inventory – Educators Form. The instrument has three sub-scales: Emotional Exhaustion (EE), Personal Accomplishment (PA), and Depersonalization (D). Higher EE and D scores and lower scores in PA dimensions refer to a higher level of burnout for mathematics teachers.

Emotional Exhaustion: This dimension was used to measure the degree of emotional depletion of teachers.

Personal Accomplishment: This dimension was used to measure teachers' feelings of efficiency and effectiveness in their work.

Depersonalization: This dimension was used to measure the physical and emotional isolation of teachers from their colleagues, students, and their family.

3.2.2. Quantitative Research Variables for Students

Mathematics Achievement Emotions: 7th and 8th-grade students' achievement emotions in mathematics were assessed by the Turkish version of the Mathematics Achievement Emotions Questionnaire (AEQ-M). AEQ-M includes seven emotional dimensions: enjoyment, pride, anger, anxiety, boredom, shame, and hopelessness. For the current study, three emotion dimensions (enjoyment, anger, and anxiety) were used to measure students' mathematics-specific emotions. Higher scores for each emotion dimension refer to higher emotional states of students for this dimension.

Enjoyment: This dimension was used to measure whether students experience enjoyment in mathematics teaching and learning settings.

Anger: This dimension was used to measure whether students experience anger in mathematics teaching and learning settings.

Anxiety: This dimension was used to measure whether students experience anxiety in mathematics teaching and learning settings.

Mathematics Self-Efficacy: 7th and 8th-grade students' mathematics self-efficacy beliefs were measured by the Turkish version of Self-Efficacy for Self-Regulated Learning Scale (SESRL). Higher scores in this scale refer to higher self-efficacy beliefs in mathematics.

Teaching Quality: Teaching quality will be assessed by the Turkish version of the Perceived Teaching Quality Scale and the Perceived Teacher Affective Support Scale. The former scale addresses eight different teaching characteristics from students' perspectives, and these characteristics are incorporated into two dimensions: supportive presentation style and excessive lesson demands. Higher scores display teachers' higher use of the relevant teaching characteristics in the corresponding dimension.

> *Supportive Presentation Style*: This dimension was used to measure students' perceptions of teachers' employment of understandability, illustration, enthusiasm, and fostering attention in their classrooms.
>
> *Excessive Lesson Demands*: This dimension was employed to measure students' perceptions of their teachers' use of clarity, difficulty, pace, and expectations in their classrooms.

Perceived Teacher Affective Support: This scale focuses on students' perceptions of their teachers' affective support. Higher scores in this unidimensional scale refer to higher perceived affective support provided by teachers.

3.3. Sample

This study was carried out in quantitative and qualitative phases, respectively, in which different groups of participants were involved in these phases. Below, the sample and the sampling procedures for the quantitative and qualitative phases of the study were scrutinized.

3.3.1. Sampling in Quantitative Phase of Study

The target population of the study was middle school mathematics teachers and their 7th and 8th-grade students. However, regarding the limitation of time and cost to include 39 districts in Istanbul, the accessible population was specified as the middle school mathematics teachers and their 7th and 8th-grade students from eleven central districts in Istanbul. The districts were decided based upon the assumption that the number of middle schools should ensure the representativeness considering their proportions in the population. Accordingly, the schools were selected from the following districts: Bahçelievler, Beyoğlu, Beşiktaş, Esenler, Eyüp, Fatih, Kağıthane, Pendik, Şişli, Üsküdar, and Zeytinburnu.

Cluster sampling, in which the intact groups are randomly selected (Frankel et al., 2019), was the current study's primary sampling strategy. It is appropriate to use cluster sampling when the population is large and spread out since gathering data through simple random sampling or obtaining the whole list of individuals might be problematic due to administrative issues (Cohen et al., 2018; Mills & Gay, 2016).

According to the Istanbul Provincial National Education Statistics (2017), there are 1100 public middle schools in Istanbul. Out of 1100 schools, 235 of them were in the selected districts: Bahçelievler (25 schools, 2.27%), Beyoğlu (19 schools, 1.73%), Beşiktaş (14 schools, 1.27%), Esenler (18 schools, 1.64%), Eyüp (27 schools, 2.45%), Fatih (27 schools, 2.45%), Kağıthane (28 schools, 2.55%), Pendik (63 schools, 5.73%), Şişli (17 schools, 1.55%), Üsküdar (29 schools, 2.64%) and Zeytinburnu (11 schools, 1%). Upon considering the number of schools in the accessible population, 25% of them were chosen in the first step. In so doing, 59 schools were selected randomly while 53 of them voluntarily participated to this study from the aforementioned districts: Bahçelievler (n = 2), Beyoğlu (n = 3), Beşiktaş (n = 2), Esenler (n = 7), Eyüp (n = 5), Fatih (n = 5), Kağıthane (n = 5), Pendik (n = 8), Şişli (n = 4), Üsküdar (n = 7), and Zeytinburnu (n = 5).

3.3.1.1. Sample of Teachers for the Quantitative Phase of Study

Based upon the database of the Istanbul Provincial Directorate of National Education, there are 1383 middle school mathematics teachers working in Bahçelievler (*N* = 206), Beyoğlu (*N* = 49), Beşiktaş (*N* = 58), Esenler (*N* = 93), Eyüp (*N* = 109), Fatih (*N* = 99), Kağıthane (*N* = 123), Pendik (*N* = 299), Şişli (*N* = 81), Üsküdar (*N* = 197), and Zeytinburnu (*N* = 69). It should be noted that the given statistics represented the total number of middle school teachers, not particularly teaching 7th and 8th-grade levels. Dillman's (2007) formula suggested reaching 300 middle school mathematics teachers to generalize to a population at a 95% confidence level with a ± 5% margin of error (Needham & Vaske, 2008).

Among the participated schools (*n* = 53), 222 middle school teachers who were teaching at 7th or 8th grades participated in this study. Regarding the research questions, teachers and the corresponding student questionnaire should have complemented each other. Still, some school administrations permitted to apply only teacher questionnaires, or some teachers did not want to implement student questionnaires in their classes. Therefore, teacher and student questionnaires were administered in 214 classes.

The teacher sample constituted 148 females (66.7%) and 73 male (32.9%) teachers. One teacher (0.5%) did not indicate gender information. Regarding the latest received educational degree, most of the teachers had bachelor's degrees (*n* = 195, 87.8%) while there were also teachers with master's degrees (*n* = 26, 11.7%). Besides, one teacher had an associate degree (*n* = 1, 0.50%) in the sample. Furthermore, most of the teachers were graduated from the Faculty of Education (*n* = 142, 64%). Some of the teachers were the graduates of the Faculty of Arts & Science (*n* = 55, 24.8%) and other faculties (*n* = 3, 1.4%). In addition to this, 22 teachers (9.9%) did not provide information about their graduation faculty. The age of the participated teachers, on the other hand, ranged from 22 to 63 years old. Participants had 11 years of teaching experience on average (*SD* = 7.76), including teachers from one month to 41 years of teaching experience.

Lastly, teachers worked in their present schools for four years on average (*SD* = 3.08), ranging from one month to twenty years. Table 3.1 displays the demographic characteristics of teachers across different variables.

Table 3.1.

Teacher Profiles by Districts, Gender, Educational Degree, and Faculty of Graduation (n = 222)

		f	%
Districts			
	Bahçelievler	9	4.1
	Beşiktaş	12	5.4
	Beyoğlu	10	4.5
	Esenler	33	14.9
	Eyüp	25	11.3
	Fatih	18	8.1
	Kağıthane	28	12.6
	Pendik	25	11.3
	Şişli	20	9.0
	Üsküdar	24	10.8
	Zeytinburnu	18	8.1
	Total	222	100
Gender			
	Female	148	66.7
	Male	73	32.9
	Missing	1	0.40
	Total	222	100
Educational Degree Received			
	Associate Degree	1	0.5
	B.S. Degree	195	87.8
	M.S. Degree	26	11.7
	Total	222	100
Faculty of Graduation			
	Faculty of Education	142	64
	Faculty of Arts & Science	55	24.8
	Other	3	1.4
	Missing	22	9.8
	Total	222	100

3.3.1.2. Sample of Students for the Quantitative Phase of Study

According to National Education Statistics for the 2017-2018 academic year, 820.349 students (400.663 female students and 419.686 male students) were registered to public middle schools in Istanbul (Ministry of National Education, 2018). On the other hand, the distribution of the number of middle school students among the selected districts might be given as: Bahçelievler (n = 32.063), Beşiktaş (n = 7.171), Beyoğlu (n = 11.430), Esenler (n = 30.530), Eyüp (n = 20.466), Fatih (n = 19.273), Kağıthane (n = 22.981), Pendik (n = 44.719), Şişli (n = 10.352), Üsküdar (n = 23.088), Zeytinburnu (n = 5.595) (Ministry of National Education, 2017). Along with the selected districts and the participated schools, a total of 5475 students from seventh and eighth grades voluntarily participated in this study. As the number of students was decided upon by the participated teachers, student questionnaires were administered to one of the 7th or 8th-grade mathematics teachers.

The student sample included 2880 female (52.6%) and 2547 male (46.5%) students, so the gender distribution was nearly equal. Among the participated students, 2981 students were from the seventh grade (54.4%), while 2494 were from the eighth grade (45.6%). The average score for the previous year's mathematics achievement was 79.54 (SD = 17.07). While students' mathematics achievement profile was reviewed regarding the grade level, the previous year's average mathematics achievement scores were 79.50 and 79.59 for the seventh (SD = 17.37) and the eighth graders (SD = 16.73), respectively. Table 3.2 presents the demographic characteristics of the targeted sample across different variables.

Table 3.2.

Student Profile by Districts, Gender, and Grade Level (n=5475)

		f	%
Districts			
	Bahçelievler	322	5.9
	Beşiktaş	323	5.9
	Beyoğlu	186	3.4
	Esenler	774	14.1
	Eyüp	658	12.0
	Fatih	394	7.2
	Kağıthane	667	12.2
	Pendik	917	16.2
	Şişli	291	5.3
	Üsküdar	426	7.9
	Zeytinburnu	517	9.4
	Total	5475	100
Gender			
	Female	2880	52.6
	Male	2547	46.5
	Missing	48	0.90
	Total	5475	100
Grade level			
	7^{th} grade	2981	54.4
	8^{th} grade	2494	45.6
	Total	5475	100

3.3.2. Sampling in Qualitative Phase of Study

Middle school mathematics teachers were selected to understand how students' emotions are shaped in mathematics regarding the learning process and their interaction with mathematics teachers according to the preliminary findings of the quantitative phase. As qualitative research is flexible, this flexibility might be used for the sampling procedures that more than one sampling techniques could be employed to provide deep and rich insights about the study (Yıldırım & Şimşek, 2016; Patton, 2002). Therefore, maximum variation sampling and convenience sampling processes were utilized to decide which teachers to include in the study. Maximum variation sampling requires selecting the cases that meet one or more certain criteria which differentiate the sites or participants to identify the common and different patterns and perspectives (Creswell, 2013; Marshall & Rosmann, 2006; Patton, 2002; Yıldırım & Şimşek, 2016). On the other hand, convenience sampling is a non-random sampling technique for selecting the sites or the available participants (Frankel et al., 2019).

For maximum variation sampling, a two-stage sampling process was applied. Preliminary quantitative analyses were performed to select the teachers. The mean scores for each dimension of Achievement Emotions Questionnaire-Mathematics (AEQ-M) were computed for the student sample. Accordingly, the classes with the highest and the lowest mean scores of enjoyment, anxiety, and anger in mathematics were identified. At least two of the classes with the highest and the lowest emotion scores of the corresponding dimension were chosen. Consequently, mathematics teachers of these classes were selected for in-depth interviews.

As well as incorporating the teachers from the highest and the lowest emotion scores of mathematics classes, some of the teachers had already mentioned their willingness to take part in this phase. These teachers also voluntarily participated in the qualitative phase of the study.

3.3.2.1. Sample of Teachers for Qualitative Phase of Study

The study's qualitative sample was a sub-sample of the participating teachers of the quantitative phase. Accordingly, 14 teachers voluntarily participated. As the criterion was based on comparing the mathematics emotions scores of student sample for each emotion dimension of AEQ-M, the classes with maximum and minimum scores for enjoyment, anxiety, and anger in mathematics were computed. In this process, one class might be classified as having the highest enjoyment and lowest anger or anxiety scores in mathematics or having the highest anxiety, anger scores, or the lowest enjoyment scores at the same time. Therefore, at least two classes for each dimension regarding the adopted classification were put on the selection list. Among the teachers in the list, one teacher with the lowest mathematics enjoyment did not want to participate in the interviews, so this teacher was excluded from the sample. According to average scores of each emotion dimension, Teacher A (*M* = 41.97, *SD* = 8.41) and Teacher B (*M* = 38.69, *SD* = 7.12) had classes with the highest enjoyment scores in mathematics, while Teacher C (*M* = 21.43, *SD* = 11.86), Teacher D (*M* = 22.62, *SD* = 7.94) and Teacher E (*M* = 24.87, *SD* = 6.10) had classes with the lowest scores. Teacher C (*M* = 30.86, *SD* = 14.04), Teacher D (*M* = 32.80, *SD* = 9.78) and Teacher E (*M* = 30.43, *SD* = 7.34) had classes with the highest anger scores in mathematics, while Teacher B (*M* = 15.70, *SD* = 9.16), Teacher F (*M* = 14.50, *SD* = 4.27) and Teacher G (*M* = 14.89, *SD* = 2.68) had the classes with the lowest scores. Lastly, Teacher C (*M* = 50.76, *SD* = 19.84), Teacher D (*M* = 50.20, *SD* = 13.58) and Teacher E (*M* = 50.34, *SD* = 11.50) had the classes with the highest anxiety scores in mathematics while Teacher B (*M* = 29.35, *SD* = 13.23) and Teacher H (*M* = 32.07, *SD* = 10.26) had classes with the lowest scores. Regarding the given statistics, Teacher B, Teacher C, Teacher D, and Teacher E were classified on more than one emotion dimension. Therefore, interviewing with those teachers became crucial for in-depth understanding. Table 3.3 presents descriptive statistics scores for the AEQ-M dimensions of the selected mathematics classes.

Table 3.3.

The Descriptive Statistics Scores of the Mathematics Classes of Participated Teachers

Participants	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
	Enjoyment	Anger	Anxiety
Teacher A	41.97 (8.41) (highest)	19.39 (9.95)	36.17 (16.02)
Teacher B	38.69 (7.12) (highest)	15.70 (9.16) (lowest)	29.35 (13.23) (lowest)
Teacher C	21.43 (11.86) (lowest)	30.86 (14.04) (highest)	50.76 (19.84) (highest)
Teacher D	22.62 (7.94) (lowest)	32.80 (9.78) (highest)	50.20 (13.58) (highest)
Teacher E	24.87 (6.10) (lowest)	30.43 (7.34) (highest)	50.34 (11.50) (highest)
Teacher F	35.20 (5.16)	14.50 (4.27) (lowest)	30.01 (12.25)
Teacher G	33.55 (7.41)	14.89 (2.68) (lowest)	35.82 (7.97)
Teacher H	43.73 (7.11)	17.15 (6.28)	32.07 (10.26) (lowest)
Teacher I			
Teacher J			
Teacher K			
Teacher L			
Teacher M	31.79 (6.94)	23.75 (11.29)	41.91 (15.30)
Teacher N	30.66 (4.00)	23.22 (8.98)	41.78 (12.61)

Teacher interviews were conducted at six different districts in Istanbul, including Beşiktaş, Fatih, Eyüp, Kağıthane, Üsküdar, and Şişli. Out of 14 teachers, two of them were male while the remaining teachers were female. The age of the participants ranged from 26 to 50 years clustering around the 30-35 age intervals. Considering teachers' educational background, five mathematics teachers had an M.S. degree in different education fields while nine of them had bachelor's degrees in mathematics or mathematics education. Besides, ten teachers were the graduates of the Faculty of Education. In comparison, four teachers were the graduates of Arts and Sciences Faculty with having certificates from Pedagogical Formation Certificate Programs of universities. Eight teachers had ten years and above teaching experience among the sample, while six of them had less than ten years of teaching experience. In addition to this, most of the teachers were pursuing their career in their current schools for less than five years. The demographic characteristics of the teacher sample given in Table 3.4.

Table 3.4.

Demographic Characteristics of Interviewed Teachers

Participants	Gender	Educational Degree	Faculty of Graduation	Total Teaching Experience	Current School Teaching Experience
Teacher A	Female	B.S.	Education	8 years	3 years
Teacher B	Female	B.S.	Education	13 years	3 years
Teacher C	Female	B.S.	Arts &Sciences	9 years	2 years
Teacher D	Male	M.S.	Education	6 years	3 years
Teacher E	Female	B.S.	Arts & Sciences	2 years	1 year
Teacher F	Female	B.S.	Education	15 years	3.5 years
Teacher G	Female	M.S.	Arts & Sciences	19 years	7 years
Teacher H	Female	B.S.	Education	5 years	3 years
Teacher I	Female	B.S.	Education	6.5 years	3 years
Teacher J	Female	M.S.	Education	10 years	6 years
Teacher K	Male	B.S.	Education	15 years	1 year
Teacher L	Female	M.S.	Education	15 years	4 years
Teacher M	Female	M.S.	Education	10 years	3 years
Teacher N	Female	B.S.	Arts & Sciences	24 years	10 years

3.4. Data Collection Instruments in the Quantitative Part

For the quantitative part, the data were collected through the Turkish versions of The Teacher Emotions Scale (TES), Teachers' Sense of Efficacy Scale (TSES), Mathematics Achievement Emotions Questionnaire (AEQ-M), Mathematics Self-Efficacy Scale for Self-Regulated Learning (SESRL), Maslach Burnout Inventory-Educators Form (MBI-EF), Perceived Teaching Affective Support (PTAS) and Perceived Teaching Quality Scale (Appendix D). Besides, the demographic information part was also incorporated into both teacher and student group questionnaires. Detailed information about each data source for relevant groups is provided in the proceeding sections.

3.4.1. Teacher Questionnaire

The teacher questionnaire was comprised of five different sections: Demographic Information Part, Teacher Emotions Scale (TES), Teachers' Sense of Efficacy Scale (TSES), and Maslach Burnout Inventory-Educators Form (MBI-EF). For the demographic information part, teachers were asked to report their gender, age, the latest degree of education, the faculty they graduated from, year of teaching experience, and teaching experience at the current school they are working.

3.4.1.1. Teacher Emotions Scale (TES)

Teacher Emotions Scale (TES) was developed by Frenzel, Pekrun, Goetz, Daniels, Durksen, Becker-Kurz, and Klassen (2016) to measure the emotional experiences of teachers. The scale was translated and adapted to the Turkish language by the researchers. TES is a multidimensional self-report instrument, including 24 items on a four-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (4) measuring three different emotions: enjoyment, anger, and anxiety. The questionnaire consists of two sections addressing teaching in general (12 items) and a specific student group (12 items). The difference between the second section from the first section is only putting the "these students" phrase at the end of each item to examine teachers' emotions for a specific group of students

Frenzel et al. (2016) proposed a three-dimension structure based on the current scale's discrete emotion approach. For the English version of TES, the general scale, the three-factor model has the following modification indices: Comparative Fit Index (CFI) =.943, Standard Root Mean Square Residual (SRMR) = .044 and Root Mean Square Error of Approximation (RMSEA) = .068. The English version of the student-group specific scale has also the following modification indices: CFI = .976, SRMR = .030 and RMSEA = .052. Along with the findings, the three-dimension model had a good model fit. Besides, Cronbach alpha coefficients for the internal consistency reliability were also given for general emotions sub-scale of the instrument: enjoyment (4 items, α = .73), anger (4 items, α = .80), and anxiety (4 items, α = .81), and for student-group specific emotions sub-scale of the instrument: (4 items, α = .80), anger (4 items, α = .87), and anxiety (4 items, α = .87).

In the current study, the student-group specific emotions subscale was used to measure middle school mathematics teachers' emotionsat 7th and 8th-grades. Sample items for each emotion dimension might be read, "I often have reasons to be happy while I teach these students" (Enjoyment, item 7); "I often have reasons to be angry while I teach these students" (Anger, item 9); "I generally feel tense and nervous while teaching these students" (Anxiety, item 12).

3.4.1.1.1. Adaptation Process of Teacher Emotions Scale (TES)

The Teacher Emotions Scale has only German and English versions, so the scale was decided to be translated and adapted to the Turkish language within this study's scope. Firstly, the scale was translated into the Turkish language by the researcher and two bilingual experts. Regarding the translation process, the "decentering" method was employed rather than a literal translation of each item. Consequently, the translated scale was back-translated to English by three experts who had a good command of the English language. Afterward, the original and back-translated versions of the scale were compared to ascertain that the back-translated version items correspond to the original scale items. Accordingly, there was a problem with the equivalency of the translated versions for the phrases “feeling annoyed,” “being frustrated,” and “have much fun” for item 3, item 5, and item 6, respectively. Therefore, expert opinion was taken from three experts in the field of Guidance and Psychological Counselling to clarify the meanings of those words directly related to emotions. The agreed Turkish translations were decided to be kept on the scale. Besides, expert opinion was obtained from an expert in the field of Measurement and Evaluation to provide evidence for the face validity to examine whether the instrument measures what is supposed to measure (Mills & Gay, 2016). In doing so, the expert checked the length and the appearance of the scale considering its format, the directions within, and the adopted rating scale.

Before finalizing the instrument, cognitive interviews were done with two former mathematics teachers, who were also Ph.D. candidates in Curriculum and Instruction and Elementary Mathematics Education departments. In general, the cognitive interview is an approach to find out the possible response errors in a questionnaire before the actual administration process (Willis, 2004). In this regard, the think-aloud method was employed to understand the probable reasons for those errors. In this method, interviewees were asked to think-aloud while responding to each item on the scale. They were expected to underscore the unclear words, phrases, or sentences on the scale. In addition to this, they also commented on the format and the design of the instrument. Accordingly, there was no problematic item, and the length and the scale’s appearance seemed to be appropriate to the interviewees.

3.4.1.2. Teachers’ Sense of Efficacy Scale (TSES)

Teachers’ Sense of Efficacy Scale (TSES) was developed by Tschannen-Moran and Woolfolk Hoy (2001) to measure teachers’ and pre-service teachers’ sense of efficacy beliefs. The scale was adapted to the Turkish language by Çapa, Çakıroğlu, and Sarıkaya (2005). TSES has both long and short versions, including 24-items and 12-items, respectively.

TSES was designed as a 9-point rating scale, and the responses vary from 1 (nothing) to 9 (a great deal). The scale is composed of three dimensions: self-efficacy for student engagement (SE), self-efficacy for instructional strategies (IS), and self-efficacy for classroom management (CM) (Tschannen-Moran & Woolfolk Hoy, 2001). Corresponding to the three-dimensional structure of the original scale, the Turkish version has the following modification indices: CFI = .99, Tucker Lewis Index (TLI) = .99, and RMSEA = .065. Furthermore, the Cronbach alpha estimates for each sub-scale were computed to provide evidence for the internal consistency. These are: SE (8 items, α = .82), IS (8 items, α = .86), CM (8 items, α = .84) (Çapa et al., 2005).

For the current study, the instrument's long version was used to assess middle school mathematics teachers' self-efficacy beliefs. Sample items for each dimension are: "How much can you do to motivate students who show low interest in school work?" (self-efficacy for student engagement, item 4); "How well can you provide appropriate challenges for very capable students?" (self-efficacy for instructional strategies; item 24); "How much can you do to control disruptive behavior in the classroom?" (self-efficacy for classroom management, item 3).

3.4.1.3. Maslach Burnout Inventory-Educators Form (MBI-EF)

Maslach Burnout Inventory was developed by Maslach and Jackson (1981) to measure burnout levels of people working at human services occupations. Maslach, Jackson, and Schwab adapted the inventory to assess educators' burnout levels (Maslach, Jackson, & Leiter, 2010) as they have a high level of interpersonal relationships with other people in their occupations. The instrument was translated and adapted to the Turkish language by İnce and Şahin (2015).

There are 22 items in MBI-ES on a 7-point Likert scale, including three dimensions: emotional exhaustion (9 items), depersonalization (5 items), and personal accomplishment (8 items). For each item, the lowest score is 0 (never), while the highest score is 6 (always). According to Maslach and her colleagues (2010), there are ranges of scores pointing out the changing levels of the corresponding burnout dimension. The abovementioned ranges for MBI-EF dimensions were presented in Table 3.5.

Table 3.5.

Scoring the Dimensions of MBI-EF

	Low	*Moderate*	*High*
Emotional Exhaustion	0-16	17-26	27+(max 54)
Depersonalization	0-8	9-13	34+ (max 48)
Personal Accomplishment	37+	31-36	0-30

Along with the results of Confirmatory Factor Analysis (CFA), the factor structure was in line with the original scale. Accordingly, the findings yielded three dimensions with the following modification indices: CFI = .94, Normed Fit Index (NFI) = .93, and RMSEA = .07. Besides, Cronbach alpha coefficients were .74 for personal accomplishment, .78 for depersonalization, and .88 for emotional exhaustion, respectively. Sample items for each dimension might be read as, “I feel used up at the end of the workday” (emotional exhaustion, item 2); “I don’t really care what happens toward some students” (depersonalization, item 15); “I can easily understand how many students feel about things” (personal accomplishment, item 4).

3.4.2. Student Questionnaire

The student questionnaire included five different sections: Demographic Information Part, Mathematics Achievement Emotions Questionnaire (AEQ-M), Mathematics Self-Efficacy Scale for Self-Regulated Learning (SESRL), Perceived Teaching Affective Support (PTAS), and Perceived Teaching Quality Scale. Students were asked to report their gender, grade level, and previous year mathematics grades for the demographic information part (Appendix E).

3.4.2.1. Mathematics Achievement Emotions Questionnaire (AEQ-M)

Mathematics Achievement Emotions Questionnaire (AEQ-M) was developed by Pekrun, Goetz, and Frenzel (2005) to measure students' mathematics achievement emotions from different age groups. The instrument was translated and adapted to the Turkish language by the researcher (Çalık & Çapa Aydın, 2019).

AEQ-M is a multidimensional self-report instrument, and it includes 60 items on a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). There are seven emotions in the scale: mathematics enjoyment (e.g., "I enjoy my class so much that I am strongly motivated to participate." item12), mathematics pride (e.g., "I am very motivated because I want to be proud of my achievements in mathematics." item 32), mathematics anger (e.g., "I get angry because the material in mathematics is so difficult." item 15), mathematics anxiety (e.g., "I am so anxious that I would rather not take the math test." item 45), mathematics shame (e.g., "After taking a test in mathematics, I feel ashamed." item 60), mathematics hopelessness (e.g., "I keep thinking that I will never get good grades in mathematics." item 44), and mathematics boredom (e.g., "My math homework bores me to death." item 31) (Pekrun et al., 2005). Students' class-related (18 items), learning-related (19 items), and test-related (23 items) emotional experiences, on the other hand, constitute three sections of the questionnaire. Besides, there are three parts within each section to measure students' mathematics-specific emotions before, during, and after sessions corresponding to the related scale.

Pekrun and his colleagues (2011) validated the factorial structure of AEQ. For this purpose, the one-emotion factor model, nine factor-emotions model, three settings-factors model, and emotion x setting factors models were tested to provide evidence about the original instrument's construct validity. Among the hypothesized models, the emotion x setting factors model statistically confirmed the data. The scales' reliability estimates ranged from .84 to .92 providing evidence for higher reliability (Knapp & Mueller, 2010; Nunnally, 1978). Although the developers of the instrument did not test the factorial structure of the English version of AEQ-M, confirmatory factor analyses were performed for the Turkish version of AEQ-M to examine the factorial structure of this instrument (Çalık & Çapa Aydın, 2019). Accordingly, the seven-factor emotions model best fitted the data with the following modification indices: CFI = .99, Non-Normed Fit Index (NNFI) = .98, and RMSEA = .069, Standard Root Mean Square Residual (SRMR) = .02. Furthermore, Cronbach alpha coefficients for each emotion dimension was found $\alpha = .93$ for enjoyment (10 items), $\alpha = .92$ for pride (6 items), $\alpha = .91$ for anger (9 items), $\alpha = .91$ for anxiety (15 items), $\alpha = .82$ for shame (8 items), $\alpha = .89$ for hopelessness (6 items), and $\alpha = .87$ for boredom (6 items).

For the current study, three achievement emotions (anxiety, anger, and enjoyment) in AEQ-M corresponding to the academic emotions of mathematics teachers in Teacher Emotions Scale (TES) were used in the main study to provide consistency among emotion types between student and teacher groups.

3.4.2.2. Mathematics Self-Efficacy

For the current study, middle school students' mathematics self-efficacy beliefs were measured by the Self-Efficacy Scale for Self-regulated Learning (SESRL). SESRL in mathematics was developed by Usher (2007) by adapting Bandura's (2006) Children Multidimensional Self-Efficacy Scale to assess students' capability judgments to use self-regulated learning strategies in mathematics. SESRL was translated and adapted to the Turkish language by the researcher (Çalık, 2014).

SESRL in mathematics includes 11 items on a 6-point rating scale ranging from 1 "not very well at all" to 6 "very well." The sample items are read as "How well can you participate in math class?" and "How well can you concentrate on your math work?". Consistent with the original scale, the Turkish version displayed a one-dimensional factor structure based upon both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) results. Regarding the findings of CFA, the modification indices for one dimensional model might be given as: CFI = .96, TLI = .94, and

RMSEA = .08. Furthermore, the Cronbach alpha coefficient of the total scale for the reliability estimates was .93. As it was above .80, the scale was appropriate (Knapp & Mueller, 2010; Nunnally, 1978).

3.4.2.3. Teaching Quality

In this study, *Perceived Teaching Quality (PTQ)* and *Perceived Teaching Affective Support (PTAS)* scales were used to measure teaching quality in mathematics.

3.4.2.3.1. Perceived Teaching Quality Scale (PTQ)

Perceived Teaching Quality Scale was developed by Goetz, Nett, Keller, and Lipnevich (2013) by combining several teaching characteristics items from different studies and adapting them to be used on a separate scale. Corresponding to the literature (Pekrun 2006), perceived teaching quality focused on eight teaching characteristics. These are *understandability, illustration, teacher enthusiasm, fostering attention, lack of clarity, difficulty, pace, and expectation level*. Accordingly, the items related to *understandability* ("In this lesson, our teacher's vocabulary is easy to understand"), *lack of clarity* ("In this lesson, our teacher's instructions are so unclear that I don't know what I have to do''), and *pace* ("The pace of this lesson is too fast for me'') were adapted from Kunter and Baumert's (2006) COACTIV study. The items for *illustration* ("In this lesson, our teacher explains the material in such a way that I can picture in my mind how things work'') and *fostering attention* ("In this lesson, our teacher makes sure that we pay attention'') were adapted from Pekrun, Vom Hofe, Blum, Frenzel, Goetz, and Wartha's (2007) PALMA study. Besides, the item for *teacher enthusiasm* ("In this lesson, our teacher presents the material with enthusiasm") was adapted from SEEQ questionnaire for teaching effectiveness in students' evaluations (e.g., Marsh & Bailey, 1993). The items assessing *difficulty* ("What is taught in this lesson is too difficult for me'') and *level of expectation* ("What our teacher expects from us in this lesson is far too much'') were adapted from Goetz et al.'s (2013) study. The scale was adapted to the Turkish language by the researcher within the scope of this study.

The original scale was designed as a 5-point Likert scale ranging from “Strongly Disagree” (1) to “Strongly Agree” (5). Exploratory Factor Analysis (EFA) was performed to test the factorial structure to provide construct-related validity evidence. Accordingly, the items were clustered on two dimensions: Supportive Presentation Style (4 items, $\alpha = .79$) and Excessive Lesson Demands (4 items, $\alpha = .78$). Sample items for each dimension are read as “In this lesson, our teacher presents the material with enthusiasm” (Supportive Presentation Style, item 6); “The pace of this lesson is too fast for me’’ (Excessive Lesson Demands, item 3).

3.4.2.3.2. Adaptation Process for Perceived Teaching Quality (PTQ) Scale

Perceived Teaching Quality (PTQ) Scale was first translated to the Turkish language by the researcher and two translators who had a good command of English. The translated versions were then back-translated to the English language by three different translators and experts in the field of Curriculum and Instruction. Afterward, the translated versions and the original scale were compared item by item to provide equivalency in terms of the grammar and the language used to prevent the semantic loss in items. Accordingly, the translation of the word “vocabulary” in item 1 did not correspond to the meaning in the original scale. There was a disagreement about selecting “the use of the language” or “word” for this word. Therefore, the researcher contacted the back translators to make them re-explain the difference between the word and the vocabulary. Finally, “word” was decided to be used in the translated version for this item. Furthermore, the translation of item 4, “In this lesson, our teacher explains the material in such a way that I can picture in my mind how things work,” seemed to be problematic as the translation of this item did not provide the meaning accurately. To remedy the problem, the researcher communicated with the corresponding author of the original scale and asked for permission to adapt the item by omitting the part of “how things work.” As the meaning of the item sounded reasonable to the readers, the author permitted this change.

Before finalizing the scale, a cognitive interview was performed with one eighth grade student to uncover whether there were any unclear words or phrases in the scale and comment on the length, appearance, and scale format. Consequently, an expert opinion was taken from one expert in the field of Measurement and Evaluation.

3.4.2.3.3. Perceived Teacher Affective Support Scale (PTAS)

Perceived Teacher Affective Support Scale (PTAS) was developed by Sakız (2017) to measure how their students perceive teachers' affective characteristics. The former scale with nine items (Sakız, 2007) was finalized by adding three more items in line with the literature. The final scale includes 12 items on a 5-point rating scale ranging from "Not at all true" (1) to "Completely true" (5). Confirmatory Factor Analysis (CFA) was performed to understand the scale's factorial structure and provide evidence for construct validity. Accordingly, the scale displayed a one-dimensional structure (Sakız, 2007, 2017). Cronbach alpha estimate was also examined for internal consistency and it was .88 (Sakız, 2017). Sample items for the scale are read as "My teacher recognizes and appreciates when I am good at something" (item 8) and "My teacher cares about me" (item 4).

3.5. Pilot Study

Pilot studies were carried out for teacher and student groups with similar characteristics with the sample to provide validity and reliability evidence. That is essential for the scale validation process and the scales with insufficient information on psychometric properties. Pilot studies for teachers and students were explained separately in the next sections.

3.5.1. Pilot Study for Teachers

In the pilot study for teachers, the Teacher Emotions Scale (TES) for the student-specific groups and Maslach Burnout Inventory - Educators Form were administered to middle school Mathematics, Science and Technology, Turkish, and Social Studies teachers.

As the pilot study was implemented to provide construct-related validity evidence for the scales mentioned above, the number of mathematics teachers in the selected districts would be insufficient to understand the scales' factorial structures regarding the number of items in each one. Therefore, the scales were decided to be administered to four main subject area teachers at the middle school level to increase the number of participants. Accordingly, a total of 164 middle school teachers were selected from sixteen public middle schools located in Beyoğlu (*n* = 5), Kartal (*n* = 4), Üsküdar (*n* = 4), and Şişli (*n* = 2) districts of Istanbul. Among the participants, 111 (67.7%) were female teachers, and 47 were male teachers (28.7%). Besides, majority of the teachers were from Turkish (*n* = 56; 34.1%) and Mathematics (*n* = 50; 30.5%) subject areas while there were also teachers from Science and Technology (*n* = 32;19.5%) and Social Studies (*n* = 18; 11%) areas. Among the sample, 82 teachers had a teaching experience of ten years or below (50%), 49 teachers were within the range of eleven- and twenty-years teaching experience (29.9%), and 25 teachers had twenty-one years and above teaching experience (15.2%). Regarding the faculty of graduation, 121 teachers were the graduates of Education Faculties (73.8%). In comparison, 33 teachers were the Faculty of Science and Arts or Open University graduates with a Pedagogical Formation Certificate for teaching (20.1%). Among the participated teachers, 140 of them had a bachelor's degree (85.4%), while 16 of them had completed a graduate-level program and had a master's or doctoral-level degree (9.7%).

Confirmatory Factor Analyses (CFA) was done through Mplus 8.3 (Muthen & Muthen, 2019) to confirm the scales' hypothesized factorial structure. In CFAs, whether the indicators or observed variables loaded on the specified dimensions and the possible relations among latent or unobserved variables/factors based on a theoretical framework or empirical grounds are examined (Kline, 2016; Stevens, 2009).

Before performing CFA for TES-student specific group, the data were screened for missing variables, the univariate and multivariate outliers, respectively. For missing data analysis, first, frequency statistics were examined for both items in this scale. Accordingly, the percentage of missing data did not exceed 5% for each item on TES, and Item 11, “I teach these students with enthusiasm.” was at the highest frequency with 3% of missing cases. Tabachnick and Fidell (2019) stated that the pattern of missing data is substantially more critical than the amount of the missing data, so Little’s MCAR test result was examined, and the result was non-significant ($\chi^2(43) = 39.945$, $p = .605$). As the percentage of missing data on any single item on the TES-student specific group did not exceed 10% (Hair, Black, Babin & Anderson, 2019) or even 5% (Tabachnick & Fidell, 2019). The missing data were completely at random (MCAR), and complete case analysis was preferred to handle the missing cases (Enders, 2010). Accordingly, seven incomplete cases were dropped from the analysis based on the assumption that the complete cases were a random sample of the target population (Pigott, 2001).

Since an extreme score on one variable or the combination of the scores on two or more variables might increase committing Type I and Type II errors (Tabachick & Fidell, 2019), the biased estimates would more likely to occur under the presence of univariate and multivariate outliers. Therefore, univariate outliers were screened after standardizing each item’s scores and comparing the standardized values with a score of 3.29 (Tabachnick & Fidell, 2019). Accordingly, 8 cases were detected as univariate analysis and removed from the sample. Mahalanobis Distance (D^2) as the distance of each case from the sample means of all cases (Kline, 2016; Tabachnick & Fidell, 2019) was computed to detect multivariate outliers. Out of 149 participants, 12 cases were multivariate outliers toward the critical value of 32.909 ($df = 12$, $p = .001$). These cases were removed from the sample.

After checking missing data and the absence of outliers assumptions, sample size adequacy for CFA was examined. Indeed, there is no particular rule of thumb for this issue, but there should be more observations than the number of variables. For this case, the number of participants was more than ten times higher than the total number of items in the scale, so the sampling adequacy was already met regarding Hair et al.'s (2019) five observations per variable suggestion. Consequently, normality and linearity assumptions were considered. Univariate and multivariate normality should be satisfied to continue with the analysis. For univariate normality, skewness, kurtosis values, Kolmogorov-Smirnov, Shapiro-Wilk statistical tests, histograms, and Q-Q plots were checked. Skewness and kurtosis values were close to zero and within -3 and +3 (Holton, 2014). Kolmogorov-Smirnov and Shapiro-Wilk statistical test results, on the other hand, were significant. However, these tests were highly influenced by large samples. Finding out significant results from small deviations was the basic limitation of these tests (Field, 2018), so histograms and Q-Q plots were scanned separately. There was no serious concern for the violation of univariate normality towards the exploration of these plots. On the other hand, Mardia's Test result for multivariate normality yielded a significant result (b2p = 225.17, p < .001), pointing out the violation. However, Kline (2016) mentioned that "slight departures from multivariate normality could be significant in large samples" (p.74). Therefore, the violation of this assumption might be reasonable for this case. For linearity, the bivariate scatterplots were inspected between each pair of items. As the data were in the interval scale of measurement, it might not be possible to obtain perfect oval-shaped scatterplots. Nevertheless, it might be contended that the linearity assumption was fulfilled.

According to the findings of CFA, Satorra-Bentler corrected chi-square test revealed a significant result (χ^2 (51) = 83.697, p = .003) with the following modification fit indices: RMSEA = .068, CFI = .97, NNFI = .96, and SRMR = .046. For a good model fit, CFI and NNFI should be greater than .95; however, the values as low as .90 are also accepted for a moderate model fit (Bentler & Bonett, 1980; Schumacker & Lomax, 1996). Besides, the SRMR value for a good model fit should be below the value of .08 (Hu & Bentler, 1999). For RMSEA, the values less than .05 were concerned as a cut-off criterion for a good model fit, while the values within the range of .05 and .08 reflect a mediocre model fit (Browne & Cudeck, 1993). As a result, the three emotions-factor model for the TES-student specific group scale seemed to fit well. Besides, each item significantly contributed to the hypothesized model with .40 and higher standardized estimates (Table 3.6). Cronbach alpha estimates were α =.87 for anger (4 items), α = .75 for anxiety (4 items), and α = .92 for enjoyment (4 items). As the internal consistency estimates were above .70 for each emotional dimension, they were concerned to be acceptable, according to Nunnaly's (1978) criterion.

Table 3.6.

Standardized Estimates for TES-Student Specific Group Scale for Pilot Study

Dimensions	Items	Standardized estimates
Anger	Item5	.891
	Item 4	.801
	Item 9	.788
	Item3	.769
Anxiety	Item 12	.876
	Item 10	.826
	Item 8	.704
	Item 2	.416
Enjoyment	Item11	.892
	Item 6	.889
	Item7	.836
	Item 1	.807

Missing data profile, sample size requirement, absence of outliers, normality, linearity, and assumptions were checked beforehand for the Maslach Burnout Inventory-Educators Form. First and foremost, the frequency statistics of missing data were examined item by item, and item 15, "I don't really care to what happens to some students," had the highest frequency with 7.3% of missing cases. Little MCAR test result was non-significant ($\chi^2(401) = 437.819$, p = .099), which provided evidence on the random distribution of incomplete response. Complete case analysis was done to deal with the missing data. Therefore, there was a decline from 164 to 127 participant teachers. Univariate outliers were examined by comparing the standardized values of each item with a critical value of 3.29. Accordingly, four cases displayed evidence of being a univariate outlier and were removed from the analysis. Consequently, Mahalanobis Distance (D_2) as the distance of each case from the means of all variables (Field, 2018) was computed to detect multivariate outliers. Out of 123 cases, two cases were identified as multivariate outliers toward the critical value of 48.268 ($df = 22$, $p = .001$), so these cases were dropped from the analysis.

According to Hair et al.'s (2019) five observations per variable suggestion, the remaining sample size (121 participants for this case) was adequate to perform CFA for this scale. Afterward, normality and linearity assumptions were checked. After inspecting skewness and kurtosis values, Kolmogorov-Smirnov and Shapiro-Wilk statistical test results, histograms, and Q-Q were satisfied with the univariate normality plots, multivariate normality of data were examined by looking at Mardia's Test result. Accordingly, this test was significant ($b2p = 575.425$, $p < .001$), indicating the violation of the multivariate normality assumption. As Kline (2016) mentioned that "slight departures from multivariate normality could be significant in large samples" (p.74), the violation of this assumption might be tenable for this case. Then, the linearity of items was checked by looking at the bivariate scatterplots of item pairs. As the number of items in this form was high compared to other scales, screening each item pair seemed difficult, so item5-item13 and item8-item 20 pairs were randomly selected to examine. As a result, the linearity assumption was deemed to be satisfied.

The first run of CFA with Satorra-Bentler correction yielded a significant result (χ^2 (205) = 342.62, $p < .05$) with the following modification fit indices: RMSEA = .070, CFI = .89, NNFI = .88, and SRMR = .075. There were three relatively higher error covariances after consulting the modification indices. These items (item2-item3, item1-item6, and item1-item13) were considered to load on the same factor, so the error terms of these indicators were allowed to covary. The second run of CFA resulted in a decrease in the chi-square value (χ^2 (202) = 298.199, $p < .05$). The modification indices of the model were RMSEA = .063, CFI = .92, NNFI = .91, and SRMR = .072.

Therefore, a three-dimensional theoretical framework of burnout for educators was validated in this case. Although all items significantly contributed to the proposed dimensions, the standardized estimates of item 4 and item 22 were below .40 (Table 3.7). They were decided to be retained in the scale for the main study.

Table 3.7.

Standardized Estimates for Maslach Burnout Inventory-Educators Form for Pilot Study

Dimensions	Items	Standardized estimates
Emotional Exhaustion	Item1	.842
	Item 8	.835
	Item 20	.780
	Item 6	.776
	Item 16	.730
	Item 13	.714
	Item 2	.616
	Item 14	.547
	Item 3	.510
Depersonalization	Item 10	.847
	Item 11	.821
	Item 15	.662
	Item 5	.629
	Item 22	.314
Personal Accomplishment	Item 17	.787
	Item 9	.726
	Item 19	.698
	Item 12	.672
	Item 18	.638
	Item 21	.595
	Item 7	.593
	Item 4	.319

Besides, Cronbach alpha estimates were $\alpha = .91$ for emotional exhaustion (9 items), $\alpha = .79$ for depersonalization (5 items), $\alpha = .84$ for personal accomplishment dimensions (8 items). As they were all above .70 (Nunnally, 1978), they were deemed to be acceptable. The summary of the information about the revisions done on teacher scales was presented in Table 3.8.

Table 3.8.

Summary of the Scales for Pilot Study for Teachers

Scales used in the pilot study for teachers	Revisions made
Teacher Emotions Scale (TES)-Student Specific Group	The direction of the scale was revised for the main study. Teachers were asked to think about their 7th and 8th-grade students in the stated academic year.
Maslach Burnout Inventory-Educators Form	-

3.5.2. Pilot Study for Students

Two pilot studies were conducted with middle school students with two different groups. The participants' detailed information and the revisions done for each study are explained in the proceeding sections.

3.5.2.1. Pilot Study 1 for Students

In pilot study 1, Perceived Teaching Quality (PTQ) was administered to the 7th-grade middle school students. In this regard, 493 students from twelve randomly selected public middle schools from four districts of Istanbul (Beyoğlu (*n*=5), Kartal (*n*=3), Üsküdar (*n*=2), and Şişli (*n*=2) voluntarily participated in the pilot study 1. The gender distribution of the participants was nearly equal. Accordingly, 238 of them (48.3%) were female students, and 253 of them (51.3%) were male students, while two students did not indicate their gender.

Exploratory Factor Analysis (EFA) was preferred as it is usually performed "to identify the factor structure or model for a set of variables" (Bandalos, 1996, p. 389). Therefore, EFA was performed to determine the factorial structure of the PTQ scale. Before performing EFA, the data were screened for missing variables, the univariate and multivariate outliers. For missing data analysis, first, frequency statistics were examined for each item. Accordingly, the percentage of missing data did not exceed 5%, while item 6, “In this lesson, our teacher explains the material with enthusiasm,” was at the highest frequency with 1.8% of missing cases. Little’s MCAR test results were examined to understand the pattern of the missing data. The result was non-significant ($\chi^2(77) = 81.837$, $p = .332$), indicating the random distribution of the incomplete responses for this scale. Considering the frequency statistics and Little’s MCAR test results, complete case analysis was done, and 36 cases were dropped from the analysis.

Univariate outliers were inspected first by examining each item’s standardized value. The scores above or below the cut-off of value of 3.29 would be called a univariate outlier (Tabachnick & Fidell, 2019). There was no standardized value for each item above or below 3.29, so there was no univariate outlier in the data. However, there might be some other extreme cases on more than one variable entitled multivariate outliers that might result in biased estimates (Tabachnick & Fidell, 2019). Therefore, Mahalanobis Distance (D_2) as the distance of each case from the means of all variables (Field, 2018) was computed to detect multivariate outliers in the dataset. As a result, 15 cases were identified as multivariate outliers toward the critical value of 26.124 ($df = 8$, $p = .001$), so these cases were dropped from the analysis.

After checking missing variables and the outliers on the data, metric variables, correlations above .30, Barlett’s Test of Sphericity, Kaiser Meyer-Olkin (KMO) value, and normality assumptions (Hair et al., 2019) were examined. The perceived teaching quality variable was in the interval scale of measurement, so the PTQ scale confirmed the metric variable assumption. The correlation matrix was examined to discover the preliminary factor structure and determine the bivariate relationships among eight items. The correlations among each item should be no less than .30 (Field, 2018; Hair et al., 2019; Tabachnick & Fidell, 2019). According to the correlation matrix results, no item was correlating with any other item with a value above .90. Still, item 8 seemed problematic as this item’s correlation coefficients with the others were below .30.

However, Bartlett's Test of Sphericity was significant for the scale (χ^2 (28) = 1198.82, p < .05), indicating that the correlation matrix was different from the identity matrix. For sampling adequacy, KMO values were checked in the data. Kaiser (1974) supports .50 as the minimum value for an adequate sample size while the values in the .60's, .70's, .80's, and .90's were interpreted as mediocre, middling, meritorious, and marvelous for sample size adequacy. The KMO value was .83, and the number of participants (n= 442) was more than ten times greater than the total number of items in the scale, so the sample size might be concerned as adequate to continue with EFA (Hair et al., 2019). Lastly, normality assumptions were checked. Skewness, and kurtosis values, Kolmogorov-Smirnov and Shapiro-Wilk statistical tests, histograms, and Q-Q plots were examined. Accordingly, the skewness and kurtosis values were within -3 and +3 (Holton, 2014). On the other hand, Kolmogorov-Smirnov and Shapiro-Wilk test results were significant, but they are highly sensitive to the sample sizes (Field, 2018). Histograms and Q-Q plots were also examined to provide more evidence about the univariate normality. After satisfying the univariate normality, the multivariate normality assumption was checked with Mardia's Test through norm test SPSS Macro. Mardia's Test result was significant (*b2p*= 98.06, p<.001), which means that the multivariate normality assumption was violated. Therefore, Principal Axis Factoring (PAF) extraction method with Oblique rotation was used to simplify and clarify the data assuming that the intended factors would be correlated (Costello & Osborne, 2005). Catell's Scree Test and Eigenvalue Criterion were checked to determine the retained factors in the data. According to Catell's Scree Test, the breakpoint of the plot points out a two-dimensional factorial structure for the PTQ scale (Figure 3.2.).

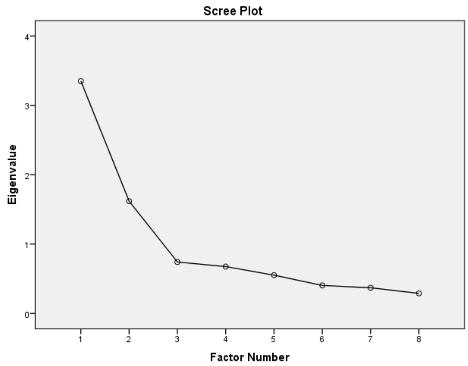

Figure 3.2.

Scree plot of PTQ scale for pilot study 1

According to the scree test, two factors appeared based on the eigenvalues greater than one criterion (Tabachnick & Fidell, 2019). Besides, 62.12% of the total variance on perceived teaching quality was accounted for by those dimensions. The difference between high and low factor loadings is more observable in the pattern matrix than the structure matrix. The pattern matrix was examined to identify if any item was cross-loading or freestanding. Hair et al. (2019) cited the factor loading of .30 to .40 as the cut-off point to be minimally accepted to load on a factor. Accordingly, item 4, item 5, item 6, and item1 loaded on factor 1 entitled as “Supportive Presentation Style” with the values ranging from .749 to .845 while item 3, item 2, item 7 loaded on factor 2 named as “Excessive Lesson Demands” with the values from .452 to .632 (Table 3.9). However, item 8 loaded on two factors with loadings of .355 and .394, so this item cross-loaded on both factors.

Table 3.9.

Factor Loadings for PTQ Scale for Pilot Study 1

Item	Factor 1	Factor 2
Item4	**.85**	-.004
Item5	**.78**	-.02
Item6	**.77**	-.02
Item1	**.75**	-.16
Item3	.05	**.63**
Item2	-.29	**.57**
Item7	-.26	**.45**
Item8	**.36**	**.39**
Eigenvalues	3.35	1.62
% of Variance	41.89	20.23

As oblique rotation was used based on the assumption that the factors are correlated with each other, the factor correlation matrix was inspected. According to Tabachnick and Fidell (2019), the correlation among factors should be .32 or above with at least 10% overlapping variance; otherwise, the orthogonal rotation is regarded. In this case, the correlation between factor 1 and factor 2 was -.14 below the cut-off criterion. Although these two factors were not truly inter-correlated, the orthogonal and oblique rotation would produce nearly identical results (Costello & Osborne, 2005), so there was no need to re-perform EFA with orthogonal rotation.

Cronbach Alpha coefficients were calculated to report internal consistency results and decide whether each item was working as intended in the literature. The reliability coefficient of the Supportive Presentation Style factor (4 items) was .87, whereas .56 was for the Excessive Lesson Demands factor (4 items). The Cronbach alpha coefficient was below .70 (Nunnally, 1978) for the second factor. Besides, item 8 was problematic according to the item-total correlation results confirming the findings of EFA. When Cronbach alpha value for if item deleted was checked for this item, it became .61. However, item 8 was decided to be kept on the scale after revising its writing. The Turkish translation of item 8 "Öğretmenimizin bu derste bizden beklentisi çok fazladır." (Our teacher's expectation from us is very high in this class) was changed to “Bu derste öğretmenimiz bizden çok şey bekler.” (In this class, our teacher expects a lot from us) based on expert suggestions.

3.5.2.2. Pilot Study 2 for Students

In pilot study 2, the revised version of Perceived Teaching Quality (PTQ) was administered to a different middle school student group. A total of 490 students from three randomly selected public schools in two districts of Istanbul (Kartal (n = 1), Üsküdar (n = 2)) voluntarily participated in the study. Among the participants, 318 were 7th-grade students (64.9%), while 172 were 8^{th} graders (35.1%). Furthermore, the gender distribution of the students was nearly identical as in the pilot study 1. Accordingly, 241 students were female students (49.2%), while 243 students were male students (49.6%). Besides, six students did not indicate their gender.

EFA was re-performed to reveal the factorial structure of the PTQ scale as the wording of item 8 was changed. Data were screened for missing cases and the outliers beforehand. Accordingly, item 4, “In this lesson, our teacher explains the material in such a way that I can picture in my mind how things work,” had the highest frequency with 5% of incomplete responses. The percentage of missing cases was not above 5% for any other item on the scale, so the pattern of incomplete responses was explored. In this regard, Little’s MCAR test result was significant ($\chi^2(105) = 236.26$, $p < .05$). Therefore, one-way analysis of variance (ANOVA) was performed to understand whether participants differ in the perceived teaching quality in complete and incomplete cases. For this aim, perceived teaching quality scores of participants for item 4 was preferred to be compared as this item had the highest frequency of missingness. However, Bonferroni correction was made before performing one-way ANOVA to prevent inflation of experimentwise error rates due to performing multiple ANOVAs simultaneously. Accordingly, alpha level (.05) was divided by the number of remaining items on the scale (.05/7), and the new alpha was .007. Based on the ANOVA findings, there was no significant difference between incomplete and complete cases of item 4 on students’ perceived teaching quality scores for the remaining items on the scale. As the ANOVA results were non-significant, the missing values could be ignored. In this regard, complete cases analysis was done to deal with the missing cases, so 37 cases were dropped from the analysis

Each item was standardized and compared with the value of 3.29 in this sample to determine the univariate outliers. No item in the scale exceeded the stated cut-off point, so no univariate outliers were inspected. Mahalanobis Distance (D^2) as the distance of each case from the centroid of the means of all items was computed to identify the multivariate variables (Tabachnick & Fidell, 2019). Accordingly, four cases were detected as multivariate outliers toward the critical value of 26.124 ($df = 8$, $p = .001$), so these cases were eliminated before performing EFA.

Except for missing values and outliers, correlation matrix, Barlett's test of Sphericity and KMO value, and normality assumptions were checked. First, the correlation matrix was examined to determine the preliminary factor structure. Accordingly, each item should correlate with at least one of the items in the scale with a value of .30 or above, and the correlation coefficients between each item pair in the matrix should not be above .90; otherwise, a multicollinearity issue would arise (Field, 2018; Hair et al., 2019; Tabachnick & Fidell, 2019). Although no item was correlating with any other item on the scale with a value of .90 or above, item 8 was correlating with other items with a value of less than .30 as in the pilot study 1. Notwithstanding the correlation coefficient results, Bartlett's Test of Sphericity was significant (χ^2 (28) = 967.04, $p <$ .05), indicating the difference of correlation matrix from the identity matrix. According to Kaiser's (1974) criterion, KMO value (.80 for this case) could be viewed as meritorious, and the number of participants ($n = 449$) was more than fifty times greater than the number of items in PTQ, so the sample size adequacy was fulfilled to perform EFA. Finally, univariate and multivariate normality assumptions were tested for this sample. For the univariate normality, skewness and kurtosis values were within the range of -3 and + 3. Kolmogorov-Smirnov and Shapiro-Wilk's test results were significant, but there was no serious evidence for the violation of univariate normality regarding histograms and Q-Q plots for each item. Afterward, Mardia's test result was significant (*b2p* = 89.42, $p < .001$), indicating that the multivariate normality assumption was violated. In this regard, Principal Axis Factoring (PAF) extraction method with oblique rotation was selected based on the assumption that the retained factors would be correlated (Costello & Osborne, 2005). Besides, Catell's Scree Test and eigenvalues greater than one rule were inspected to determine the factorial structure of the PTQ scale for this sample. According to Catell's Scree Test (Figure 3.3), two factors were extracted when the curve's inflection was examined carefully.

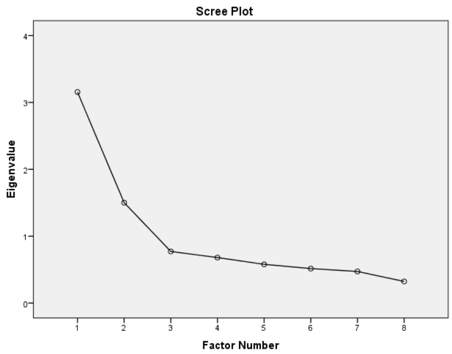

Figure 3.3.

Scree plot of PTQ scale for pilot study 2

In line with the scree plot findings, 58.21% of the total variance was accounted for by two factors when the eigenvalues-greater-than-one rule was considered (Tabachnick & Fidell, 2019). The pattern matrix was examined to determine the factor loadings and cross-loading items, if any. Accordingly, items 4, 5, 6, and 1 loaded on factor 1 (Supportive Presentation Style) with the values ranging from .57 to .85 while items 7, 3, 8 loaded on factor 2 (Excessive Lesson Demands) with the values ranging from .47 to .57. Regarding the original scale and the findings of pilot study 1, item 2 should load on factor 1; however, this item loaded on both factor 1 and factor 2 with the values .40 and .46, respectively. The factor loadings of each item in the PTQ scale were presented in Table 3.10.

Table 3.10.

Factor Loadings for PTQ Scale for Pilot Study 2

Item	Factor 1	Factor 2
Item6	**.85**	.16
Item5	**.78**	.09
Item4	**.70**	-.06
Item1	**.57**	-.17
Item7	-.28	**.57**
Item3	.009	**.50**
Item8	.12	**.47**
Item2	**-.398**	**.46**
Eigenvalues	3.16	1.50
% of Variance	39.45	18.77

According to the factor correlation matrix results, two factors were correlated with a coefficient of -.24. Since the correlation coefficient was below the cut-off point of .32, it might not be asserted that these two factors were truly inter-correlated to each other. These findings were, indeed, in line with the pilot study 1 results. On the other hand, Cronbach alpha coefficients were computed to provide evidence about internal consistency estimates of the PTQ scale scores. The reliability coefficient was found .81 for Supportive Presentation Style (4 items). Besides, the Cronbach alpha coefficient for Excessive Lesson Demands dimension (4 items) increased from .56 to .62 in pilot study 2; however, the findings were still below .70. Therefore, item-total correlations were examined to understand the problematic items on this dimension. Accordingly, Cronbach alpha coefficients increased to .622 when item 8 was deleted, but this change was small to guarantee that the Excessive Lesson Demands dimension had appropriate reliability estimates. However, this item was decided to be kept in the scale and a new item, "Bu derste, ne yapmam gerektiğini bilemem" (In this class, I do not know what I should do) was included for the main study to increase the number of items for this dimension. This item assesses "lack of clarity" in mathematics classes.

3.6. Data Collection Instruments in the Qualitative Part

For the qualitative part, data were collected through semi-structured interviews with middle school mathematics teachers. Patton (2002) specifies that the basic goal of qualitative interviewing is to elicit other people's perspectives by concentrating on their personal stories and the histories that would be meaningful to figure out the phenomenon of interest. There are several potential benefits of qualitative interviewing compared to other data collection means such as the flexibility, response rate, non-verbal behavior, controlling the environment, the sequencing of the questions, spontaneous reactions, confirmability of the data source, full response, and in-depth knowledge (Bailey, 1982). As people's feelings, thoughts, and past behaviors cannot be genuinely observed, qualitative interviewing provides an opportunity to obtain extensive information to describe the phenomenon itself through an emic perspective (Bogdan & Biklen, 2007; Marshall & Rossman, 2006; Rubin & Rubin, 2005).

The researcher developed the interview schedule after a comprehensive review of the literature to unfold the possible factors shaping students' emotions when learning mathematics regarding the learning process and students' interactions with their teachers. The interview schedule included two sections. In the first section, demographic questions were asked to elucidate background information about participants. They consisted of information about gender, age, the latest education degree received, faculty of graduation, total teaching experience, and the teaching experience in their current school. The demographic questions were kept at a minimum level, not to bother the participants at the beginning of the interview. Besides, the easiness and the manageability of these questions contributed to establishing confidence and a kind of rapport between the interviewer and the interviewees (Patton, 2002; Yıldırım & Şimşek, 2016). In the second section, open-ended and singular questions were prepared to uncover students' emotional experiences in mathematics learning environments. More specifically, the interview questions, including probes and follow-ups, mainly focused on three mathematics achievement emotions (anxiety, anger, and enjoyment) and the reasons to experience these emotions. Besides, the schedule consisted of questions seeking out the ways students used to regulate their emotions, the instructional methods and the strategies employed by their mathematics teachers to regulate students' emotions and teachers' feeling states, and the ways they used to regulate their emotions. As the teachers were selected for the interviews based on the preliminary findings, interviews were carried out with the teachers who had already filled out the teacher questionnaire. Teachers would respond to teacher questionnaires through regarding one of their 7th or 8th-grade classes that they had been teaching. Based on this issue, teachers would respond to the interview questions by considering these specific classes.

Expert opinions were obtained to ensure the questions' content validity from five faculty members experienced in qualitative research and studying emotions and mathematics education. After refining and revising the interview schedule, most of the interview questions inquire about students' emotions regarding different mathematics teaching and learning phases. In contrast, one question was included in the schedule to examine teachers' control and value appraisals.

Before finalizing the interview schedule, a pilot study was carried out with two middle school mathematics teachers having similar characteristics with the intended sample to receive feedback on the questions' grammar, clarity, and usability. As well as evaluating and improving the structure and transition between questions, pilot testing was also employed to standardize the interview conditions before the main study. Participants had bachelor's degrees in Elementary Mathematics Education with five-year total teaching experience, and they have been working for two years at a public middle school in Ümraniye, İstanbul. The pilot interviews revealed that the questions directly served the purpose of the study and the relevant research question, and accordingly, the interview schedule was finalized (Appendix F). Sample interview questions might be read as: How do you describe your school environment? Whenever you think about students in … (corresponding class), how do you describe student-teacher, student-student, and parent-teacher relationships? Whenever you think about students in … (corresponding class), do you think that there is/are one/ones who feel(s) anger toward mathematics? What might be the reasons behind mathematics anxiety? How do you feel when your students enjoy studying mathematics in … (corresponding class)?

3.7. Trustworthiness

As data analysis in qualitative research is described as "an interpretive act" (Glesne, 2016, p.211), the researcher should strive for the trustworthiness of the interpretations. In this context, the quality of qualitative research is judged by its validity and reliability. Four main criteria should be addressed. These are credibility, transferability, dependability, and confirmability (Creswell, 2013; Guba, 1981; Marshall & Rossman, 2006). Credibility or internal validity examines whether the observations and the inferred meanings and interpretations reflect the reality (Guba, 1981; Yıldırım & Şimşek, 2016). Expert opinions were granted for the interview schedules from five experts to ensure credibility. Persistent observations were also guaranteed by collecting accurate and relevant data through in-depth semi-structured interviews and generating their verbatim transcripts. Besides, the researcher provided prolonged engagement by following a rigorous data collection and analysis procedures to build a rapport with participants to learn the culture of the environment thoroughly. Lastly, peer debriefing sessions were assured by two peers to obtain external feedback about the process, especially for the coding scheme. Accordingly, four transcripts (two for each) were coded by the researcher and these two peers simultaneously. The number of the transcripts constituted a quarter of the total amount that the resulting codes were compared, ensuring the intercoder agreement among both coders (Glesne, 2016; Marshall & Rossman, 2006; Maxwell, 2013; Miles & Huberman, 1994; Yıldırım & Şimşek, 2016). Transferability or external validity refers to what extent the results would apply to different groups and situations (Guba, 1981; Yıldırım & Şimşek, 2016). Such a generalizability issue was considered through analytical generalizability. In so doing, the findings would serve readers to understand that the audience would develop a kind of empathy toward others' lives (Glesne, 2016). In this perspective, to address transferability, the participants were selected based on some predetermined criteria. In addition to this, a thick description of the phenomenon was assured by providing relevant quotations from the interview data (Creswell, 2013; Maxwell, 2013). Dependability (internal reliability) and confirmability (external reliability) of data were ensured by audit trail through an independent expert who went through each phase of the study to provide evidence as if the findings were objective and internally coherent and also whether the results and the interpretations were supported with the data (Creswell, 2013; Marshall & Rossman, 2006).

3.8. Data Collection Procedures

Initially, the permissions to conduct the study were granted from the Middle East Technical University Human Subjects Ethics Committee (HSEC) (Appendix A) and the Provincial Directorate of National Education in Istanbul for the selected districts for the pilot study (Appendix B). The pilot study lasted four weeks in the Spring semester of the 2017-2018 academic year and lasted three weeks in the Fall semester of the 2018-2019 academic year. During the data collection phase, the researcher can go to the schools, only one or two school days in a week, and the researcher visited sixteen schools during this process. First, the selected schools' administrations were informed about the purpose and asked for their approval. After receiving the school principals' approval, the researcher obtained the teacher informed consent verbally to administer the instruments in their classes. The teacher questionnaire administration took approximately ten or twelve minutes, and the student questionnaire took one class hour. Some teachers filled out the questionnaire during break time, while some preferred filling them out during class hours while administering the student questionnaire.

For the main study, permission to conduct the research was granted again from the Provincial Directorate of the National Education in Istanbul for both districts (Appendix C). The quantitative part of the study was carried out in the Spring semester of the 2018-2019 academic year between February 2019 and April 2019.

Consequently, the qualitative phase of the study was conducted in May 2019. Two graduate students were recruited to collaborate with the researcher for the data collection process for the quantitative part. To remove the data collector characteristics threat, the researcher trained them for the administration process. The researcher also prepared a data collection protocol that included the essential elements that should be considered during the data collection process and shared it with the data collectors.

For the quantitative data collection part, school administrators of the selected schools were informed about the study purpose and requested their collaboration. Accordingly, fifty-three schools from eleven districts in Istanbul approved to participate in the study voluntarily. However, more than five schools in two districts in Istanbul refused to participate in the study, so these districts were decided to be excluded from the study. The researcher first asked for 7th and 8th-grade mathematics teachers' informed consent to participate in the study during the data collection process. After receiving their approval, they were requested to fill out the questionnaire by considering one of their classes. Consequently, student questionnaires were administered to these classes.

The teacher questionnaire administration took ten or twelve minutes while the student questionnaire took approximately one-class hours. Many of the mathematics teachers did not want to allocate their class hours for student questionnaire administration. Accordingly, the researcher and the data collectors asked other subject area teachers to administer the student questionnaire during their class hours. Suitable times were scheduled for these classes. The researcher and the data collectors were usually present at classes during the administration to respond to the student questions, if any, and check for the assumption of independent observations. In some schools, however, school administrations did not permit being present at classes to administer the instruments, so teachers were requested to administer the instruments for these classes. During the data collection process, some teachers filled out the questionnaire during break time while some of them preferred filling them out during the class hour. Students were informed about the purpose and nature of the study during the student questionnaire administration. Potential benefits, and rights of the withdrawal and the confidentiality of data, and their voluntary participation was ensured. At the end of this process, the teacher and the corresponding student questionnaires were gathered.

After the quantitative part, preliminary analyses were performed based on the quantitative data to select the interviewed teachers. Two pilot interviews were carried out during the preliminary analyses in April 2019, with two middle school mathematics teachers having similar characteristics with the intended sample. After revising and finalizing the interview questions, the interview protocol was made ready for the main study.

During the quantitative data collection period, the researcher and the data collectors had mentioned the participated teachers about the qualitative part of the study. They asked them whether they would like to join in the second phase. Based on their responses and attitudes, the researcher had asked for the volunteer teachers' contact information. In addition to the researcher's request, some teachers had already shared their e-mail addresses or contact numbers with the researcher and the data collectors to be informed about the study findings. The researcher communicated with the mathematics teachers through personalized e-mails or phone calls if the contact information was available regarding the selection criteria. The researcher re-visited the schools of the selected teachers to ask for their voluntary participation in the interviews. In so doing, the researcher visited the school administrations and first talked with the school principals or the associate principals, reminded the quantitative phase of the study, and explained the purpose of the qualitative phase. After receiving the approval, the researcher talked with the teachers in the vice- principal office or the teacher's lounge. In this process, the researcher first introduced herself and explained the study purpose, and reminded the quantitative phase that they also took part in, the estimated length of the interviews, and the significance of their voluntary participation for the second phase. Accordingly, out of fifteen teachers, one teacher did not want to participate in the second phase. The researcher scheduled the meeting times with the volunteer teachers during these school visits.

Consequently, the researcher conducted semi-structured interviews with the volunteer teachers in pre-scheduled periods in May 2019. The interviews generally took from thirty to forty minutes. They were mostly carried out in classrooms, teachers' lounge, or vice-principal offices during free hours of teachers in a school day or before and after school. Before the interview day, the researcher reminded each teacher about the meeting through text messages, and the researcher was ready at schools at least half an hour before the interview time. Before starting the interviews, the researcher attempted to move to the most appropriate place in the room and paid attention to remove the distractors from the environment, such as closing the windows or approaching the chairs or the tables together. However, some of the interviews were held in a noisy environment. If the interview was interrupted by someone (e.g., student, teacher, parent), the teachers kindly warned them to wait until the end of the meeting to remove such interferences. During the interviews, the researcher emphasized being neutral about the content and the interview's progress, provided participants with differential reinforcements, and gave verbal and non-verbal feedback to increase the likelihood of obtaining full responses (Patton, 2002).

For both the quantitative and qualitative parts of the study, the most salient challenge was the reluctance of school administrations and the teachers to participate. On the other hand, it was promising to note that some school principals and the teachers for the participated schools asked the researcher to be informed about the findings.

3.9. Data Analysis

Regarding the research questions, quantitative and qualitative data analyses were explained in the next sections.

3.9.1. Quantitative Data Analysis

The purpose of the quantitative part of the study upheld two primary goals. The first goal was to investigate the relationship between teachers' sense of efficacy and teacher burnout with their academic emotions (i.e., enjoyment, anger, and anxiety). The second goal was to unravel the relationship between teachers' academic emotions and their 7th and 8th-grade students' self-efficacy for self-regulated learning in mathematics, mathematics teaching quality perceptions, and their mathematics achievement emotions. Structural Equation Modelling (SEM) and Multilevel Structural Equation Modelling (ML-SEM) were used to respond to the research questions. However, preliminary analyses were done first before moving on to the main analyses. Accordingly, descriptive statistics results in terms of frequency and percentages of both groups of participants were computed to obtain more information about the participants' demographic qualities. Missing Value Analysis (MVA) was performed to understand the distribution pattern for missing cases for teacher and student samples through IBM SPSS 22. ANOVA tests and Fisher's Exact Test were performed consequently for some of the items on the scales to decide whether the missing data at random or not. Then, Exploratory Factor Analyses (EFA) and Confirmatory Factor Analyses (CFA) were conducted to provide construct-related validity evidence for scales in teacher and student samples after checking the assumptions for pilot and main studies. IBM SPSS 22 and Mplus 8.3 (Muthen & Muthen, 2019) were used to perform EFA and CFA, respectively. Besides, the internal consistency for the scores of the scales was estimated through Cronbach Alpha coefficients through IBM SPSS 22. Before moving on to the inferential test statistics, mean and standard deviation values, and the bivariate correlations among each sub-scale for each group of participants were computed to describe the samples well.

SEM, in the statistical literature, is also called as latent variable modeling that estimates and investigates the relationships between latent or unobserved variables (Hoyle, 2012; Weston & Gore, 2006). On the other hand, ML-SEM is a combination of multiple regression and SEM (Byrne, 2011; Kline, 2016; Rabe-Hesketh, Skrondal

& Zheng, 2012). The individual data are nested within higher-level groups or clusters: classes, schools, or neighborhoods. In this hierarchically structured data, the total variance is partitioned between and within variances while separate structural models are specified and tested for individual and group levels simultaneously (Byrne, 2011; Kline, 2016; Rabe-Hesketh, Skrondal & Zheng, 2012). As a result, the proposed models for the first and the second research questions were statistically tested with SEM and ML-SEM to understand whether the hypothesized models would fit the real data (Byrne, 2009) through employing the following model testing procedures (Kline, 2016).

First, the exogenous and endogenous variables and the hypothesized relationships among these variables were specified considering directional effects, path coefficients, and covariances in the model specification process (Hoyle, 2012; Kline, 2016; Weston & Gore, 2006). Exogenous variables do not depend on any other observed or latent variable in the model, whereas endogenous variables are predicted by observed or latent variables (Kline, 2016; Weston & Gore, 2006; Wang & Wang, 2012). There is a third kind of variable that is also classified in endogenous variables, called the mediator or an intervening variable. A mediator variable attempts to intervene in the relationship between a criterion and a predictor variable by conveying the predictors' effects on the criterion variable (Cheong & MacKinnon, 2012). For the first research question, teachers' academic emotions in mathematics and teacher self-efficacy were the endogenous variables, while teacher burnout was the exogenous variable. On the other hand, for the second research question, teachers' academic emotions, perceived teaching quality, perceived teacher affective support, and self-efficacy for self-regulated learning in mathematics were exogenous variables. There was also a mediator variable in Question 2a. Accordingly, self-efficacy for self-regulated learning in mathematics was identified as the mediator variables for the model proposed for Question 2a.

In the model specification step, measurement and structural models were tested for each research question through Mplus 8.3 (Muthen & Muthen, 2019). A measurement model depicts the relationship between the observed variables and the constructs of these variables, while a structural model examines the relationships among the constructs only. The proposed models are generally considered a full structural model when both measurement and structural models are considered (Weston & Gore, 2006). Accordingly, CFAs were performed through Mplus 8.3 (Muthen & Muthen, 2019) to test and evaluate the measurement models before testing structural models. In the Model Identification step, both parameters in the model were attempted to be identified. If the model is under-identified or unidentified, the researcher needs to return to the previous step to re-specify their model. In the Model Estimation process, the proposed model is compared with the observed model. Finally, the researcher decides whether to accept or reject the hypothesized model based on the significance and strength of the parameters and the model's fit with the data (Weston & Gore, 2006). Kline (2016) recommends giving estimates of model Chi-Square test value, Steiger-Lind Root Mean Square Error of Estimation (RMSEA), Bentler Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR) values to evaluate the model fit. Accordingly, CFI makes a comparison between the fit of the hypothesized and the null model. At the same time, Tucker Lewis Index (TLI) or also called as Non-Normed Fit Index (NNFI), tends to identify the improvement of the hypothesized model over the null model (Barbeau, Boileau, Sarr, & Smith, 2019). Furthermore, the RMSEA value adjusts the model's complexity. It points out the unexplained variance (Steiger, 1990). SRMR is the standard absolute fit index referring to the absolute differences between the estimated and the observed correlations (Bentler, 1995, as cited in Barbeau et al., 2019). In this study, Chi-square statistics (χ^2) and SRMR as absolute fit indices, CFI and NNFI values as relative fit indices, and RMSEA value as evidence of non-centrality fit indices were provided to estimate the model fits (Kline, 2016; Wang & Wang, 2012).

3.9.2 Qualitative Data Analysis

The analysis of qualitative data, in a general sense, refers to the organization of data in transcriptions or images and breaking this data into small and manageable parts through the coding process, and unveiling specific themes and patterns at the end of this continuum (Creswell, 2013; Bogdan & Biklen, 2007). In this regard, the data analysis spiral as the analysis of qualitative data does not ground on a fixed approach implying the integrity of both collection, analysis, and interpretation of data (Creswell, 2013). The researcher is generally immersed in data analysis from the beginning of the data collection process (Glesne, 2016; Miles, Huberman & Saldana, 2014). Accordingly, thematic analysis, which strives to uncover the processes, perceptions, values, and the beliefs of participants relevant to the phenomena under interest (Glesne, 2016), was employed to analyze the qualitative data by considering several steps, respectively.

Firstly, twelve audio-recorded interviews were transcribed verbatim through a word-processing program. As two participants did not permit to record during the interviews, detailed interview notes were taken during their interviews, and these notes were also added to the word-processing program. The transcription of the data and its transference to the computer program was completed. Then, close reading and memoing were employed to immerse in the raw data (Creswell, 2013). Consequently, the coding process was carried out by considering the relevant literature and the data itself using an open coding approach. The open coding approach provides an opportunity to generate categories or themes and describe specific and pertinent patterns of the data (Corbin & Strauss, 2007; Marshall & Rossman, 2006; Yıldırım & Şimsek, 2016). Accordingly, the emerging codes were aggregated into more general and common ideas through deriving larger themes. Finally, the resulting themes were described by adding relevant quotations to interpret them in a more explanatory way.

3.10. Limitations

The current study includes several limitations regarding employed sampling and data collection methods and the design that should be considered while making interpretations and generalizations over the findings. First, although the study employed a mixed-method research design, the quantitative part mainly investigated the association between students' and their mathematics teachers' academic emotions, including several other relevant psychological constructs. Therefore, cause-and-effect inferences among these variables could not be used for both teacher and student samples. Accordingly, an experimental design could be preferred to talk about the causality and reciprocity of the variables.

Second, each scale on student and teacher questionnaires was administered to each group simultaneously. Hence, the study took a snapshot of both teachers' and students' academic emotions, self-efficacy beliefs, feeling of burnout, and teaching quality perceptions at a particular time point. However, longitudinal designs providing time lags between the measures could be utilized to elucidate the relationship among the constructs mentioned above and capture the dynamic nature of such association, especially regarding the mediator variables.

Third, although there are several methods such as the use of peripheral and physiological measures, functional magnetic resonance imaging (FMRI), electroencephalography, observation of nonverbal behavior and prosodic behavior of nonverbal speech (Frenzel & Stephens, 2013; Pekrun, 2009) to sufficiently and meticulously analyze emotions experienced in different settings, the implementation of such methods in classrooms could be difficult due to methodological problems and ethical concerns. Therefore, the data were collected through self-report measures. Herein, the limitations of these measures and the precautions taken in the study should be carefully discussed.

Self-report measures might yield common-method bias in behavioral research, denoting the variance due to the employed measurement methods rather than the studied constructs (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In this regard, social desirability, defined as "the need for social approval and acceptance and appropriate behaviors" (p.109), is one of the potential sources of common-methods bias. In such conditions, participants might mask their actual ideas and feelings over an issue or a topic to get acceptance or approval from the researchers, threatening internal validity. Measurement-context effects are another potential source of common-methods bias due to measuring predictor and criterion variables at the same time. Along with these possible problems, several procedural remedies were taken based on Podsakoff et al. 's (2003) recommendations, respectively. Accordingly, wordings of items and the instruction were carefully designed to remove any confusion and ambiguity while giving responses. Before administering the instruments, the purpose was clearly described to each group of participants explaining the presence of anonymity. Additionally, the participants were informed that there was no correct answer for each item on each scale. Furthermore, although self-report measures were used for the quantitative part of the study, semi-structured interviews were held with teachers for the qualitative part, which provided methodological separation of the measurement due to obtaining predictor and criterion variables at the same time point and from the same sources. That is, students' emotions in mathematics were tried to be revealed by applying questionnaires to students and interviewing with their teachers.

Fourthly, the study was restricted to 7^{th} and 8^{th}-grade public middle school students and their mathematics teachers in Istanbul. The study focused on the mathematics domain due to the domain-specific nature of studied constructs. The findings could not be generalized to the extent beyond the other grade levels, the domains, and other cities in Turkey. These issues might be a concern for ecological generalizability; in other words, a threat to external validity.

Lastly, location and data collector characteristics might pose internal validity threats in the study. Bearing in the mind that different school climates might impact students' and teachers' responses, which might induce location threat, identical or similar conditions were attempted to be created while collecting data from both participants. For instance, student questionnaires were applied in classrooms during class hours, and teacher questionnaires were administered in classrooms or teachers' lounges according to teacher availability. In addition to the researcher, two graduate students were recruited to collect paper-based instruments for the quantitative part during the data collection process. That might also pose data collector characteristics threat to internal validity. Accordingly, data collectors were trained by the researchers before the administration of the questionnaires to control this threat. A data collection protocol was prepared by the researcher and shared with the data collectors. The protocol included essential data collection elements to remove the unavoidable effects of data collector characteristics.

3.11. Assumptions

The current study held the following assumptions: First, student and teacher questionnaires were administered to the participants under the standard conditions. Second, the participants gave sincere responses to the items on each scale, and they were not influenced by anyone while filling out the questionnaires. Therefore, the responses truly reflected the participants' ideas. Third and the last, the interview questions were similarly comprehended by all interviewees, and they sincerely gave their responses.

CHAPTER 4

RESULTS

In this chapter, quantitative and qualitative data analyses were presented according to the research questions. Before moving on to the results, missing value analysis, the construct validity and reliability evidence for quantitative measures, and the structural equation modeling assumptions were checked and reported, respectively. Consequently, descriptive statistics results were presented, and then the findings of the measurement model were given before the full structural equation model results. Afterward, the results of full structural equation models were provided, which was followed by qualitative findings. The content analysis results in line with the research question were given accordingly. Finally, a summary of both quantitative and qualitative findings was presented at the end of this section.

4.1. Missing Value Analysis

The study's missing data profile was examined to understand how the incomplete cases were distributed in the whole data set for each group of participants. In doing so, the frequency statistics of incomplete cases for each scale were computed item by item. Then Little's MCAR test was performed to reveal whether the missing values in each scale were distributed completely at random or not. After screening the teacher questionnaire data, the Teacher Emotions Scale (TES) frequency statistics were examined first. The highest frequency of the incomplete responses for this scale was 1.8% for item 5, "Teaching these students frustrates me," and Little's MCAR test result was significant ($\chi^2(96) = 133.51$, $p = .007$). Afterward, one-way analysis of variance (ANOVA) was carried out to determine whether teachers differ on academic emotion scores for item 5 with the highest frequency of missingness. Bonferroni correction was done by dividing the alpha level (.05) by the number of remaining items in the scale (.05/11) to prevent inflation of the experimentwise error rates. In this case, the new alpha was adjusted to .0045. According to ANOVA results, there was no significant difference between complete and incomplete responses on teachers' academic emotion scores for the rest of the items on the scale. As the proportion of each item's missing values was below 5% (Tabachnick & Fidell, 2019) and ANOVA was non-significant for the item with the highest frequency of missing values, the incomplete cases could be considered completely at random (MCAR) and could be ignored.

Second, the frequency statistics of the missing values were examined for Teachers' Sense of Efficacy Scale (TSES) and Maslach Burnout Inventory - Educators Form in teacher questionnaire. The highest frequency of the incomplete cases was 2.3% for item 17, "How much can you do to adjust your lessons to the proper level for individual students" on TSES, and 3.6% for item 19, "I have accomplished many worthwhile things in this job" on Maslach Burnout Inventory - Educators Form. Next, Little's MCAR test was carried out for each scale to unravel whether the incomplete cases were completely at random or not. Accordingly, Little's MCAR test was found non-significant for both TSES ($\chi^2(184) = 169.68$, $p = .77$) and Maslach Burnout Inventory - Educators Form ($\chi^2(487) = 520.13$, $p = .15$). As the proportion of the missing cases for each item on the abovementioned scales was below 5%, and Little's MCAR test results were non-significant, the missingness could be ignored.

Data were also screened for each scale in the student questionnaire. Accordingly, frequency statistics of the missing values were computed for Achievement Emotions Questionnaire-Mathematics (AEQ-M), Self-Efficacy for Self-Regulated Learning (SESRL), Perceived Teaching Quality (PTQ), and Perceived Teacher Affective Support (PTAS) scales, respectively. There was no item with and above 5% of the missing values on both scales.

In the AEQ-M, item 32, "I am so angry that I would like to tear the exam paper into pieces" had the highest frequency of missing values with 2.1% of all cases. Little's MCAR test resulted significant difference ($\chi^2(10101) = 13761.34$, $p < .01$). Therefore, one-way ANOVA was performed to determine whether students with complete and incomplete responses differ in mathematics achievement emotions regarding item 32. Bonferroni correction was done beforehand to prevent the inflation of experimentwise error rates that alpha level (.05) was divided by the number of the remaining items on the scale (.05/33). The new alpha value was set at .0015. Accordingly, there was no significant difference. In addition to one-way ANOVA, Fisher's Exact Test was performed to understand whether students with complete data on item 32 were statistically different from those with incomplete data regarding their gender and grade level. Accordingly, the proportion of complete and incomplete responses on item 32 did not seem to depend upon students' gender (p = .808) and their grade levels (p = .54). As the proportion of the missing data was very small, and the ANOVA and Fisher's Exact Test results were not significant, the missing data could be ignored for AEQ-M. Accordingly, Expectation-Maximization (EM) imputation method was preferred, as unbiased parameter estimates could be obtained through this method, especially if the missing values are MCAR and MAR (Enders, 2010; Schafer & Graham, 2002).

For the SESRL scale, item 7, "How well can you participate in math classes?" had the highest frequency of missing responses (3.5%). As Little's MCAR test ($\chi^2(804)$ = 1087. 57, p < .01) was significant, one-way ANOVA was performed to understand whether students differ on self-efficacy for self-regulated learning scores on the item with the highest frequency of missing values. First, Bonferroni correction (.05/10) was done. Then, ANOVA findings pointed out a non-significant difference between complete and incomplete responses of item 7 on students' self-efficacy for self-regulated learning scores in mathematics except for item 8 (p < .01). However, the effect size (μ^2 = .002) was small. Therefore, Fisher's Exact Test was examined to determine whether students with complete and incomplete responses on item 7 differ on their gender and grade levels. Accordingly, male students tended to provide incomplete responses more than female students (p=.001) for item 7 with a small effect size (Cramer's V =.045). Likewise, seventh-grade students' incomplete responses seemed to be higher than the eighth-grade students for the same item (p=.008) with again small effect size (Cramer's V =.045). Accordingly, the EM imputation method was applied on this scale since any imputation method could be employed when the missing values were below 10% (Hair et al., 2019).

In the PTAS, item 4, "My math teacher really cares about me," had 3.1% of missing values with the highest frequency compared to other items on the scale. After inspecting Little's MCAR test result ($\chi^2(920) = 1484.33$, $p <.01$), one-way ANOVA was carried out to determine whether students differ on perceived teacher affective support considering their complete and incomplete responses for item 4. According to ANOVA results, no significant difference was found between complete and incomplete cases on item 4 regarding perceived teacher affective support scores with the exceptions of item 1 ($p <.01$, $\mu^2 = .004$) and item 12 ($p <.01$, $\mu^2 = .002$). As the effect sizes were small, other test results should also be considered. Therefore, Fisher's Exact Test was performed to decide whether students' complete and incomplete responses on item 4 differ regarding their gender and grade level. Fisher's Exact Test revealed that students with complete and incomplete responses on item 4 did not differ on their gender ($p = .75$) and their grade level ($p = .43$). Therefore, the missing values on PTAS could be ignored, and the EM imputation method was used.

For the PTQ scale, item 6, "In this lesson, our teacher presents the material with enthusiasm," had the highest frequency of missing values (3.5%). Little's MCAR test was significant ($\chi^2(387) = 583.505$, $p < .01$), so whether students' perceived teaching quality scores differ regarding their complete and incomplete responses on item 6 was examined through performing one-way ANOVA. According to ANOVA results with the new alpha value of .006 after performing Bonferroni correction (.05/8), students with complete and incomplete responses on item 6 tended to differ only for item 1 (p=.001, μ^2=.002) and item 2 (p=.001, μ^2=.002). However, the effect sizes were small for those cases. Consequently, Fisher's Exact Test was performed to determine whether perceived teaching quality scores of students regarding item 6 differ on their individual and school-level characteristics. Accordingly, students with complete and incomplete responses on item 6 did not significantly differ on their gender (p = .59) but differed on their grade level (p = .03). However, this difference could be ignored as the effect size (Cramer's V = .03) was small regarding Cohen's (1988) criteria. Despite the significant findings, the effect sizes did not confirm the practical significance that the missing values were decided to be ignored, and the EM imputation method was applied at the end.

4.2. Preliminary Analyses

Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) assumptions were evaluated in the following sections before performing SEM and Multilevel Structural Equation Modeling (ML-SEM) analyses. Accordingly, sample size criterion, univariate and multivariate outliers, univariate and multivariate normality, linearity and homoscedasticity, and multicollinearity assumptions were checked carefully.

4.2.1. Sample Size

Sample size criteria were examined for TES, TSES, and Maslach Burnout Inventory-Educators Form, separately. For Confirmatory Factor Analysis (CFA), there should be more observations than the number of variables (Hair et al., 2019). The number of the participants was approximately twenty times the number of the TES items, so the sample size criterion was satisfied for this scale. According to Kline (2016), a medium sample size should comprise 200 cases regarding education and psychology studies, so sampling adequacy was also confirmed for Maslach Burnout Inventory - Educators Form and TSES since the teacher sample included 222 cases in this study. Sample size criteria were also checked for AEQ-M, SESRL, PTAS, and PTQ scales, respectively. According to Kline's (2016) recommendation of 200 cases and Hair et al.'s (2019), five observations per variable suggestion, the student sample was adequate to perform CFA.

According to Kline (2016), the sample with fewer than 100 participants is described as "small" from 100 to 200 participants is "medium," while the sample with more than 200 participants is depicted to be "large." Kline (2016) suggested to include 200 participants in the sample to perform simple SEM, whereas this case might differ while conducting ML-SEM analysis. The sample size of the group or higher-level is essential in multilevel modeling. Although the group-level sample size of 100 was recommended by Hox, Maas, and Brinkhuis (2010) in ML-SEM, the group-level sample size of 50 were also reported to be enough for the accuracy of the model testing. Therefore, the student and teacher samples in this study were sufficient to perform conventional SEM and ML-SEM.

4.2.2. Influential Outliers

Univariate and multivariate outliers were inspected in Teacher and Student Questionnaire. Accordingly, univariate outliers were screened after standardizing the scores of each item on each scale. The standardized scores were compared with the cut-off value of 3.29 (Tabachnick & Fidell, 2019). After detecting univariate outliers, multivariate outliers were checked through computing Mahalanobis Distance (D^2) on each scale.

First, three data sets were created before performing factor analyses for the scales in Teacher Questionnaire. More specifically, both univariate and multivariate outliers were kept in one data set. In contrast, the common outliers, which were displaying the property of being a univariate and multivariate outlier at the same time, were deleted in the second data set. Finally, all univariate and multivariate outliers were deleted in the last data set. The main idea was to decide on whether to remove the extreme cases or to keep them as they were to find the best fit of the model to the data. Accordingly, two cases with *ID 64* and *ID 205* displayed the characteristics of both univariate and multivariate outliers toward the threshold ($\chi^2(12) = 32.909$, $p = .001$) in TES and seven cases with *ID 79*, *ID 44*, *ID 111*, *ID 121*, *ID 136*, *ID 152* and *ID 187* were identified as both univariate and multivariate outliers toward the threshold ($\chi^2(24) = 51.179$, p =

.001) in TSES. For Maslach Burnout Inventory - Educators Form, 18 cases exceeded the cut-off value of 3.29, and six cases described the characteristics of being multivariate outliers toward the critical value of 48.268. Furthermore, two cases with *ID 121* and *ID 85* were identified as both univariate and multivariate outliers in the teacher sample for this scale. However, the models with outliers reflected appropriate fits to data for each scale, so outliers were decided to be kept in the data for further analyses.

Second, univariate and multivariate outliers were inspected for the scales in Student Questionnaire, respectively. There was no standardized score below or above the cut-off value of 3.29, indicating the absence of univariate outliers on the student sample for each scale in the student questionnaire. Although there was no univariate outlier, there might also be extreme cases on more than one variable, implying multivariate outliers. Therefore, multivariate outliers were examined by checking Mahalanobis Distance results on the student sample. For AEQ-M, 489 cases were detected as the multivariate outliers toward the threshold ($\chi^2(34) = 65.247$, $p = .001$), 360 cases were determined toward the threshold ($\chi^2(11) = 31.264$, $p = .001$) for SESRL, 269 cases were labelled as multivariate outliers toward the critical value ($\chi^2(12) = 32.909$, $p = .001$) for PTAS, and finally 101 cases were inspected as multivariate outliers toward the critical value ($\chi^2(9) = 27.877$, $p = .001$) for PTQ. Since there was no univariate outlier in each scale in Student Questionnaire, two data sets were created before the factor analyses as in teacher data. In other words, both multivariate outliers were deleted in one data set, while they were all kept in the other one. Similar to the teacher sample, datasets with outliers in student sample displayed acceptable fit to the data for each scale, so those cases were decided to be retained in the student sample to prevent loss of sample for further analyses.

4.2.3. Normality

Univariate and multivariate normality assumptions were also examined for each scale to determine whether the teacher and student populations in which the samples were selected were normally distributed or not. Skewness and Kurtosis values, Kolmogorov-Smirnov, and Shapiro-Wilk's tests, Histograms, and Q-Q plots were checked first (Field, 2018).

For the scales in Teacher Questionnaire, the Skewness and Kurtosis values were mostly within the range of -3 and +3 (Holton, 2014). For TES, the skewness values ranged from -1.095 to 1.783, and kurtosis value ranged from -.525 to 3.309. Although the kurtosis index was beyond three for item 10, the serious non-normality could be discerned with the skew index with a value beyond three and kurtosis index with a value beyond ten regarding Kline's (2016) criteria. For TSES, the skewness values ranged from -.517 to .016, and kurtosis values ranged from -.609 to .343. For the Maslach Burnout Inventory - Educator Form, kurtosis values were from -1.372 to 1.457, and kurtosis values were from -1.360 to 1.861. On the other hand, Kolmogorov-Smirnov and Shapiro-Wilk's statistical test results yielded significant results for each scale in the teacher questionnaire. However, these statistical tests were assumed to be highly influenced by large samples (Field, 2018). Therefore, histograms and Q-Q plots were scanned separately. Although there were small deviations from the sample in some of the items on each scale, there was no serious concern for violating univariate normality assumptions based on the exploration of those plots. Except for univariate normality, a multivariate normality assumption was examined by looking at Mardia's test results. Accordingly, Mardia's Test yielded significant results pointing out the violation of multivariate normality ($b2p$ = 213.817, p < .001) for TES, and ($b2p$ = 595.608, p < .001) for Maslach Burnout Inventory - Educators Form whereas non-significant results were obtained for TSES ($b2p$ = 51.019, p =.0249 >.001). However, the non-normality for the samples with 200 or more cases could be neglected (Hair et al., 2019) because the sampling distributions of sample means were assumed to be normally distributed under sufficiently large samples considering the central limit theorem (Tabachnick & Fidell, 2019). In addition to this, Kline (2016) argued the limitations of such tests that even slight departures from the normality could be significant in a large sample. Therefore, the deviations on the multivariate normality were assumed reasonable as there was no serious concern about the results of univariate normality in both scales in the Teacher Questionnaire.

For the scales in Student Questionnaire, the same analysis for univariate and multivariate normality was performed, respectively, as in the Teacher Questionnaire. For AEQ-M, the skewness values ranged from -.263 to 1.030, and kurtosis values ranged from -.759 to .475. For SESRL, skewness values ranged from -.697 to -.206, while kurtosis values ranged from -1.284 to -1.036. For PTAS, skewness values ranged from -1.094 to -.234, and kurtosis values were from -1.210 to .240. For PTQ, skewness values ranged from -.969 to .974, and kurtosis values ranged from -1.432 to -.412. Mardia's Test results yielded significant findings for each scale regarding multivariate normality, pointing out the violation of the multivariate normality assumption. As the number of the student sample is sufficiently large, and there was no serious evidence of a violation of the univariate normality, the departures from the normality could be ignored for this sample.

4.2.4. Linearity and Homoscedasticity

Linearity and homoscedasticity were required for SEM (Kline, 2016). There should be a straight-line relationship between two or the combination of more than two variables to satisfy the linearity assumption (Tabachnick & Fidell, 2019). On the other hand, homoscedasticity refers to the equal variances of the residuals at each level of predictor variables; otherwise, heteroscedasticity would arise (Field, 2018). Partial regression plots of independent and dependent variables of each group of participants were inspected to check the linearity assumption. Although the partial regression plots were not perfectly oval-shaped, which Tabachnick and Fidell (2019) suggested addressing the linearity assumption, the data's linearity could be admissible because Norman (2010) indicated the robustness of assumption violations in parametric tests for Likert data. In this case, both teacher and student data were in an interval scale of measurement, so such kind of violation might be neglected. For homoscedasticity, scatterplots of each dependent variable for each group of participants were examined.

It appears that there was no apparent pattern. These plots for each group of participants are presented in Appendix G.

4.2.5. Multicollinearity

Multicollinearity refers to considerably high intercorrelations between two or more than two variables (Stevens, 2009; Field, 2018). Specifically, there are two ways to diagnose the multicollinearity problem across variables. These might be through investigating the simple correlations or examining the variance inflation factors among variables (Field, 2018; Kline, 2016; Stevens, 2009; Tabachnick & Fidell, 2019). Regarding these methods, the simple correlations should not be too high (at or above .90), and Variance Inflation Factor (VIF) value should be lower than 4, while the Tolerance value should be higher than .20 (Field, 2018). Accordingly, simple correlations between each item or item parcels on each scale were examined first. Then, VIF and Tolerance values were checked to determine whether there was a collinearity problem. According to each scale's correlation matrix in the Teacher and Student Questionnaire, the correlation coefficients were not at or above .90. Besides, Table 4.1 provides information about VIF and Tolerance values for the scales.

Table 4.1.

VIF and Tolerance Values of Items and Item Parcels for Multicollinearity

	VIF	*Tolerance*
Teacher Questionnaire		
TES	1.47 - 3.72	.27 - .68
TSES	2.55 - 4.55	.22 - .39
Maslach Burnout Inventory-Educators Form	1.30 – 4.66	.22 -.79
Student Questionnaire		
AEQ-M	2.60 – 3.62	.28 - .39
SESRL	1.38 – 2.08	.48 - .73
PTAS	1.70 – 2.64	.38 - .59
PTQ	1.09 – 1.68	.59 - .92

Although VIF values were higher than 4 for TSES and Maslach Burnout Inventory-Educators Form, the value of 10 and above was specified as a problem for collinearity issues (Field, 2018). The multicollinearity issue was also inspected between mean scores of the employed scales in addition to examining the collinearity diagnostics between each item or item parcels for each scale (Table 4.2). Besides, simple correlations between each sub-scale were investigated to check whether any variable correlates to the others with a value of .90 or above. According to the correlation matrix results, no variable correlates to the others with a value of .90 or above. Besides, VIF and Tolerance values were also checked to provide more evidence about the multicollinearity issue among dimensions. Accordingly, VIF values were lower than 4, while Tolerance values were higher than .20 (Field, 2018) (Table 4.2). Therefore, no serious evidence of multicollinearity was inspected in both student and teacher samples.

Table 4.2.

VIF and Tolerance Values between the Dimensions of the Scales for Multicollinearity

	VIF	*Tolerance*
Teacher Questionnaire		
Enjoyment	2.05	.49
Anxiety	2.65	.42
Anger	2.95	.36
Efficacy for Classroom Management	2.17	.46
Efficacy for Instructional Strategies	2.42	.41
Efficacy for Student Engagement	2.24	.45
Emotional Exhaustion	2.09	.48
Depersonalization	2.07	.48
Personal Accomplishment	1.59	.63
Student Questionnaire		
Enjoyment	2.47	.41
Anxiety	2.75	.36
Anger	2.99	.33
SESRL	2.12	.47
PTAS	2.06	.49
Excessive Lesson Demands	1.35	.74
Supportive Presentation Style	2.15	.46

4.3. Psychometric Characteristics of the Scales

Validity and reliability analyses for the Teacher Emotions Scale (TES), Teachers' Sense of Efficacy Scale (TSES), Maslach Burnout Inventory - Educators Form, Mathematics Achievement Emotions Questionnaire (AEQ-M), Perceived Teacher Affective Support Scale (PTAS), Self-Efficacy for Self-Regulated Learning Scale (SESRL), and Perceived Teaching Quality Scale (PTQ) were performed, respectively to provide sufficient evidence for the psychometric characteristics of these scales.

4.3.1. Validity and Reliability of Teacher Emotions-Student Specific Group Scale (TES)

Confirmatory Factor Analysis (CFA) was performed through Mplus 8.3 (Muthen & Muthen, 2019) to confirm the hypothesized three emotions-factor model and provide construct-related validity evidence for TES. The first run of CFA with Satorra-Bentler correction revealed a significant chi-square χ^2 (51) = 98.896, p < .001). As this test is sensitive to sample size (Tabachnick & Fidell, 2019), other index values were examined: Root Mean Square Error of Approximation (RMSEA) = .065, Comparative Fit Index (CFI) = .96, Non-Normed Fit Index (NNFI) = .95, and Standard Root Mean Square Residual (SRMR) = .053. Although RMSEA value was within the range of .05 and .08 for a mediocre model fit (Browne & Cudeck, 1993), the proposed model reflected a good model fit as CFI and NNFI values were at and above .95 and the SRMR value was below .08 (Hu & Bentler, 1999). Besides, each item’s standardized estimates significantly contributed to the corresponding factor with loadings of .40 or higher value (Table 4.3). Regarding the original scale findings and the pilot study results, the Turkish version of Teacher Emotions for Student Specific Group Scale confirmed the three-emotions factorial structure.

Table 4.3.

Standardized Estimates for TES-Student Specific Group Scale

Dimensions	Items	Standardized estimates
Anger	Item 5	.868
	Item 4	.829
	Item 3	.751
	Item 9	.743
Anxiety	Item 12	.840
	Item 10	.720
	Item 8	.624
	Item 2	.477
Enjoyment	Item11	.907
	Item 6	.861
	Item1	.825
	Item7	.758

Cronbach alpha estimates were computed to reveal internal consistency estimates for each emotion dimension. The results were α = .87 for anger (4 items), α = .75 for anxiety (4 items), and α = .90 for enjoyment (4 items). In general, Cronbach's alpha values reflected good reliability estimates for this scale.

4.3.2. Validity and Reliability of Teachers' Sense of Efficacy Scale (TSES)

The initial run of CFA to confirm the three-dimensional structure of Teachers' Sense of Efficacy Scale (TSES) resulted an inadmissible poor model fit with a significant chi-square value (χ^2 (249) = 596.374, p < .001) with the following fit indices: RMSEA = .079, CFI = .84, NNFI = .82, and SRMR = .080. The sample size and the violation of the multivariate normality assumption might be the reasons for this poor fit. In this regard, the item parceling method was preferred to deal with the sample size issue and violation of the multivariate normality assumption. Bandalos and Finney (2001) recommended using this method when the normality, sample size, the sample size to variable ratio, and the parameter estimates were problematic in the tested model. While parceling the data, item means, or item sums are used rather than including the proposed model's items. That leads to fewer parameter estimates, the fewer sample size to variable ratio, and less likely to have correlated residuals and cross-loadings. Therefore, the measurement error would be smaller (Little, 2013; Matsunaga, 2008;

Williams & O'Boyle, 2008). Besides, non-normal distributions under the inclusion of individual items would approach more normal distributions with parcelled data with increased fit indices (Bandalos, 2002; Holt, 2004; Matsunaga, 2008). From this perspective, the dimensionality of the items should be noted beforehand. The item parceling method is supported if the items reflect a unidimensional structure. The solutions regarding the estimates and the index values would be unwarrantedly biased with multidimensional structures. In addition to this, the differential factor structure would obscure with parcelled data, so the method of item parceling is not suggested with multidimensional item structures (Bandalos, 2002, 2008). On the other hand, Rogers and Schmitt (2004) warned the researchers not to apply this method while validating the newly developed instruments not to neglect individual item effects. This method is strongly recommended with an already developed instrument in light of testing a more comprehensible theoretical framework. Bearing in mind these points, TSES is an already developed instrument, including three dimensions with their items, which indicated their unidimensional structure in the model. Therefore, item parceling could be employed to maintain the factor analysis in this sample. According to Bollen (1989), each parcel should contain at least four items, but Bandalos (2002) described this criterion as possessing at least two items per parcel. Through increasing the number of items in each parcel, the parcel numbers are suggested to be kept at a minimum value to increase the model fit (Holt, 2004; Rogers & Schmitt, 2004). Therefore, two parcels with eight items in the efficacy for student engagement dimension, two parcels with eight items in the efficacy for instructional strategies dimension, and two parcels with eight items in the efficacy for classroom management dimension were created for the TSES data. Consequently, CFA was performed with the parcelled data resulting an improved model fit as follows: (χ^2 (6) = 11.932, p =.0635), RMSEA = .067, CFI = .99, NNFI = .98, and SRMR = .019. Furthermore, each parcel's standardized estimates were significant, ranging from .85 to .95 (Table 4.4).

Table 4.4.

Standardized Estimates for TSES

Dimension	Item parcels	Standardized estimates
Efficacy for Student Engagement	Parcel 1	.87
	Parcel 2	.85
Efficacy for Instructional Strategies	Parcel 1	.89
	Parcel 2	.92
Efficacy for Classroom Management	Parcel 1	.95
	Parcel 2	.91

The reliability coefficients of the parcelled data were also computed for each sub-scale of the TSES. Cronbach alpha estimates were α = .85 for the efficacy for student engagement dimension (8 items, 2 parcels), α = .89 for the efficacy for instructional strategies dimension (8 items, 2 parcels), and α = .93 for the efficacy for classroom management dimension (8 items, 2 parcels).

4.3.3. Validity and Reliability of Maslach Burnout Inventory - Educators Form

CFA was performed with Satorra-Bentler correction considering the model specifications regarding the original scale and the pilot study findings. The first run of CFA resulted a poor model fit for three-dimensional factorial structure for teacher burnout with a significant chi-square value (χ^2 (206) = 398.079, p < .001) and the following fit indices: RMSEA = .065, CFI = .89, NNFI = .88 and SRMR = .082. Examination of the modification indices revealed that one item pair had higher error covariances (item2-item3). The item pair was to load on the same factor, so the error terms of these items (e2-e3) were allowed to covary. Accordingly, the second run of CFA resulted a decrease in chi-square value (χ^2 (205) = 357.395, p < .001) with the following indices: RMSEA = .058, CFI = .91, NNFI = .90 and SRMR = .081. All items significantly contributed to the corresponding dimensions with a factor loading of .40 or above, except for item 4 (Table 4.5). Item 4 loaded on the proposed dimension with the loading of .347. This result seemed a weaker indicator; however, the item might be kept under the relevant factor since it was statistically significant (e.g., Wang & Wang, 2012). Thus, this item was kept on the scale.

Table 4.5.

Standardized Estimates for Maslach Burnout Inventory - Educators Form

Dimensions	Items	Standardized estimates
Emotional Exhaustion	Item 8	.903
	Item 1	.829
	Item 20	.810
	Item 6	.794
	Item 13	.766
	Item 16	.682
	Item 3	.653
	Item 2	.607
	Item 14	.498
Depersonalization	Item 10	.828
	Item 11	.730
	Item 5	.576
	Item 15	.466
	Item 22	.412
Personal Accomplishment	Item 18	.689
	Item 17	.594
	Item 12	.549
	Item 19	.543
	Item 21	.452
	Item 9	.445
	Item 7	.397
	Item 4	.347

Cronbach alpha estimates were computed for each subscale of teacher burnout. Accordingly, $\alpha = .91$ for emotional exhaustion (9 items), $\alpha = .73$ for depersonalization (5 items), and $\alpha = .73$ for personal accomplishment dimensions (8 items). Therefore, the Turkish version of the Maslach Burnout Inventory-Educators Form's psychometric properties were deemed acceptable to measure teachers' burnout in educational contexts.

4.3.4. Validity and Reliability of Achievement Emotions Questionnaire-Mathematics (AEQ-M)

CFA was performed to confirm three-emotion dimension model of AEQ-M; however, the first run of CFA resulted a poor model fit (χ^2 (524) =11867.28, $p < .001$) with the following indices: RMSEA = .063, CFI = .85, NNFI = .84, and SRMR = .062. Although RMSEA and SRMR values indicated a mediocre model fit (Browne &

Cudeck, 1993), CFI and NNFI index values could not be within the acceptable ranges (Hu & Bentler, 1999). Consistent with the findings of the adaptation and validation study of AEQ-M (Çalık & Çapa Aydın, 2019), the item parceling method was employed before performing CFA for the second time. Accordingly, the number of items per parcel was attempted to be kept at a maximum level. The number of parcels was preserved at the minimum level (Bollen, 1989; Holt, 2004; Rogers & Schmitt, 2004). Therefore, two parcels with ten items in the enjoyment dimension, two parcels with nine items in the anger dimension, and three parcels with fifteen items in the anxiety dimension were created for the AEQ-M. In this regard, CFA was performed with the parcelled data with the following fit indices: (χ^2 (11) = 879.39, p < .001), RMSEA = .12, CFI = .96, NNFI = .93, and SRMR = .029. As Chi-square statistics are used to compute RMSEA value, this index's inflation might be influenced by multivariate normality violations. On the other hand, smaller models might have more constraints regarding degrees of freedoms that make RMSEA more sensitive to model sizes (Breivik & Olson, 2001, as cited in Kline, 2016). As in this case, the RMSEA value did not reflect an admissible model due to this possible violation and model size issues. However, other fit indices were within the acceptable range, so the findings of CFA could be provided to confirm the factorial structure of AEQ-M data for the three-emotion dimension model. Furthermore, standardized estimates of each parcel were significant. The factor loadings ranged from .76 to .98 for enjoyment, from .89 to .91 for anger, from .86 to .88 for the anxiety dimension (Table 4.6).

Table 4.6.

Standardized Estimates for AEQ-M

Dimension	Item parcels	Standardized estimates
Enjoyment	Parcel 1	.76
	Parcel 2	.98
Anger	Parcel 1	.91
	Parcel 2	.89
Anxiety	Parcel 1	.88
	Parcel 2	.88
	Parcel 3	.86

Cronbach alpha coefficients of each emotion sub-scale were examined to provide evidence on the reliability estimates for the parcelled data on AEQ-M. These are as follows: α = .84 for enjoyment (2 parcels), α = .89 for anger (2 parcels), and α = .91 for anxiety dimensions (3 parcels). They were all above .80 (Knapp & Mueller, 2010), so AEQ-M was deemed to provide reliable scores to assess students' achievement emotions in mathematics.

4.3.5. Validity and Reliability of Self-Efficacy for Self-Regulated Learning (SESRL)

The initial CFA to confirm the unidimensional structure of Self-Efficacy for Self-Regulated Learning Scale (SESRL) resulted a significant chi-square value (χ^2 (44) = 571.65, p < .001) with the following fit indices: RMSEA = .047, CFI = .96, NNFI = .96, and SRMR = .028. CFA findings yielded appropriate fit indices regarding the criteria to evaluate fit index values for a good model fit. Furthermore, each item significantly contributed to the proposed factor, and the standardized estimates were higher than .40 (Table 4.7). Therefore, the results supported the Turkish version of the SESRL scale's unidimensional structure, similar to the original scale's findings.

Table 4.7.

Standardized Estimates for Self-Efficacy for Self-Regulated Learning (SESRL)

Dimensions	Items	Standardized estimates
SESRL	Item 3	.746
	Item 6	.745
	Item 5	.729
	Item 9	.715
	Item 2	.707
	Item 1	.656
	Item 7	.650
	Item 10	.582
	Item11	.570
	Item 4	.552
	Item 8	.533

Cronbach's alpha coefficient of the scale was found .89, deemed acceptable based upon Nunnally's (1978) criteria for reliability.

4.3.6. Validity and Reliability of Perceived Teacher Affective Support (PTAS)

CFA was performed to test the unidimensional structure of the Perceived Teacher Affective Support Scale (PTAS). The initial run of CFA with Satorra-Bentler correction yielded a significant chi-square value (χ^2 (54) = 1166.51, p < .001) with the following indices: RMSEA = .062, CFI = .96, NNFI = .95 and SRMR = .03. Although RMSEA value was high for a perfect fit, CFI, NNFI, and SRMR values were deemed satisfactory for a good model fit (Hu & Bentler, 1999). Besides, each item's contribution to the scale was significant and had a loading of .40 or higher value (Table 4.8). Therefore, PTAS reflected a unidimensional factorial structure parallel with the findings of Sakız (2017).

Table 4.8.

Standardized Estimates for Perceived Teacher Affective Support Scale (PTAS)

Dimensions	Items	Standardized estimates
PTAS	Item 7	.809
	Item 11	.798
	Item 4	.796
	Item 2	.795
	Item 3	.742
	Item 9	.733
	Item 6	.713
	Item 5	.705
	Item 1	.704
	Item 12	.691
	Item 8	.639
	Item 10	.636

Cronbach's alpha coefficient of the scale as evidence for internal consistency was .93. The scale had higher reliability as it was above .80 (Knapp & Mueller, 2010).

4.3.7. Validity and Reliability of Perceived Teaching Quality Scale (PTQ)

Regarding the results of Pilot Study 1 and Pilot Study 2, CFA was performed to confirm the factorial structure of the Perceived Teaching Quality (PTQ) scale. CFA with Satorra-Bentler correction resulted a significant chi-square value (χ^2 (26) = 525.34, p < .001) with a moderate model fit: RMSEA = .06, CFI = .94, NNFI = .92 and SRMR = .056. Modification indices of errors were examined, and two item pairs (item 5-item6; item3-item8) had higher error terms. As the abovementioned items pertained to the same factors, the error terms (e5-e6; e3-e8) were allowed to covary in the model.

The second run of CFA resulted the following chi-square value (χ^2 (24) = 448.19, p < .001) and the following fit indices RMSEA =.057, CFI = .95, NNFI = .92 and SRMR = .053. The findings of CFA reflected improved fit indices (Bentler & Bonett, 1980; Browne & Cudeck, 1993; Hu & Bentler, 1999; Schumacker & Lomax, 1996) compared to the initial run of CFA. The standardized estimates of the items were presented in Table 4.9.

Table 4.9.

Standardized Estimates for Perceived Teaching Quality

Dimensions	Items	Standardized estimates
Supportive Presentation Style	Item 4	.717
	Item 6	.687
	Item 1	.667
	Item 5	.657
Excessive Lesson Demands	Item 7	.727
	Item 9	.747
	Item 2	.486
	Item 3	.377
	Item 8	.210

Based on the standardized estimates, although each item’s contribution was significant, the factor loadings of item 3 and item 8 were relatively low. More specifically, item 3 and item 8 loaded on the factor of excessive lesson demands with a value of .377 and .210, respectively. Consequently, reliability estimates of each factor were checked by looking at Cronbach alpha values. These were given as α=.79 for supportive presentation style (4 items), α =.64 excessive lesson demands (5 items). The latter dimension's reliability estimates were comparably low, so item-total correlations were explicitly examined for this factor. Accordingly, item 8 seemed to be problematic again because Cronbach alpha increased from .64 to .67 when item 8 was deleted, supporting the CFA findings. Considering the pilot study and the main study results, item 8 seemed to be consistently problematic, so it was decided to be eliminated for the subsequent analysis. After deleting this item, CFA was re-performed and resulted with the following improved fit indices: RMSEA =.059, CFI = .96, NNFI = .94, and SRMR = .043.

On the other hand, Taber (2017) mentions the fact that falling behind the threshold values of the reliability does not always indicate the unsatisfactory nature of the instrument because Cronbach alpha coefficients could be directly influenced by the number of the items. The relationship between the number of items and the size of Cronbach was also stated to be positive (Churchill & Peter, 1984; Cortina, 1993). Therefore, the low reliability might be related to the lower number of items on this sub-scale. George and Malley (2003) also proposed a range of criteria toward reliability estimates for the scales. Accordingly, Cronbach alpha values within the range of .60 and .70 are acceptable, while the values within the boundaries of .50 and .60 had lower reliability. For the current case, the reliability estimates of excessive lesson demands sub-scale could be accepted.

4.4. Descriptive Statistics

Descriptive statistics for each scale were examined and presented in Table 4.10. Accordingly, mathematics teachers experienced more enjoyment (M = 3.23, SD = 0.73) than anger (M = 1.61, SD = 0.69) and anxiety (M = 1.59, SD = 0.61). Besides, self-efficacy of participated teachers for classroom management (M = 7.19, SD = 1.05) and instructional strategies (M = 7.12, SD = 0.91) was higher than their self-efficacy for student engagement (M = 6.44, SD = 0.95). Lastly, participated teachers reported less depersonalization (*M* = 1.14, *SD* = 1.06) and emotional exhaustion (*M* = 2.23, *SD*=1.41), but more personal accomplishment (*M* = 4.56, *SD* = 0.83) with respect to the teacher burnout dimensions.

Cohen's (1988) criteria were used to examine the effect sizes of bivariate correlations. The coefficient of ±.10 indicates a small correlation, ±.30 indicates a moderate correlation, and ±.50 indicates a large correlation. Accordingly, large correlations for academic emotion variables were described. Academic anxiety was positively related to teachers' academic anger ($r = .75$, $p < .001$), whereas teachers' academic anxiety was negatively related to their academic enjoyment ($r = -.60$, $p < .001$). Besides, teachers' academic anger was negatively related to teachers' academic enjoyment ($r = -.65$, $p < .001$). Moderate correlations for academic variables were also given. Teachers' academic enjoyment was positively related to teachers' self-efficacy for classroom management ($r = .33$, $p < .001$) and their sense of personal accomplishment ($r = .32$, $p < .001$),

Small to moderate correlations for academic emotion variables were also provided. Teachers' academic anxiety was negatively related to their self-efficacy for classroom management ($r = -.24$, $p < .05$). Teachers' academic anger was negatively related to their self-efficacy for classroom management ($r = -.27$, $p < .001$) and their self-efficacy for student engagement ($r = -.22$, $p < .001$). On the other hand, teachers' academic anger was positively related to their sense of depersonalization ($r = .22$, $p < .001$) and their sense of emotional exhaustion ($r = .20$, $p < .001$). Teachers' academic enjoyment was positively related to their self-efficacy for student engagement ($r = .29$, $p < .001$), whereas academic enjoyment was negatively related to their sense of depersonalization ($r = -.28$, $p < .001$), and their sense emotional exhaustion ($r = -.27$, $p < .001$).

Small correlations for academic emotion variables were also given. Teachers' academic anxiety was negatively related to their sense of personal accomplishment ($r = -.18$, $p < .001$), their self-efficacy for student engagement ($r = -.18$, $p < .001$), and their self-efficacy for instructional strategies (r = -.14, p < .05). On the other hand, teachers' academic anxiety was positively related to their sense of depersonalization (r = .15, p <.05) and their sense of emotional exhaustion (r = .15, p<.05). Teachers' academic anger was negatively related to their sense of personal accomplishment (r =-.14, p < .05), and their self-efficacy for using instructional strategies (r = -.14, p < .05). Teachers' academic enjoyment was positively related to their self-efficacy for instructional strategies (r = .20, p < .001).

Table 4.10.

Descriptive Statistics Results for Teacher Sample

Variable	1	2	3	4	5	6	7	8	9
1.Anxiety	-	$.75^{**}$	$-.60^{**}$	$.15^{*}$	$.15^{*}$	$-.18^{**}$	$-.18^{**}$	$-.14^{*}$	$-.24^{*}$
2.Anger		-	$-.65^{**}$	$.22^{**}$	$.20^{**}$	$-.14^{*}$	$-.22^{**}$	$-.14^{*}$	$-.27^{**}$
3.Enjoyment			-	$-.28^{**}$	$-.27^{**}$	$.32^{**}$	$.29^{**}$	$.20^{**}$	$.33^{**}$
4.Depersonalization				-	$.70^{**}$	$-.37^{**}$	$-.30^{**}$	$-.20^{**}$	$-.18^{**}$
5.Emotional Exhaustion					-	$-.35^{**}$	$-.37^{**}$	$-.25^{**}$	$-.21^{**}$
6.Personal Accomplishment						-	$.45^{**}$	$.44^{**}$	$.49^{**}$
7.Efficacy for SE							-	$.69^{**}$	$.60^{**}$
8.Efficacy for IS								-	$.67^{**}$
9.Efficacy for CM									-
M	1.59	1.61	3.23	1.14	2.23	4.56	6.44	7.12	7.19
SD	.61	.69	.73	1.06	1.41	.83	.95	.91	1.05

$^{*}p$<.05 $^{**}p$<.001

Note. SE= Student Engagement, IS=Instructional Strategies, CM= Classroom Management

For student sample, mean, standard deviation values, and bivariate correlations were presented in Table 4.11. Considering students' achievement emotions in mathematics, they seemed to experience more enjoyment (M = 3.41, SD = 0.82) than anxiety (M = 2.66, SD = 0.88), and anger (M = 2.15, SD = 0.97), respectively. Their perceptions for teaching quality and supportive presentation style scores (M = 3.71, SD = 1.11) were higher than their perceptions toward excessive lesson demands dimension scores of teaching quality (M = 2.57, SD = 1.07).

Bivariate correlations for student emotion variables were described concerning effect sizes. Large correlations for academic emotion variables were provided. Accordingly, mathematics enjoyment was negatively related to students' mathematics anger (r = -.66, $p < .001$), mathematics anxiety (r = -.59, $p < .001$). On the other hand, students' mathematics enjoyment was positively related to their self-efficacy for self-regulated learning in mathematics (r = .68, $p < .001$), their perceptions toward teachers' using supportive presentation style (r = .51, $p < .001$). Besides, students' mathematics anger was positively related to their mathematics anxiety (r = .77, $p < .001$). In contrast, students' mathematics anger was negatively related to their self-efficacy for self-regulated learning in mathematics (r = -.57, $p < .001$). Students' mathematics anxiety was negatively related to their self-efficacy for self-regulated learning in mathematics (r =- .56, $p < .001$).

Moderate to large correlations were also provided as follows: students' mathematics enjoyment was positively related to their perceptions toward teacher affective support (r = .49, $p < .001$). On the other hand, students' mathematics anger was negatively associated with their perceptions toward teachers' using supportive presentation style (r =- .45, $p < .001$), and their perceived teacher affective support (r = -.43, $p < .001$). Students' mathematics anxiety was positively related to their perceptions of excessive lesson demands dimension of teaching quality (r =.48, $p < .001$). Moderate correlations were given as in the following: mathematics enjoyment was negatively related to students' perceptions toward excessive lesson demands dimension of teaching quality (r = -.39, $p < .001$). On the other hand, students' mathematics anxiety was negatively related to their perceptions toward their teachers' using supportive presentation style (r =- .39, $p < .001$), and their perceived teacher affective support (r =- .35, $p < .001$).

Table 4.11.

Descriptive Statistics Results for Student Sample

Variable	1	2	3	4	5	6	7
1. Enjoyment	-	-.66**	-.59**	.49**	.68**	.51**	-.39**
2.Anger		-	.77**	-.43**	-.57**	-.45**	.43**
3.Anxiety			-	-.35**	-.56**	-.39**	.48**
4.PTAS				-	.47**	.70**	-.26**
5.SESRL					-	.50**	-.36**
6.Supportive presentation style						-	-.30**
7. Excessive lesson demands							-
M	3.41	2.15	2.66	3.67	4.01	3.71	2.57
SD	.82	.97	.88	.99	1.26	1.11	1.07

$^{*}p<.05$ $^{**}p<.001$

Note. PTAS= Perceived Teacher Affective Support, SESRL=Self-efficacy for Self-regulated Learning

Descriptive statistics by the grade level indicated that 7th grade students tended to experience more enjoyment (*M* = 3.50, *SD* = 0.82), less anxiety (*M* = 2.58, *SD* = 0.89), and less anger (*M* = 2.06, *SD* = 0.96) compared to the 8th grade students' mathematics enjoyment (*M* = 3.29, *SD* = 0.80), mathematics anxiety (*M* = 2.76, *SD* = 0.87), and mathematics anger (*M* = 2.25, *SD* = 0.97), respectively. Similarly, 7th grade students had higher self-efficacy for self-regulated learning in mathematics (*M* = 4.09, *SD* = 1.26), higher scores in perceived teacher affective support (*M* = 3.72, *SD* = .97), and supportive presentation style (*M* = 3.78, *SD* = 1.09) than the 8th grade students' self-efficacy for self-regulated learning in mathematics (*M* = 3.92, *SD* = 1.25), their perceived teacher affective support (*M* = 3.60, *SD* =1.01), supportive presentation style (*M* = 3.62, *SD* = 1.27) scores. Besides, 7th grade students reported less in excessive lesson demands sub-scale of PTQ (*M* = 2.55, *SD* = 1.06) than the 8th grade students (*M* = 2.60, *SD* = 1.09).

4.5. Quantitative Findings

In this section, the findings of measurement and structural models are presented, respectively. A measurement model is a model that examines the relationship between latent variables and their observed indicators (Wang & Wang, 2012).

For the first research question, the measurement model examining the relationship between teacher self-efficacy for student engagement, self-efficacy for classroom management, self-efficacy for instructional strategies, sense of emotional exhaustion, depersonalization, personal accomplishment, mathematics teacher anxiety, mathematics teacher anger, and mathematics teacher enjoyment were tested.

For the second research question, two measurement models were checked, respectively. The first sub-research question attempted to understand the relationship between students' perceived teacher affective support, perceived teaching quality, self-efficacy for self-regulated learning, and their anxiety, anger, and enjoyment in mathematics. On the other hand, the second sub-research question investigated the relationship between mathematics teachers' anxiety, anger, and enjoyment with their students' anxiety, anger, and enjoyment in mathematics. Therefore, the second sub-research question was tested through multilevel confirmatory factor analysis regarding Muthen's (1994) procedure.

According to this procedure, in the first step, single-level confirmatory factor analysis was suggested to be performed without decomposing the total covariance matrix into between-group and within-group covariances. As multilevel factor analysis is a complex process with hierarchically structured data, performing a conventional factor analysis would be easier to continue with the next steps. For the second step, the researchers should decide whether the multilevel analysis is suitable for the data by looking at intraclass correlation coefficients (ICC). The ICC may range from 0 to 1 that higher ICC values indicate higher between-group level variations, which shows the data's multilevel nature. In contrast, ICC values less than .05 may yield lower between-group level variations and possible multilevel modeling problems. Lastly, multilevel confirmatory factor analyses were conducted to provide evidence for the measurement model of the data. The model fit was assessed by Chi-Square test value, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), Standard Root Mean Square Residual (SRMR) for the within-model, and SRMR for the between-model (Kyriazos, 2019).

4.5.1. Measurement Model for Research Question 1

The measurement model, including the relationships between items/item parcels of teacher self-efficacy for instructional strategies, student engagement and classroom management, teacher sense of emotional exhaustion, depersonalization, personal accomplishment, and teacher anxiety, anger, and enjoyment in mathematics were tested.

The first run of CFA with Satorra-Bentler correction revealed a significant chi-square value (χ^2 (704) = 1040.35, $p < .001$) with the following modification indices: RMSEA = .046 (90% *CI* = .040-.052, $p_{\text{close}} > .05$), CFI = .92, NNFI = .92, and SRMR = .065. Although the RMSEA value was below .05 for a perfect fit (Browne & Cudeck, 1993; MacCallum, Browne, & Sugawara, 1996) and SRMR value was below .08 for a good model fit (Hu & Bentler, 1999), NNFI and CFI values were at the edge for a reasonable model, so modification indices of errors were examined in the model. Accordingly, errors between item2-item3 in Maslach Burnout Questionnaire were allowed to covary as they belonged to the same sub-scales.

The second run of CFA resulted a significant chi-square value (χ^2 (703) = 997.31, $p < .001$) with an improved model fit: RMSEA = .043 (90% CI = .037-.049, $p_{\text{close}} > .05$), CFI = .93, NNFI = .93 and SRMR = .067. Each item in the model significantly contributed to the proposed dimension with the values above .40 except for two items. However, the loadings of these items were above .30 as the cut-off point for standardized factor loadings suggested by Kim and Mueller (1978) and Brown (2006).

The standardized regression weights of each item with their confidence intervals were presented in Table 4.12.

Table 4.12.

Standardized Regression Weights for the Measurement Model for Research Question 1

Dimensions		Parameter	Standardized estimates	*CI*
P1_SE	<---	Efficacy for Student Engagement	.83	.78-.87
P2_SE	<---	Efficacy for Student Engagement	.89	.86-.93
P1_IS	<---	Efficacy for Instructional Strategies	.88	.84-.92
P2_IS	<---	Efficacy for Instructional Strategies	.92	.89-.95
P1_CM	<---	Efficacy for Classroom Management	.95	.93-.97
P2_CM	<---	Efficacy for Classroom Management	.91	.88-.93
Burn_5	<---	Depersonalization	.59	.52-.65
Burn_11	<---	Depersonalization	.73	.66-.79
Burn_10	<---	Depersonalization	.83	.77-.89
Burn_15	<---	Depersonalization	.46	.36-.57
Burn_22	<---	Depersonalization	.41	.32-.50
Burn_14	<---	Emotional Exhaustion	.50	.43-.57
Burn_2	<---	Emotional Exhaustion	.61	.54-.67
Burn_3	<---	Emotional Exhaustion	.65	.60-.71
Burn_6	<---	Emotional Exhaustion	.79	.75-.84
Burn_8	<---	Emotional Exhaustion	.90	.88-.93
Burn_1	<---	Emotional Exhaustion	.83	.80-.87
Burn_13	<---	Emotional Exhaustion	.77	.72-.81
Burn_16	<---	Emotional Exhaustion	.68	.63-.74
Burn_20	<---	Emotional Exhaustion	.81	.77-.85
Burn_4	<---	Personal Accomplishment	.34	.23-.46
Burn_9	<---	Personal Accomplishment	.45	.35-.56
Burn_7	<---	Personal Accomplishment	.39	.29-.50
Burn_18	<---	Personal Accomplishment	.67	.60-.75
Burn_17	<---	Personal Accomplishment	.61	.51-.71
Burn_19	<---	Personal Accomplishment	.59	.52-.65
Burn_21	<---	Personal Accomplishment	.44	.35-.53
Burn_12	<---	Personal Accomplishment	.52	.43-.61
Tem_3	<---	Anger	.75	.70-.80
Tem_4	<---	Anger	.83	.78-.88
Tem_9	<---	Anger	.74	.68-.80
Tem_5	<---	Anger	.87	.84-.90
Tem_2	<---	Anxiety	.47	.39-.55

Note. SE= Self-efficacy for student engagement; IS= Self-efficacy for instructional strategies; CM=Self-efficacy for classroom management; Burn= Burnout; Tem= Teacher Emotion

Table 4.12.

Standardized Regression Weights for the Measurement Model for Research Question 1-cont

Dimensions		Parameter	Standardized estimates	*CI*
Tem_8	<---	Anxiety	.62	.53-.72
Tem_10	<---	Anxiety	.72	.64-.80
Tem_12	<---	Anxiety	.84	.78-.91
Tem_1	<---	Enjoyment	.83	.78-.87
Tem_6	<---	Enjoyment	.86	.83-.89
Tem_7	<---	Enjoyment	.76	.70-.82
Tem_11	<---	Enjoyment	.91	.86-.95

Note. SE= Self-efficacy for student engagement; IS= Self-efficacy for instructional strategies; CM=Self-efficacy for classroom management; Burn= Burnout; Tem= Teacher Emotion

All of the correlations among latent variables were also significant, and the correlation coefficients ranged from .14 to .90. The correlation matrix between latent variables was given in Table 4.13.

Table 4.13.

Correlations in the Measurement Model for Research Question 1

Variable	1	2	3	4	5	6	7	8	9
1.Efficacy for SE	-								
2.Efficacy for IS	$.78^{**}$	-							
3.Efficacy for CM	$.67^{**}$	$.74^{**}$	-						
4.Depersonalization	$-.35^{**}$	$-.21^{**}$	$-.18^{**}$	-					
5.Emotional Exhaustion	$-.44^{**}$	$-.27^{**}$	$-.22^{**}$	$.84^{**}$	-				
6.Personal Accomplishment	$.57^{**}$	$.57^{**}$	$.60^{**}$	$-.46^{**}$	$-.45^{**}$	-			
7.Anger	$-.27^{**}$	$-.14^{*}$	$-.28^{**}$	$.24^{**}$	$.25^{**}$	$-.20^{**}$	-		
8.Enjoyment	$.32^{**}$	$.22^{**}$	$.35^{**}$	$-.30^{**}$	$-.31^{**}$	$.42^{**}$	$-.72^{**}$	-	
9.Anxiety	$-.26^{*}$	$-.16^{*}$	$-.30^{**}$	$.14^{*}$	$.20^{**}$	$-.27^{**}$	$.90^{**}$	$-.78^{**}$	-

$^{*}p<.05$, $^{**}p<.01$

Note. SE= Student Engagement, IS=Instructional Strategies, CM= Classroom Management

4.5.2. Structural Model for Research Question 1

The hypothesized model investigating the relationships among latent variables was tested through structural equation modeling. This model was presented in Figure 4.1. For the aim of the clarity and ease of reading, only latent variables were depicted in the displayed figure.

Findings indicated an acceptable model fit to the data. Although chi-square value was found to be significant (χ^2 (712) = 1020.37, p < .001), RMSEA was .044 (90% CI = .038-.050, p_{close} >.05), CFI was .93, NNFI was .92, and SRMR was .07. Accordingly, the hypothesized structural model displayed an acceptable fit to the data (Browne & Cudeck, 1993; Hu & Bentler, 1999; MacCallum, Browne & Sugawara, 1996). Each indicator (items & item parcels) in the proposed model significantly loaded on their corresponding latent variables with the values ranging from .34 to .92 (Table 4.14).

Table 4.14.

Standardized Regression Weights for the Structural Model for Research Question 1

Dimensions		Parameter	Standardized estimates
P1_SE	<---	Efficacy for Student Engagement	.83
P2_SE	<---	Efficacy for Student Engagement	.89
P1_IS	<---	Efficacy for Instructional Strategies	.88
P2_IS	<---	Efficacy for Instructional Strategies	.92
P1_CM	<---	Efficacy for Classroom Management	.95
P2_CM	<---	Efficacy for Classroom Management	.91
Burn_5	<---	Depersonalization	.58
Burn_11	<---	Depersonalization	.73
Burn_10	<---	Depersonalization	.83
Burn_15	<---	Depersonalization	.47
Burn_22	<---	Depersonalization	.41
Burn_14	<---	Emotional Exhaustion	.50
Burn_2	<---	Emotional Exhaustion	.61
Burn_3	<---	Emotional Exhaustion	.65
Burn_6	<---	Emotional Exhaustion	.79
Burn_8	<---	Emotional Exhaustion	.90
Burn_1	<---	Emotional Exhaustion	.83
Burn_13	<---	Emotional Exhaustion	.77
Burn_16	<---	Emotional Exhaustion	.69
Burn_20	<---	Emotional Exhaustion	.81
Burn_4	<---	Personal Accomplishment	.34
Burn_9	<---	Personal Accomplishment	.46
Burn_7	<---	Personal Accomplishment	.40
Burn_18	<---	Personal Accomplishment	.66
Burn_17	<---	Personal Accomplishment	.60
Burn_19	<---	Personal Accomplishment	.61
Burn_21	<---	Personal Accomplishment	.45
Burn_12	<---	Personal Accomplishment	.52
Tem_3	<---	Anger	.75
Tem_4	<---	Anger	.83
Tem_9	<---	Anger	.74
Tem_5	<---	Anger	.87
Tem_2	<---	Anxiety	.48
Tem_8	<---	Anxiety	.63
Tem_10	<---	Anxiety	.72
Tem_12	<---	Anxiety	.84
Tem_1	<---	Enjoyment	.82
Tem_6	<---	Enjoyment	.86
Tem_7	<---	Enjoyment	.76
Tem_11	<---	Enjoyment	.90

Note. SE= Self-efficacy for student engagement; IS= Self-efficacy for instructional strategies; CM=Self-efficacy for classroom management; Burn= Burnout; Tem= Teacher Emotion.

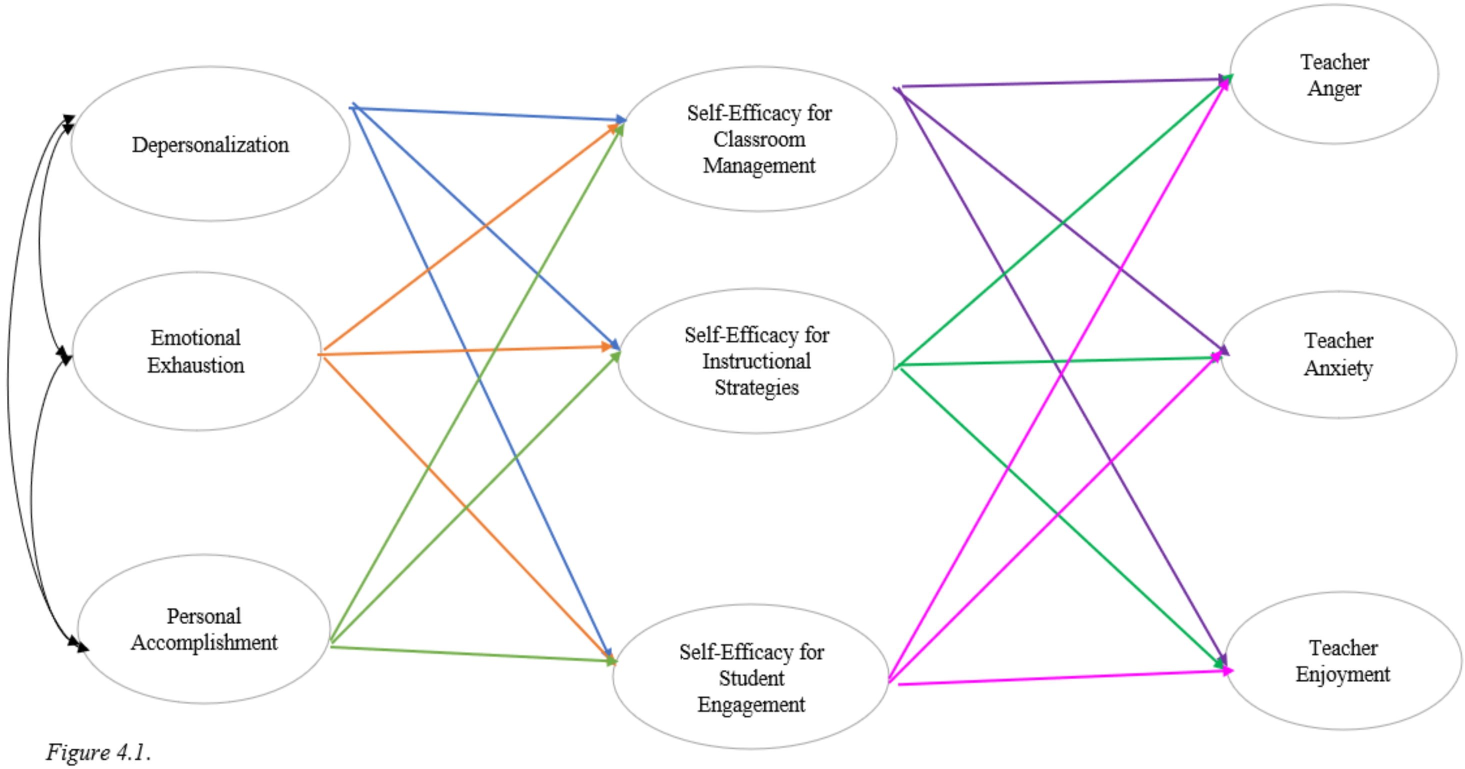

Figure 4.1.

The hypothesized structural model for research question 1

4.5.2.1. Direct Effects of the Structural Model for Research Question 1

The direct relationships in the full structural model were presented in Figure 4.2. The full lines indicated the significant paths, and dashed lines represented non-significant paths in the model. Accordingly, direct effects of teacher burnout variables (emotional exhaustion, depersonalization, and personal accomplishment) on teacher self-efficacy variables (student engagement, instructional strategies, classroom management), and the direct effects of teacher self-efficacy variables on teachers' academic emotions (anger, anxiety, enjoyment) were described, respectively.

The results show that teachers' sense of emotional exhaustion (γ = - .39, $p < .05$) and personal accomplishment (γ = .495, $p < .05$) significantly predicted their self-efficacy for student engagement. In line with the expected direction, teachers with high emotional exhaustion tended to experience less self-efficacy for student engagement. In contrast, an increased level of personal accomplishment was associated with higher self-efficacy levels for student engagement. On the other hand, no significant relationship was concluded for a sense of depersonalization and self-efficacy for student engagement (γ = .19, $p > .05$). There was no significant relationship between teacher self-efficacy for instructional strategies dimension and emotional exhaustion (γ = -18, $p > .05$) and depersonalization (γ = .21, $p > .05$). However, teachers' sense of personal accomplishment significantly predicted their self-efficacy for instructional strategies (γ = .58, $p < .05$). Teachers with high personal accomplishment seemed to be more efficacious for using instructional strategies in their classrooms. Only the personal accomplishment variable made a significant contribution to explain teacher self-efficacy for classroom management (γ = .65, $p < .05$). As teachers' sense of personal accomplishment increased, they experienced a high level of self-efficacy for classroom management. However, there was no significant relationship between sense of emotional exhaustion (γ = -.09, $p > .05$) and depersonalization (γ = .18, $p > .05$) with teacher self-efficacy for classroom management.

On the other hand, teacher self-efficacy for student engagement significantly predicted teacher anger ($\beta = -.39$, $p < .05$), anxiety ($\beta = -.30$, $p < .05$), and enjoyment ($\beta = .38$, $p < .05$). The directions of the relationships were negative for anger and anxiety, and positive for enjoyment, respectively. Teachers with higher self-efficacy for student engagement were deemed to experience less anger and less anxiety and more enjoyment in their mathematics classes. Although teacher self-efficacy for instructional strategies made a significant contribution on accounting for their anger ($\beta = .41$, $p < .05$), anxiety ($\beta = .32$, $p < .05$), and enjoyment ($\beta = -.35$, $p < .05$), the relationships were not in the expected directions. That is, increased self-efficacy for instructional strategies was associated with a decline in enjoyment and an increase in anxiety and anger levels of teachers in their mathematics classes. Lastly, teacher self-efficacy for classroom management significantly predicted their anger ($\beta = -.32$, $p < .05$), anxiety ($\beta = -.33$, $p < .05$), and enjoyment ($\beta = .36$, $p < .05$). Mathematics teachers who reported a high level of self-efficacy for classroom management tended to feel less anger and less anxiety but more enjoyment in their mathematics classes.

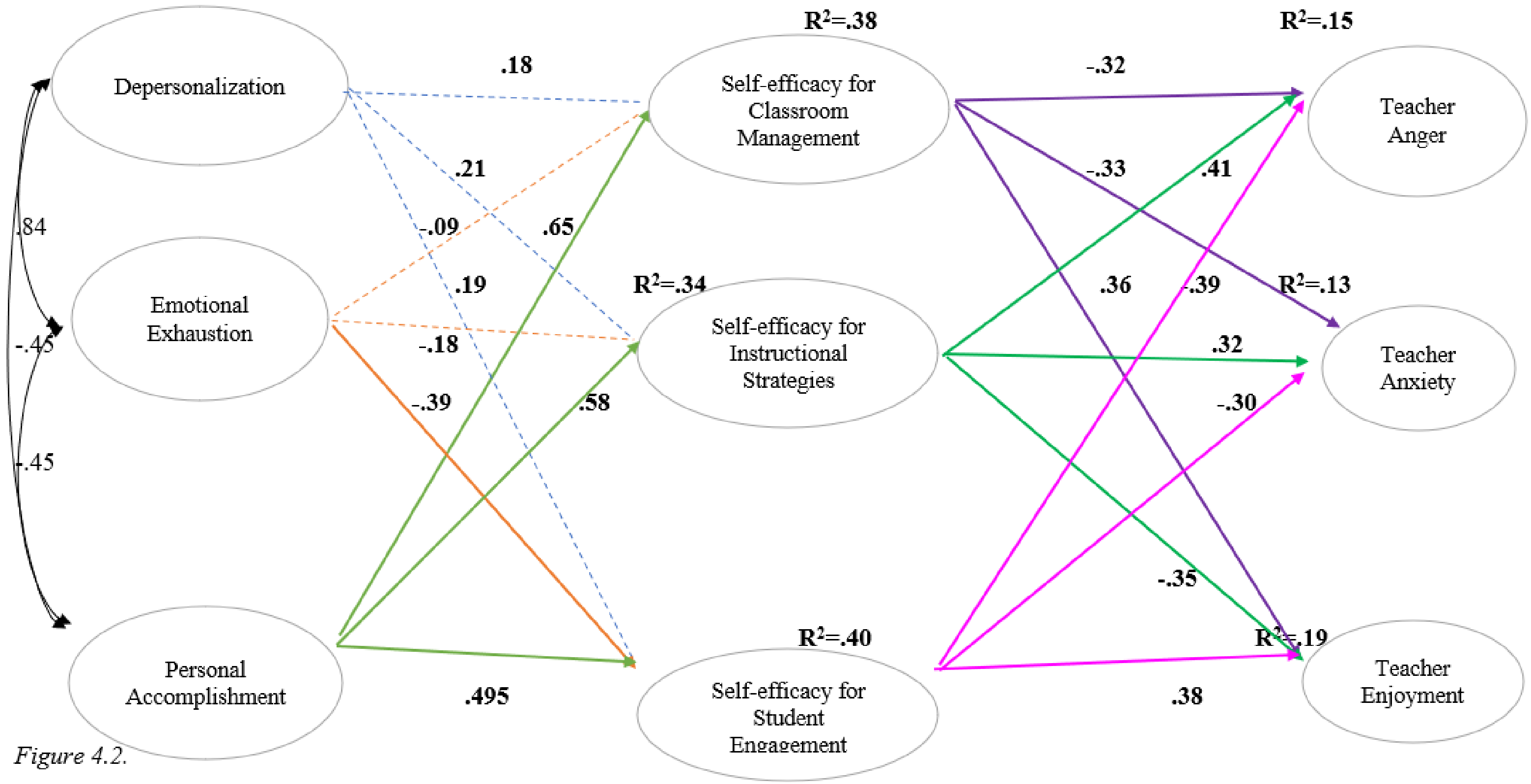

Figure 4.2.

The structural model with significant and non-significant direct effects for research question 1

Note. Full lines indicated the significant paths, and dashed lines referred to non-significant paths. For the clarity of the presentation, the relationships were displayed only for latent variables.

4.5.2.2. Indirect Effects of the Structural Model for Research Question 1

In addition to the direct effects, indirect effects of the structural model of teacher emotions were examined. The standardized direct, total indirect, and total effects were presented in Table 4.15. According to the results, all of the indirect effects of sense of emotional exhaustion and depersonalization on emotion variables through teacher self-efficacy dimensions were statistically non-significant. In contrast, all of the indirect effects of personal accomplishment through teacher self-efficacy dimensions were significant.

More specifically, sense of depersonalization had a non-significant indirect effect on teacher anxiety (-.05, p > .05), teacher anger (-.05, p > .05), and teacher enjoyment (.06, p > .05). Sense of emotional exhaustion had also a non-significant indirect effect on teacher anxiety (.09, p > .05), teacher anger (.11, p > .05), and teacher enjoyment (-.12, p > .05). On the other hand, a sense of personal accomplishment had significant negative indirect effects on teacher anxiety (-.18, p<.001) and teacher anger (-.16, p<.001) through teacher self-efficacy for instructional strategies, teacher self-efficacy for student engagement, and teacher self-efficacy for classroom management. That is, an increase in the sense of personal accomplishment was associated with less teacher anxiety and teacher anger through teacher self-efficacy for instructional strategies, student engagement, and classroom management. The sense of personal accomplishment also had a significant positive indirect effect on teacher enjoyment (.22, p<.001) via teacher self-efficacy for instructional strategies, teacher self-efficacy for student engagement, and teacher self-efficacy for classroom management. That is, teacher enjoyment was expected to increase by .22 for every increase in personal accomplishment via teacher self-efficacy for instructional strategies, student engagement, and classroom management.

Table 4.15.

Standardized Direct, Total Indirect, and Total Effects for the Structural Model for Research Question 1

Endogenous variables		Self-efficacy for Student Engagement	Self-efficacy for Instructional Strategies	Self-efficacy for Classroom Management	Depersonalization	Emotional Exhaustion	Personal Accomplishment
Teacher Enjoyment	Direct Effect	.38***	-.35**	.36***	-	-	-
	Total Indirect	-	-	-	.06	-.12	.22***
	Total	.38***	-.35**	.36***	.06	-.12	.22***
Teacher Anger	Direct Effect	-.39**	.41***	-.32**	-	-	-
	Total Indirect	-	-	-	-.05	.11	-.16***
	Total	-.39**	41***	-.32**	-.05	.11	-.16***
Teacher Anxiety	Direct Effect	-.30**	.32**	-.33**	-	-	-
	Total Indirect	-	-	-	-.05	.09	-.18***
	Total	-.30**	.32**	-.33**	-.05	.09	-.18***

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$

4.5.2.3. Squared Multiple Correlations for the Structural Model for Research Question 1

Squared multiple correlations (R^2) of the latent variables in the full structural model were displayed in Table 4.16 to explain the percent of the variance explained by the exogenous variables. Accordingly, 40% of the variance on teachers' self-efficacy for student engagement was accounted for by a sense of emotional exhaustion, depersonalization, and personal accomplishment. Teachers' sense of personal accomplishment, emotional exhaustion, and depersonalization explained 34% variance in teachers' self-efficacy for instructional strategies and 38% variance in teachers' self-efficacy for classroom management in their classes. On the other hand, 15% of the variance in the arousal of anger, 13% of the variance in the arousal of anxiety, and 18% of the variance in the arousal of enjoyment were accounted for by teacher self-efficacy for student engagement, classroom management, and instructional strategies, and sense of depersonalization, emotional exhaustion, and personal accomplishment.

Table 4.16.

Squared Multiple Correlations for the Structural Model for Research Question 1

	R^2
Self- Efficacy for Student Engagement	.40
Self- Efficacy for Instructional Strategies	.34
Self- Efficacy for Classroom Management	.38
Anger	.15
Anxiety	.13
Enjoyment	.19

4.5.3. Measurement Model for Research Question 2a

For Research Question 2a, "the relationships between the seventh and eighth-grade students' mathematics achievement emotions with their self-efficacy beliefs, and their teaching quality perceptions in mathematics," the measurement model involving the relationships between items/item parcels of students' perceptions toward their teachers' supportive presentation style and excessive lesson demands and perceived teacher affective support, their self-efficacy for self-regulated learning in mathematics, and students' anxiety, anger, and enjoyment in mathematics were tested.

The run of CFA with Satorra-Bentler corrected chi-square test revealed a significant result (χ^2 (645) = 5208.87, p < .001) with the following modification fit indices: RMSEA = .036 (90% CI = .035-.037, p_{close} > .05), CFI = .95, NNFI = .94 and SRMR = .034. The findings reflected an admissible model because CFI and NNFI values as low as .90 are accepted for a moderate model fit (Bentler & Bonett, 1980; Schumacker & Lomax, 1996). Besides, SRMR value reflected a good model fit as SRMR was below the value of .08 (Hu & Bentler, 1999). For RMSEA, the values less than .05 were concerned as a cut-off criterion for a good model fit, while the values within the range of .05 and .08 reflect a mediocre model fit (Browne & Cudeck, 1993). In this model, RMSEA was .036, so it reflected a good model fit. Besides, each item significantly contributed to the proposed dimension with a value of .40 and above except for one item (item 3) in the Perceived Teaching Quality Scale with a loading of .36. Standardized regression weights of each item with their confidence intervals were presented in Table 4.17. All of the correlations among latent variables were significant, and the correlation coefficients ranged from .32 to .86 (Table 4.18).

Table 4.17.

Standardized Regression Weights for the Measurement Model for Research Question 2a

Dimensions		Parameter	Standardized estimates	*CI*
Eff_1	<---	SESRL*	.66	.65-.67
Eff_2	<---	SESRL	.71	.69-.72
Eff_3	<---	SESRL	.75	.73-.76
Eff_4	<---	SESRL	.55	.53-.57
Eff_5	<---	SESRL	.73	.72-.74
Eff_6	<---	SESRL	.74	.73-.75
Eff_7	<---	SESRL	.67	.65-.68
Eff_8	<---	SESRL	.52	.50-.54
Eff_9	<---	SESRL	.70	.69-.71
Eff_10	<---	SESRL	.58	.56-.60
Eff_11	<---	SESRL	.56	.55-.58
Perc_1	<---	PTAS*	.71	.69-.72
Perc_2	<---	PTAS	.79	.78-.80
Perc_3	<---	PTAS	.74	.73-.75
Perc_4	<---	PTAS	.79	.78-.81
Perc_5	<---	PTAS	.71	.70-.72
Perc_6	<---	PTAS	.71	.70-.72
Perc_7	<---	PTAS	.81	.80-.82
Perc_8	<---	PTAS	.64	.62-.65
Perc_9	<---	PTAS	.74	.72-.75
Perc_10	<---	PTAS	.64	.62-.65
Perc_11	<---	PTAS	.80	.79-.81
Perc_12	<---	PTAS	.70	.68-.71
Qual_6	<---	SPS*	.72	.71-.74
Qual_5	<---	SPS	.70	.69-.70
Qual_4	<---	SPS	.70	.68-.72
Qual_1	<---	SPS	.67	.65-.69
Qual_7	<---	ELD*	.75	.73-.77
Qual_3	<---	ELD	.36	.34-.39
Qual_2	<---	ELD	.46	.44-.49
Qual_9	<---	ELD	.74	.72-.76

Note. SESRL=Self-efficacy for Self-regulated Learning; PTAS= Perceived Teacher Affective Support; SPS= Supportive Presentation Style; ELD= Excessive Lesson Demands; Eff=Self-efficacy for Self-regulated Learning Scale item; Perc= Perceived Teacher Affective Support item, Qual=Perceived Teaching Quality Scale item; Enj=Enjoyment; Ang=Anger; Anx=Anxiety.

Table 4.17.

Standardized Regression Weights for the Measurement Model for Research Question 2a-cont

Dimensions		Parameter	Standardized estimates	*CI*
Enj_P1	<---	Enjoyment	.80	.79-.81
Enj_P2	<---	Enjoyment	.94	.93-.95
Ang_P1	<---	Anger	.91	.90-.91
Ang_P2	<---	Anger	.88	.88-.89
Anx_P1	<---	Anxiety	.89	.88-.89
Anx_P2	<---	Anxiety	.88	.87-.89
Anx_P3	<---	Anxiety	.86	.85-.87

Note. Enj=Enjoyment; Ang=Anger; Anx=Anxiety

Table 4.18.

Correlations for the Measurement Model for the Research Question 2a

Variable	1	2	3	4	5	6	7
1.SESRL	-						
2.PTAS	$.52^{**}$	-					
3.SPS	$.59^{**}$	$.81^{**}$	-				
4.ELD	$-.50^{**}$	$-.32^{**}$	$-.39^{**}$	-			
5.Enjoyment	$.77^{**}$	$.53^{**}$	$.60^{**}$	$-.54^{**}$	-		
6.Anger	$-.64^{**}$	$-.47^{**}$	$-.53^{**}$	$.56^{**}$	$-.74^{**}$	-	
7.Anxiety	$-.63^{**}$	$-.38^{**}$	$-.45^{**}$	$.63^{**}$	$-.69^{**}$	$.86^{**}$	-

Note.SESRL=Self-efficacy for Self-regulated Learning; PTAS= Perceived Teacher Affective Support; SPS= Supportive Presentation Style dimension; ELD= Excessive Lesson Demands dimension.
$^{*}p<.05$, $^{**}p<.01$

4.5.4. Structural Model for Research Question 2a

The hypothesized structural model was presented in Figure 4.3. This model was tested through single-level structural equation modeling. Given that cluster sampling was employed to select the group of participants, observations cannot be independent across individual students as students in the same classrooms may respond similarly (Wu & Kwock, 2012). Based on the assumption that students were nested within classrooms for cluster sampling, Du Toit and Du Toit (2008) argued that "By ignoring the hierarchical structure of the data, incorrect parameter estimates, standard errors, and inappropriate fit statistics may be obtained" (p. 456). Muthen and Satorra (1995) suggested two approaches for such complex data structures: the design-based and model-based approaches to remove such biased estimates. In the design-based approach, the multilevel data are analyzed with one single model. In contrast, the multilevel data are analyzed for both within- and between-levels in the model-based approach. The selection of these approaches was related to the hypotheses of the study. There was no hypothesis for higher levels for Question 2a, and the interest was to analyze the model in within-level. Therefore, a design-based approach was adopted. An ad-hoc robust standard estimator (i.e., complex) was used to uncover data's hierarchical nature due to multistage sampling (Wu & Kwock, 2012).

According to the structural equation modeling results, the model yielded an acceptable fit to the data. Although the chi-square value was found to be significant (χ^2 (642) = 4583.85, $p < .05$), RMSEA value was .033 (90% CI = .033-.035, $p_{close} > .05$), CFI was .95, NNFI was .95, and SRMR was .034. The fit indices were within the boundaries of an acceptable model fit (Browne & Cudeck, 1993; Hu & Bentler, 1999; MacCallum et al., 1996). Besides, each indicator (items & item parcels) in the proposed model significantly loaded on their corresponding latent variables with the values ranging from .36 to .94 (Table 4.19).

Table 4.19.

Standardized Regression Weights for the Structural Model for Research Question 2a

Dimensions		Parameter	Standardized estimates
Eff_1	<---	SESRL*	.65
Eff_2	<---	SESRL	.70
Eff_3	<---	SESRL	.75
Eff_4	<---	SESRL	.55
Eff_5	<---	SESRL	.74
Eff_6	<---	SESRL	.74
Eff_7	<---	SESRL	.67
Eff_8	<---	SESRL	.50
Eff_9	<---	SESRL	.69
Eff_10	<---	SESRL	.58
Eff_11	<---	SESRL	.56

Note. SESRL=Self-efficacy for Self-regulated Learning

Table 4.19.

Standardized Regression Weights for the Structural Model for Research Question 2a-cont

Dimensions		Parameter	Standardized estimates
Perc_1	<---	PTAS*	.71
Perc_2	<---	PTAS	.79
Perc_3	<---	PTAS	.74
Perc_4	<---	PTAS	.79
Perc_5	<---	PTAS	.71
Perc_6	<---	PTAS	.71
Perc_7	<---	PTAS	.81
Perc_8	<---	PTAS	.64
Perc_9	<---	PTAS	.74
Perc_10	<---	PTAS	.64
Perc_11	<---	PTAS	.80
Perc_12	<---	PTAS	.70
Qual_6	<---	SPS*	.72
Qual_5	<---	SPS	.70
Qual_4	<---	SPS	.70
Qual_1	<---	SPS	.67
Qual_7	<---	ELD*	.75
Qual_3	<---	ELD	.36
Qual_2	<---	ELD	.46
Qual_9	<---	ELD	.74
Enj_P1	<---	Enjoyment	.80
Enj_P2	<---	Enjoyment	.94
Ang_P1	<---	Anger	.91
Ang_P2	<---	Anger	.88
Anx_P1	<---	Anxiety	.89
Anx_P2	<---	Anxiety	.88
Anx_P3	<---	Anxiety	.86

Note. PTAS= Perceived Teacher Affective Support;SPS= Supportive Presentation Style dimension; ELD= Excessive Lesson Demands dimension; Eff=Self-efficacy for Self-regulated Learning Scale item; Perc= Perceived Teacher Affective Support Scale item; Qual=Teaching Quality Scale item; Enj=Enjoyment; Ang=Anger; Anx=Anxiety.

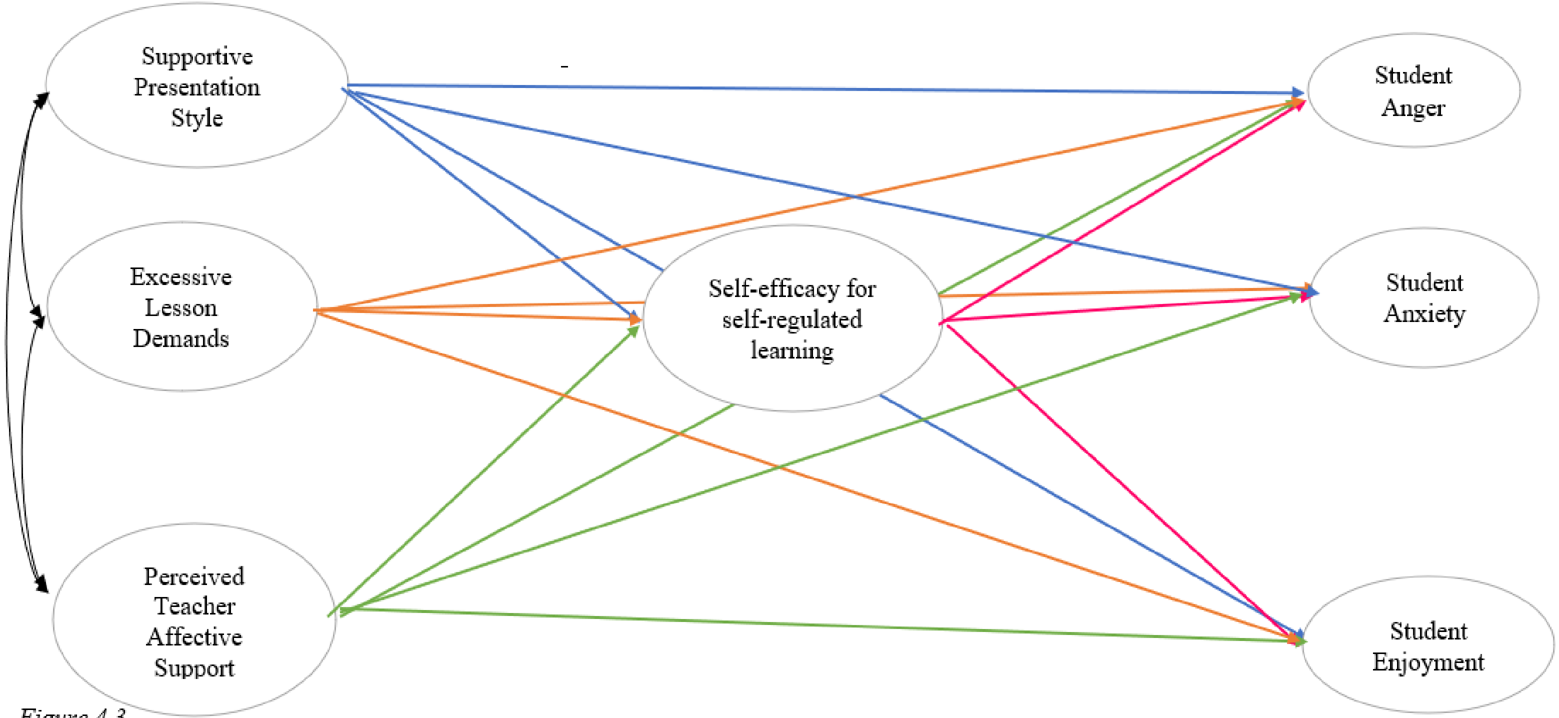

Figure 4.3.

The hypothesized structural model for research question 2a

Note. For the clarity of the presentation, the relationships were displayed only for latent variables.

4.5.4.1. Direct Effects of the Structural Model for Research Question 2a

The direct effects of the structural model were presented in Figure 4.4. The full and the dashed lines indicated significant and non-significant paths, respectively. Firstly, the direct effects of perceived teaching quality variables (supportive presentation style, excessive lesson demands), perceived teacher affective support, self-efficacy for self-regulated learning in mathematics on students' enjoyment, anger, and anxiety were presented. Secondly, the direct effects of teaching quality variables on self-efficacy for self-regulated learning in mathematics were explained.

Findings indicated that students' perceived teacher affective support (γ = -.08, p < .01), students' perceptions toward their teachers' supportive presentation style (γ = -.13, p <.001) and excessive lesson demands (γ = .29, p < .001), student self-efficacy for self-regulated learning (β = -.38, p < .001) significantly predicted their anger in mathematics. The relationships were all negative for all variables except for excessive lesson demands. Students with higher perceived teacher affective support, higher scores on their perceptions of their mathematics teachers' supportive presentation style, higher self-efficacy for self-regulated learning in mathematics, and lower scores on the excessive lesson demands dimension tended to experience less anger in mathematics.

Similarly, students' perceptions of their teachers' supportive presentation style (γ = -.07, p < .05) and excessive lesson demands (γ = .41, p < .001), student self-efficacy for self-regulated learning (β = -.38, p < .001) made a significant contribution to explain their anxiety in mathematics. The direction of the relationships between the abovementioned variables was the same as in students' anger. However, no significant relationship was found between students' perceived teacher affective support and their mathematics anxiety (γ = .006, p >.05). Students who reported lower scores on their perceptions of their mathematics teachers' excessive lesson demands and higher scores on their mathematics teachers' supportive presentation style and greater self-efficacy for self-regulated learning in mathematics experienced less anxiety in mathematics.

Except for negative emotions, enjoyment as a positive emotion and one of the endogenous variables of this study was also included in the hypothesized model. Results pointed out that students' perceptions of their teachers' supportive presentation style (γ = .16, p < .001) and students' perceptions of their teachers' using excessive lesson demands (γ = -.18, p < .001) and student self-efficacy for self-regulated learning (β = .56, p < .001) significantly predicted their level of enjoyment in mathematics. The directions of the relationships were positive, except for the excessive lesson demands dimension. Besides, perceived teacher affective support did not significantly explain students' enjoyment in mathematics (γ = .05, p > .05). Accordingly, students with higher scores on perceptions of their mathematics teachers' supportive presentation style, higher self-efficacy for self-regulated learning in mathematics, and lower scores on the excessive lesson demands dimension reported more enjoyment in mathematics.

Students' perceptions of their teachers' supportive presentation style significantly and positively predicted their self-efficacy for self-regulated learning in mathematics (γ = .38, p < .001). As students' perceptions toward their teachers' supportive presentation style increased, they had higher self-efficacy for self-regulated learning in mathematics. Besides, perceived teacher affective support made a significant contribution to explain student self-efficacy for self-regulated learning in mathematics (γ = .10, p < .01). As students' perceived teacher affective support increased, students seemed to have higher self-efficacy for self-regulated learning in mathematics. In contrast, students' perceptions of excessive lesson demands significantly and negatively predicted student self-efficacy for self-regulated learning in mathematics (γ = -.32, p < .001). As students' perceptions of excessive lesson demands increased, they tended to have less self-efficacy for self-regulated learning in mathematics.

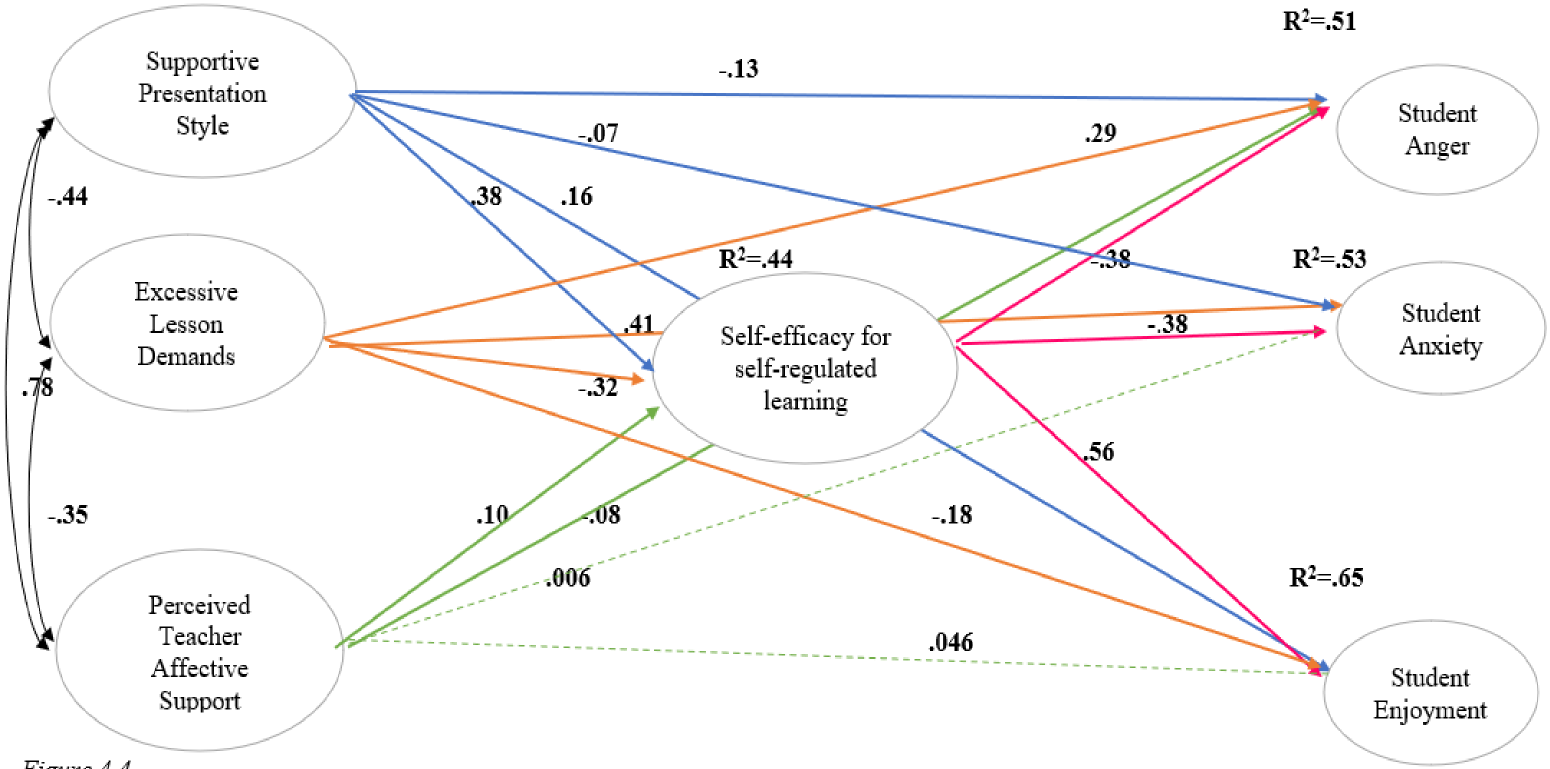

Figure 4.4.

The structural model with significant and non-significant direct effects for research question 2a

Note. Full lines indicated the significant paths, and dashed lines referred to non-significant paths. For the clarity of the presentation, the relationships were displayed only for latent variables.

4.5.4.2. Indirect Effects of the Structural Model for Research Question 2a

In addition to the direct effects, indirect effects of the structural model of student emotions in mathematics were examined. The standardized direct, indirect, and total effects were presented in Table 4.20. Accordingly, all of the indirect effects were found to be significant in the full structural model.

Although the direct effect of the perceived teacher affective support on students' mathematics anxiety was non-significant, it was found that perceived teacher affective support had a significant negative indirect effect on anxiety (-.039, $p < .01$) and anger (-.039, $p < .01$) through self-efficacy for self-regulated learning in mathematics. That is, an increase in students' perceptions toward teacher affective support was associated with less anxiety and anger in mathematics through self-efficacy for self-regulated learning in mathematics. Besides, perceived teacher affective support had a significant positive indirect effect on students' enjoyment in mathematics (.057, $p < .01$) through self-efficacy for self-regulated learning. That is, mathematics enjoyment was expected to increase by .057 for every increase in students' perceptions toward teacher affective support via self-efficacy for self-regulated learning in mathematics.

The results also showed that students' perceptions of their mathematics teachers' supportive presentation style had significant indirect effects on student anger (-.145, $p < .001$), anxiety (-.147, $p < .001$), and enjoyment (.213, $p < .001$) in mathematics through their self-efficacy for self-regulated learning in mathematics. The directions of the relationships were negative for negative emotions and positive for enjoyment. Accordingly, an increase in students' perceptions toward supportive presentation style was associated with more enjoyment and less anxiety and anger in mathematics through self-efficacy for self-regulated learning in mathematics.

Students' perceptions of excessive lesson demands had also significant indirect effects on student anger (.121, $p < .001$), anxiety (.122, $p < .001$), and enjoyment (-.178, $p < .001$) in mathematics through self-efficacy for self-regulated learning. The direction of the relationship was negative for enjoyment while it was positive for anger and anxiety. According to the results, an increase in students' perceptions toward excessive lesson demands was associated with less enjoyment and more anger and anxiety in mathematics through self-efficacy for self-regulated learning in mathematics.

Table 4.20.

Standardized Direct, Total Indirect, and Total Effects for the Structural Model for the Research Question 2a

Endogenous variables		Perceived Teacher Affective Support	Supportive Presentation Style	Excessive Lesson Demands
Student Enjoyment	Direct Effect	.046	.162***	-.183***
	Total Indirect	.057**	.213***	-.178***
	Total Effect	.103***	.375***	-.361***
Student Anger	Direct	-.083**	-.127***	.291***
	Total Indirect	-.039***	-.145***	.121***
	Total	-.122***	-.272***	.412***
Student Anxiety	Direct	.006	-.073**	.414***
	Total Indirect	-.039**	-.147***	.122***
	Total	-.033	-.220***	.536***

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$

4.5.4.3. Squared Multiple Correlations of the Structural Model for the Research Question 2a

Squared multiple correlations (R^2) of the latent variables in the structural model were described in Table 4.21 to explain the percent of the variance explained by the exogenous variables. Accordingly, 65% of the variance in student enjoyment in mathematics and 53% of the variance in student anxiety in mathematics were accounted for by students' self-efficacy for self-regulated learning, their perceptions of their teachers' supportive presentation style, and excessive lessons demands, and perceived teacher affective support. Students' perceived teacher affective support, self-efficacy for self-regulated learning, their perceptions toward their teachers' supportive presentation style, and excessive lesson demands also accounted for 51% of the variance in students' anger in mathematics. On the other hand, 44% of variance in self-efficacy for self-regulated learning was explained by students' perceived teacher affective support and their teaching quality perceptions (perceived teacher supportive presentation style and excessive lesson demands dimensions).

Table 4.21.

Squared Multiple Correlations for the Structural Model for Research Question 2a

	R^2
Self-efficacy for self-regulated learning	.44
Student Enjoyment	.65
Student Anger	.51
Student Anxiety	.53

4.5.5. Measurement Model for the Research Question 2b

According to Muthen's (1994) procedure, a single-level CFA was performed in the first step. The total covariance matrix would not be decomposed into between-group and within-group variances in this way. The results revealed a significant chi-square test χ^2 (137) = 4230.05, p < .001) with the following modification fit indices: RMSEA = .08, CFI = .93, NNFI = .92 and SRMR = .04. The findings resulted in tenable fit indices; however, intraclass correlations should have been checked to consider between-group variations, which is crucial to decide on performing multilevel modeling.

Consequently, intraclass correlation coefficients (ICC) were checked to decide on whether the multilevel analysis is appropriate for the data. According to Furer and Zombo (2011), ICC refers to “the proportion of individual variance that is influenced by or depends on group memberships” (p. 241). If the between-group variations are high enough (greater than .05), multilevel modeling would be essential for unbiased estimates (Dyer, Hanges, & Hall, 2005). Consequently, in this study, ICC values ranged from .047 to .096, which pointed out the higher between-group variations among the data to continue multilevel modeling. As the last step, multilevel confirmatory factor analyses were conducted to provide evidence for the measurement model. The findings yielded a significant chi-square test χ^2 (148) = 1235.19, $p < .001$) with the following fit indices: RMSEA = .04, CFI = .96, NNFI = .95, $SRMR_{within}$ = .01, and $SRMR_{between}$ = .05. The findings of both steps were presented in Table 4.22.

Table 4.22.

Comparison of Measurement Models for the Research Question 2b

	χ^2	*df*	*RMSEA*	*CFI*	*NNFI*	*SRMR*
Total	4230.05	137	.075	.932	.916	.041
Multilevel	1235.19	148	.037	.958	.945	*W*=.013; *B*=.052

According to tested measurement models (Table 4.22), and standardized estimates for single and multilevel confirmatory factor analyses (Table 4.23), multilevel confirmatory factor analysis findings best fit the data. These findings also supported Dyers et al. ‘s (2005) assertion of performing multilevel CFA to test measurement models with multilevel data.

Table 4.23.

Standardized Regression Weights for the Measurement Models for Research Question 2b

Items/Item Parcels		Parameter	Step I: Total Standardized Estimates	Step V: Within Standardized Estimates	Step V: Between Standardized Estimates
Anx_P1	<---	Student Anxiety	.88	.88	
Anx_P2	<---	Student Anxiety	.88	.87	
Anx_P3	<---	Student Anxiety	.86	.85	
Ang_P1	<---	Student Anger	.91	.90	
Ang_P2	<---	Student Anger	.89	.87	
Enj_P1	<---	Student Enjoyment	.76	.74	
Enj_P2	<---	Student Enjoyment	.98	.99	
Item 2	<---	Teacher Anxiety	.47		.50
Item 8	<---	Teacher Anxiety	.66		.66
Item 10	<---	Teacher Anxiety	.70		.71
Item 12	<---	Teacher Anxiety	.86		.83
Item 3	<---	Teacher Anger	.75		.75
Item 4	<---	Teacher Anger	.80		.82
Item 5	<---	Teacher Anger	.86		.87
Item 9	<---	Teacher Anger	.73		.75
Item 1	<---	Teacher Enjoyment	.81		.82
Item 6	<---	Teacher Enjoyment	.86		.86
Item 7	<---	Teacher Enjoyment	.74		.76
Item 11	<---	Teacher Enjoyment	.92		.91

Note. Enj=Enjoyment; Ang=Anger; Anx=Anxiety.

4.5.6. Multilevel Structural Model for the Research Question 2b

The goal was to investigate the relationship between students' and their mathematics teachers' emotions (i.e., anger, anxiety, enjoyment). There were two-levels on the dataset. Students' emotions in mathematics were placed at within-level being endogenous variables, while their mathematics teachers' emotions were placed at between-level being exogenous variables of the study. In other words, student emotions were nested within their mathematics teachers' classes (mathematics teachers' emotions). Therefore, multilevel structural equation modeling (ML-SEM) was performed to explain students' nested data structure into their mathematics teachers/classes. According to the variables in each level, a doubly latent approach was used to model students' anger, anxiety, and enjoyment in mathematics at between-level (Marsh, Lüdtke, Robitzch, Trautwein, Asparouhov, Muthen, & Nagengast, 2009). For this, aggregated student emotions scores were used at between-level. Therefore, the effects were simultaneously estimated at both within and between-levels. The proposed structural model was presented in Figure 4.5.

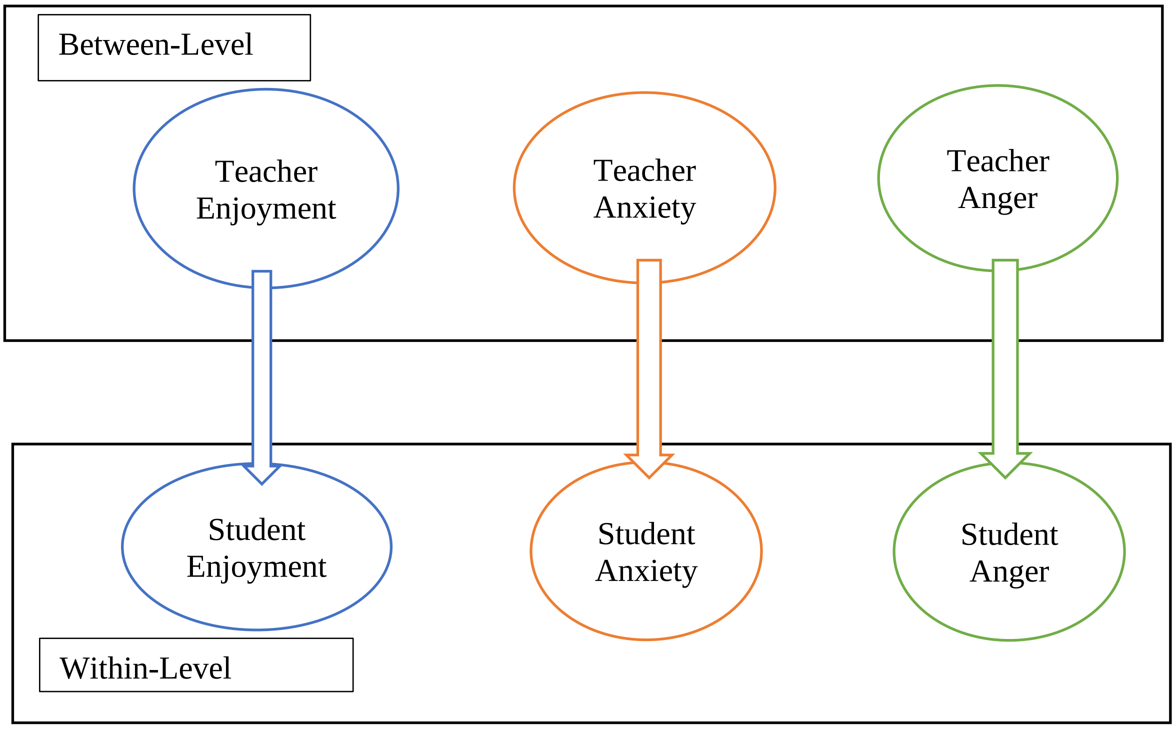

Figure 4.5. The hypothesized structural model for the Research Question 2b

The run of ML-SEM resulted an acceptable model fit to the data with the following fit indices: χ^2 (154) = 1268.65, p < .05, RMSEA = .037, CFI = .96, NNFI = .95, $SRMR_{within}$ = .013, and $SRMR_{between}$ = .105. According to the findings, both CFI and NNFI values were above .95, RMSEA, and $SRMR_{within}$ values were below .05. As proposed by Schermelleh-Engell, Moosbrugger, and Müller (2003), $SRMR_{between}$ values should be .10 or below to talk about the model fit for multilevel data. The index values were within the boundaries of an acceptable model fit. The standardized estimates and errors of items and item parcels for within-level and between-level constructs were given in Table 4.24.

Table 4.24.

Standardized Estimates and Error Variances of ML-SEM

Within-Class		
	Estimate	*SE*
Student Enjoyment		
Enjoyment_P1	.74	.01
Enjoyment_P2	.99	.01
Student Anxiety		
Anxiety_P1	.88	.01
Anxiety_P2	.87	.01
Anxiety_P3	.85	.01
Student Anger		
Anger_P1	.90	.01
Anger_P2	.88	.01
Between-Class		
Teacher Enjoyment		
Item 1	.82	.04
Item 6	.86	.02
Item 7	.76	.05
Item 11	.90	.04
Teacher Anxiety		
Item 2	.49	.06
Item 8	.66	.07
Item 10	.71	.07
Item 12	.84	.05
Teacher Anger		
Item 3	.75	.04
Item 4	.82	.04
Item 5	.87	.03
Item 9	.75	.06

4.5.6.1. Direct Effects for the Multilevel Structural Model Results for the Research Question 2b

The direct effects of mathematics teachers' enjoyment, anxiety, and anger on their students' enjoyment, anxiety, and anger in mathematics were reported, respectively. According to the results, there was no significant relationship between mathematics teachers' enjoyment and their students' enjoyment in mathematics (β = .06, p > .05), mathematics teachers' anxiety and their students' anxiety in mathematics (β = .07, p > .05), and mathematics teachers' anger and their students' anger in mathematics (β = .06, p > .05). Path coefficients and error variances for the multilevel model were presented in Table 4.25. Besides, the dashed lines indicated non-significant paths in the model in Figure 4.6.

Table 4.25.

Path Coefficient Results for Teacher and Student Emotions in Mathematics

Variable	β	*SE*
Student Enjoyment on		
Teacher Enjoyment	.06	.07
Student Anxiety on		
Teacher Anxiety	.07	.07
Student Anger on		
Teacher Anger	.06	.08

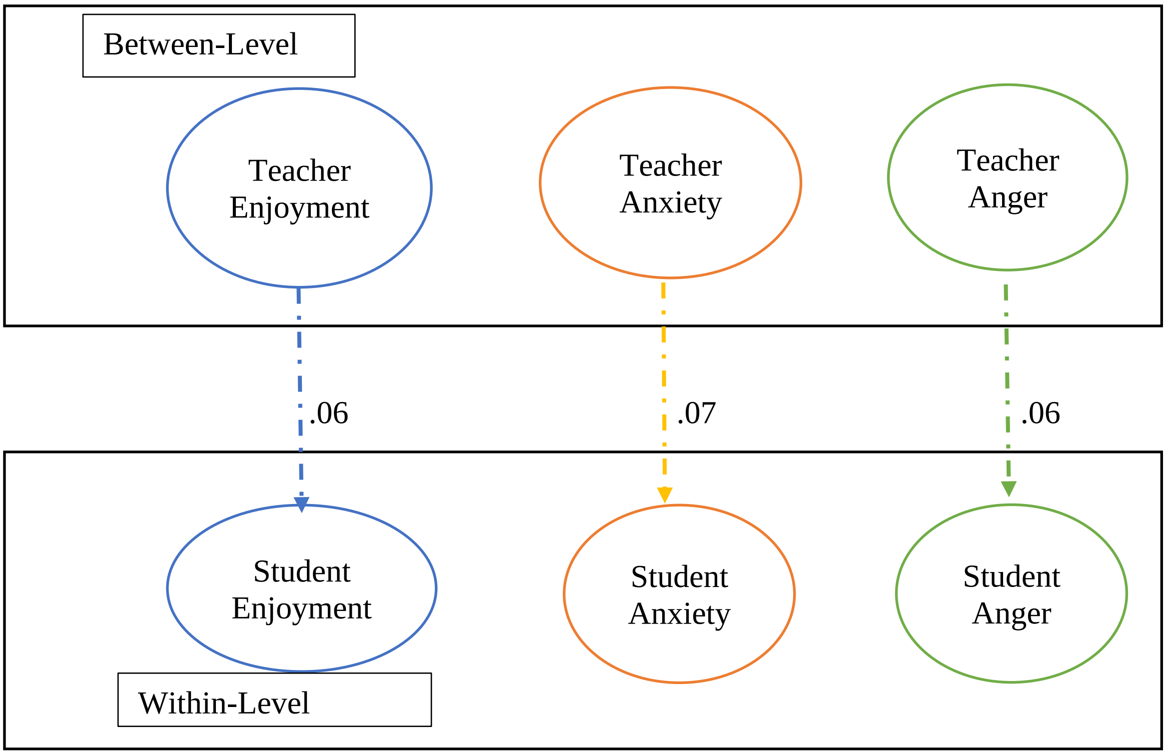

Figure 4.6. The structural model for the research question 2b

Note. Dashed lines referred to non-significant paths

4.6. Qualitative Findings

The third research question attempted to explain teachers' perceptions of how their students' mathematics achievement emotions are shaped through the learning process and interactions with their mathematics teachers. Accordingly, how 7th and 8th-grade students' emotions in mathematics are shaped through the learning process, and their interactions with mathematics teachers were explained from teachers' perspectives.

4.6.1. Students' Mathematics Achievement Emotions during the Learning Process

The findings of the interviews to portray how students' achievement emotions in mathematics are shaped through the learning process and interactions with their teachers revealed four main themes: types of *students' emotions in mathematics learning and teaching*, *sources of students' emotions in mathematics*, *consequences of* *students' emotions in mathematics*, and *strategies to regulate students' emotions in mathematics*.

4.6.1.1. Types of Students' Emotions in Mathematics Learning and Teaching

All of the teachers agreed that students have been experiencing anxiety and enjoyment in mathematics. However, some of the teachers rejected students' experience of mathematics anger.

Except for these emotions, both teachers mentioned some other positive and negative emotions in mathematics learning environments. For instance, Teacher B mentioned students' happiness in mathematics, "*When I say math, their eyes are shining, and they are smiling, they are happy.*" Teacher I pointed out students' excitement in mathematics as "*They are excited during the lesson, but they become more excited before the exams. They study for the exam and want to see whether they become successful or not.*" In addition to these, the experience of relief, passion, relaxation, and satisfaction was expressed in mathematics classes.

On the other hand, not only positive but also negative mathematics emotions seemed to arise. For example, Teacher I expressed her students' boredom in mathematics, "*Sometimes, some of the topics in mathematics require direct instruction. Students are bored. You understand when the flow of the lesson is stable.*" Besides, fear, hopelessness, sadness, stress, and unhappiness were also reported by mathematics teachers. To illustrate, Teacher N mentioned students' feelings of sadness and anxiety in mathematics, "*Students say that 'teacher, I can't do, I can't understand you,' but they don't experience anger. I didn't see the anger in their eyes. They get anxious and become sorry and question themselves on why they can't do*". Teacher M also commented on students' unhappiness and fear toward mathematics, "*Rather than hate, I think they don't love, or they are unhappy, or they get anxious. There is a fear of mathematics as well. They feel as if mathematics is a particularly important thing that* *requires respect. There are more signs of anxiety and fear rather than hate in my personal view*."

4.6.1.2. Sources of Students' Emotions in Mathematics

Teachers also talked about the possible reasons for mathematics emotions. The reasons were classified into *sources of positive emotions in mathematics* and *sources of negative emotions in mathematics*.

4.6.1.2.1. Sources of Positive Emotions in Mathematics

The interviews with teachers unraveled that students' positive emotions were based on *teacher-related* and *student-related factors*. Teacher-related factors are teachers' instructional practices, including using rhymes, codes, and storytelling *(n*=2*)*, and games (*n*=3) while explaining a topic. Besides, cooperative learning activities (*n*=2) and external rewards (*n*=1) are other teacher-related factors. The following quotes present the relevant instructional practices being the sources of positive emotions in mathematics, "*While explaining a topic, I use rhymes, codes and employ storytelling. Students like these methods and exclaim that "wow how forty minutes passed!*" (Teacher A, using rhymes, codes, and storytelling),

> I formed three groups in the class, considering the seating arrangement of students. I start asking questions from easy to difficult ones. The student comes to the board to solve the problem and gets the point for their groups. …Groups of students will take stars when they come to the board. The group with three stars will receive an award. I took the group with three stars to 'Kaçış Evi.' (Teacher B, use of external rewards)

As well as teachers' instructional practices, teachers' supportive practices were also articulated by some teachers as possible reasons for students' positive emotions in mathematics. These practices were a teacher's friendly manner (*n*= 2), teachers' use of humor (n=5), and mathematics teachers' attention toward students' problems (n=1). The following quotes present examples for these practices, "*I am trying to teach the lesson by using humor. If I am humorous, students enjoy the lesson.*" (Teacher D, use of humor)

> Whenever there is a case at school, other teachers say their students to cope with the problems by themselves or directing them to go to the school administration, but I don't like doing this. I tell them, 'Call both sides, these are my students, please tell me what my students had done, and you cannot behave them like that too.' I always support them whenever a problem appears. Such kind of things made them love mathematics. I am sincere that at least 20 students in this class hadn't been loving mathematics before. (Teacher B, mathematics teachers' attention toward students' problems)

There were also some student-related factors leading students to experience positive emotions in mathematics. These are possessing prerequisite knowledge in mathematics (*n*=2), students' perceptions of math topics as easy or well-known (*n*=5), and students' ability to understand mathematics topics (*n*=4). Some of the teachers mentioned such student-related factors, "*To me if students come to the class by satisfying the prerequisite knowledge, they start to understand and solve problems, they enjoy.*" (Teacher D, possessing prerequisite knowledge in mathematics), "*If there is an easy topic, then students solve questions. When the bell rings, students exclaim that 'wow the lesson passed very shortly, I wish there would be one more hour!'*" (Teacher C, students' perceptions of math topics as easy), *"...If they already know the topic, they become happy whenever they repeat it. They observe their ability during practicing the topic and enjoy it.*" (Teacher M, students' perceptions of math topics as well-known), "*If they comprehend the topic, this makes them very happy.*" (Teacher N, students' ability to understand mathematics topics)

Last, students have also been experiencing positive emotions in mathematics contingent upon several affective factors. These are loving mathematics teachers (*n*=6), feeling of comparison and competition (*n*=6), and feeling of accomplishment (*n*=10). Accordingly, some of the teachers responded as follows, "*They try to listen to the course because they love me. There is a dialog between the students and me, and we improved this dialog in time.*" (Teacher E, loving mathematics teacher), "*When I ask a question, I sometimes tell students 'I'll give extra credits for the one who solves the first.' Then, they display a high interest to solve the question and get the credits.*"(Teacher N, feeling of comparison and competition)

Three teachers expressed their students' feeling of accomplishment as follows, "*They do as they enjoy…They experience the feeling of 'I can succeed, and I experience enjoyment,' but if they do not love the topic, no hand raises in the class.*" (Teacher F), "*They become happy due to the feeling of accomplishing something. The feeling of 'I can be able to solve this question,' and the feeling of 'I succeeded this' make students being more motivated.*" (Teacher I).

> The feeling of accomplishing something… Mathematics is seen as a difficult subject area in our country. Students think that 'If I achieve in mathematics, I can do something in life.'…Students have a perception that 'If I can solve a problem, I can solve other things.' This perception makes students being enjoyed. (Teacher E)

4.6.1.2.2. Sources of Negative Emotions in Mathematics

The interviews with teachers unraveled four main sub-themes for the possible reasons for students' negative emotions in mathematics. These are *parent-related*, *student-related*, *curriculum and instruction-related*, and *assessment-related factors*.

Strict manner of parents toward students' grades (n=8), parents' expectations and reflections about mathematics (n=6), and parents' comparisons of their children with others (n=3) were portrayed to be the sources of students' negative emotions in mathematics. Some of the teachers argued about the parent-related factors as follows, "*Students are afraid of not performing well. Parents place pressure on them. They command them getting 90 points in mathematics, and they don't accept any grade below this.*" (Teacher A, strict manner of parents toward students' grades), "*There is a high expectation for students. I think, parents compete more than their children. If expectations are high, students stress out more.*" (Teacher K, parents' expectations and reflections about mathematics), "*Parents cause more competition. They ask for their children getting higher grades, and become superior to others.*" (Teacher F, parents' comparisons of their children with others). The following quotes also present some examples of parent-related factors.

> Most parents expect their children the grades that they couldn't receive, the school they couldn't study, and the jobs they couldn't work. Thus, children feel high pressure. I think it is not true… Our parents are more ambitious than their children (Teacher N, parents' expectations, and reflections about mathematics).

> There is student anger because of the parent. If the parents are in a high expectation and question their children's math profile regardless of thinking students' capabilities, students become unsuccessful although they put an effort. So, there will be more unhappy students hating from mathematics. (Teacher M, parents' expectations and reflections about mathematics)

> Parents are ready for a comparison of their children. Rather than small competitions among students, there is an ambition among parents to increase their expectations for their children and make comparisons. This expectation might be due to anxiety for the future of their children. (Teacher D, parents' comparisons of their children with others)

Students have also been experiencing negative emotions due to student-related factors. These are fear of failure (n=7), students' low level of mathematics self-efficacy, or self-confidence (n=11). Three teachers mentioned students' fear of failure as follows, "*The biggest reason is thinking about their failure, so they experience anxiety.*" (Teacher L), "*I think, the feeling of incapability and fear of failure… There is a desire for success, but they also have a fear of failure.*" (Teacher J). One teacher also commented on students' fear of failure as follows,

> Mathematics anxiety is related to fear of failure. Students may succeed as they know, but there is such fear. I think this fear is present in Turkey. Most of the students could not solve the questions in nationwide exams due to this anxiety. (Teacher I)

Two teachers expressed students' low level of mathematics self-efficacy or self-confidence as follows, "*They think that they can't do mathematics.*" (Teacher E), "*There is a student in my class. He is not interested in the lesson and put his head to the desk. I warn him to get up, but he says that 'Teacher, I can't do, I don't understand.' He accepts this idea, and it reflects helplessness.*" (Teacher K). One teacher also stressed students' low level of mathematics self-efficacy or self-confidence.

> I ask students to tell their answers, but they say that 'I did, but it is most

probably incorrect.' I become so upset that even they bring me the answer, they think that it is incorrect. There is no self-confidence, and there is a belief of inability in their minds. (Teacher C)

Besides, students' inability to understand abstract concepts (*n*= 3), students' low level of mathematics intelligence (*n*=2), students' previous experiences related to former mathematics teachers (*n*= 2), and students' lack of prerequisite mathematics knowledge and skills (*n*=8) were given as some of the student-related factors for the sources of negative emotions. The following quotations present expressions about some of the student-related factors, "*You know, mathematics is a cumulative course……. They tell me that 'my background is not good I never understand' as an escape from their stand.*" (Teacher G, students' lack of prerequisite mathematics knowledge and skills)

> … mathematics has a spiral nature. You extend your knowledge in math. I think students are coming with a lack of prerequisite knowledge. I apply a pre-test before starting a new topic and remind the previous topics with some questions. However, some children say that 'I didn't understand this topic last year' and give up initially, so addressing these children becomes difficult. (Teacher I, students' lack of prerequisite mathematics knowledge and skills)

> The experienced anxiety was due to their former mathematics teachers. The teacher had told them, 'Nobody could obtain 100 from my exam.' Namely, there was a kind of fear, always in discipline, and control, not even permission for breathing; some of the students had conspicuous fear, and they were shaking. As an example, I called one of the students to the board. The aim was to meet with her, and she started crying. However, now she is ranked second in the school. (Teacher B, students' previous experiences related to former mathematics teachers)

Also, students' questioning the utility of mathematics (*n*=2), students' disinterest toward mathematics (*n*=2), students' bias against mathematics (n= 7), students' study skill problems (*n*= 5), students' unwillingness to persist (*n*= 2), students' lack of study (*n*= 6), students' adaptation problems to teachers' teaching styles (*n*= 2), and students' puberty period problems (*n*=4) were expressed some of the student-related factors for the sources of negative emotions. Some of the teachers commented on these, "*I have an idea of students' mathematics anger. Students generally ask how I get benefit from* *mathematics. We can't agree on this issue. For instance, they tell me where I will use the percents in real life*." (Teacher I, students' questioning the utility of mathematics), *"…….They study, but the method they use is not appropriate for mathematics, so they get angry with mathematics…"* (Teacher D, students' study skill problems)

Other than parent-related and student-related factors, students' negative emotions could also arise due to curriculum and instruction related factors, such as the increasing difficulty level of mathematics subjects (*n*= 8), challenging nature of the 7th-grade mathematics curriculum (*n*=3), and the use of direct instruction (*n*= 2). The following quotes present the relevant curriculum and instruction related practices being the sources of negative emotions in mathematics, *"……… The most important reason is that students lose their interest toward mathematics as the difficulty level of the subjects increase.*" (Teacher L, the increasing difficulty level of mathematics subjects), "*I think, it depends on the subjects. There are topics in mathematics that students like and dislike. While explaining a topic, students' interest may decline as the difficulty level increases, and they may alienate from the course.*" (Teacher N, the increasing difficulty level of mathematics subjects), "*7th-grade mathematics subjects are difficult. Sometimes, students get bored. I teach three hours successively, and three hours of mathematics might become dull for students.*" (Teacher C, challenging nature of the 7th-grade mathematics curriculum)

Last, students' negative emotions were also portrayed to be due to assessment-related factors, such as the new high school placement system (*n*=7), and the mismatch of the questions in the Transition to High School Exam (LGS) and the current mathematics curriculum (*n*=7). Some teachers argued about these as follows:

> The new assessment system is complicated because we didn't teach students considering this exam's difficulty level. As students know their current math profile, they may experience learned helplessness. They may think that 'I wouldn't do, even I do, I would do to some extent.' Thus, in this class, I don't observe any serious effort. (Teacher M, the new high school placement system)

> The questions I solve are not related to LGS questions. It is a fact that students have been studying for seven years, but it is such an expectation for a fish climbing to a tree. Students were asked questions that could be solved if they learn it by practicing; that's why students got puzzled. There is extreme incongruency, and this is the most crucial thing that makes students anxious. Students should have learned well from my teaching, and they should have gone further on it. (Teacher D, the mismatch of the questions in the Transition to High School Exam (LGS) and the current mathematics curriculum)

> We generally ask questions at the application level, but LGS questions require verbal skills. For instance, while teaching the circle, I ask the perimeter or area only in the application level, but the explanation of the circle is integrated into the functioning of a clock in LGS. Thus, students cannot adapt their thinking accordingly. (Teacher E, the mismatch of the questions in the Transition to High School Exam (LGS) and the current mathematics curriculum).

> Students had difficulty in understanding the new question types. These questions require reasoning and comprehension, so students started to think about their inability this year. …They are under great pressure due to changing assessment system and question types. They possess a fear of failure and fear of not understanding what they have read. Mathematics requires reasoning, but even we didn't understand some of the LGS questions when we read for the first time. This situation creates anxiety for students. They are right because the current textbook doesn't include such new questions. We just explain the theoretical part, but the exam covers both theory and logic… The questions are appropriate to the curriculum, but the question types and the questioning styles are the main issues. There is a mismatch between the questions in textbooks and asked in LGS, which is very distressing for children. (Teacher K, the mismatch of the questions in the Transition to High School Exam (LGS) and the current mathematics curriculum)

4.6.1.3. Consequences of Students' Emotions in Mathematics

According to teacher interviews, the consequences of students' emotions in mathematics could be subsumed under two main themes. These are the *consequences of positive emotions* and the *consequences of negative emotions in mathematics*. These themes were also divided into sub-themes, which were explained in the following sections.

4.6.1.3.1. Consequences of Positive Emotions in Mathematics

Teacher interviews revealed that students' positive emotions in mathematics gave rise to physical symptoms, including smiling (*n*=3) and shining eyes (*n*=2). Some teachers provided examples for such physical symptoms as follows, "*When I say mathematics, their eyes are shining, they always smile, they are very happy*" (Teacher B, smiling; shining eyes), *"They reflect on their faces. Their mimics change……….they smile."* (Teacher G, smiling)

In addition to physical symptoms, positive emotions were posited to yield behavioral effects, such as sharing feelings with mathematics teachers (*n*=2). This effect was reported in the expression of Teacher L, "*They tell me that they love the lesson*" Besides, an increase in student engagement (*n*=11) was also mentioned to be one of the behavioral effects of positive emotions in mathematics. Two teachers commented on this as follows, "*They become so willing to come to the board.*" (Teacher F), "*……. They solve more problems and bring more questions. Students ask me the ones that they couldn't do, or they request me solving the unsolved ones during the lesson.*" (Teacher I). One teacher also commented on student engagement as follows,

> If they can do mathematics, they become happy, and their engagement increases. You hear their voice. If the engagement is low, there will be silence, and the class energy will be low. However, when students engage in the lesson, each student states his opinion and smiles. You observe their reactions and their happiness. (Teacher M)

4.6.1.3.2. Consequences of Negative Emotions in Mathematics

As argued by mathematics teachers, there were also several consequences of negative emotions in mathematics. Accordingly, negative mathematics emotions seemed to induce physical symptoms in students. These are sweating (*n*=1), looming (*n*=1), crying (*n*=2), glowing (*n*=1), shaking (*n*=1), and swinging one's feet (*n*=1). Some teachers mentioned the physical symptoms of negative emotions in mathematics as follows, "*When I deliver the exam papers, there is extreme anxiety on students. Namely, I see that they are sweating. There is much more physical expression, such as* *their eyes are moving around as if they would take the last exam in their lives.*" (Teacher D, sweating; looming).

On the other hand, the interview findings pointed out the behavioral effects of students' negative emotions in mathematics. These were interrupting the class (*n*=6), giving up studying, or listening to the course (*n*=9), suppressing the feelings (*n*= 4). Some of the teachers put forth students' experiences in their classes as follows, "*They don't care and try to interrupt the lesson.*" (Teacher A, interrupting the class), "*Sometimes, they attempt to interrupt the lesson by talking. They are trying to make me angry by interrupting the lesson. They think about how to make me angry because when you get angry, you start to give advice; it is natural.*" (Teacher E, interrupting the class), "*Students distract each other's attention and interrupt the lesson when they get bored.*" (Teacher M, interrupting the class), "*They do nothing and give no reaction. They think that 'I get bored, I cannot do this course, and it is over.' They don't care what the teacher is explaining. If they cannot do it, it is over.*" (Teacher E, giving up studying or listening to the course), "*They tend to suppress their stress and not to reveal it. However, the used force for suppressing it becomes apparent*." (Teacher K, suppressing the feelings), "*Some of them become silent and live with their anxiety in their inner world.*" (Teacher F, suppressing the feelings). One teacher expressed students' giving up studying or listening to the course as follows,

> When I ask a question in one step, hands raise in the class, whereas they give up when I ask questions in multiple stages. I think students are used to giving knowledge. Their anxiety tends to increase when the lesson gets difficult. They generally give up and leave studying because they believe that 'I can't do!' or ridicule their friends and say something to each other. (Teacher I, giving up studying or listening to the course)

Teachers also mentioned many off-task behaviors that students deal with when they feel negative emotions. These are drawing the desks (*n*=3), tearing something (*n*=1), playing with pencils (*n*=1), daydreaming (*n*=1), throwing something to peers (*n*=3), sleeping (*n*=3), muttering (*n*=1), praying (*n*=1). One teacher mentioned these off-task behaviors as follows, "*..... They draw desks, use their pencils, tear something, scratching, and play with their hairs. They may daydream or snipe his friends. They* *try to distract their attention to escape from the anxiety.*" (Teacher B, dealing with off-task behaviors).

As mentioned above, students' behaviors resulting from negative mathematics emotions were more likely passive-aggressive. Except for these behaviors, some teachers also indicated students' direct behaviors under the influence of negative emotions, such as help-seeking (*n*=5) and studying more (*n*=2). Two teachers commented on these as follows, "*I think, anxiety triggers students because they study if they are anxious*." (Teacher G, studying more)

> The conscious students, indeed, find solutions. If they feel anxiety, they come near me and ask the questions that they didn't understand…..If they experience anxiety related to the course, they ask questions, make comments, or they demand being guided and ask, 'What should we study or how should we do?" (Teacher J, help-seeking)

4.6.1.4. Strategies to Regulate Students' Emotions in Mathematics

Teachers tried to employ several strategies to regulate their students' emotions in their mathematics classes. They utilized *instruction-related* and *affective support strategies*. For instruction-related strategies, teachers mentioned that they were generally using student-centered teaching practices (*n*= 3). One teacher commented on this,

> I want students to be active in class. If I explain a topic, I divide it into small steps rather than giving the full information. I want my students to access the knowledge by themselves…Namely; I try to employ student-centered education. (Teacher I)

Teachers also mentioned using peer support and peer modeling (*n*=8) as an instruction-related strategy to regulate students' emotions. Some teachers shared their experiences in using peer support and peer modeling as follows, "*I make successful student sit near the one who is not good at math. If I explain the topic for two times, the high achiever explains to his peer for the third time.*" (Teacher C, using peer support and peer modeling), "They help each other by sharing their knowledge, and they may decrease their anxiety. (Teacher I, using peer support and peer modeling). Two teachers also provided examples of using peer support and peer modeling in their classes.

> One student can come to the board, and the other cannot in a group, so I tell them, 'you can help your friend by explaining the topic.' They teach each other, and they gush to get points in the group. (Teacher B, using peer support and peer modeling)

> Although I am a teacher, students sometimes understand well from a peer. For example, I write algebraic equations side by side like 5x+5, but others may report 5x and then five below this. Students may understand well from the second one. There is no difference between them, but students may prefer the ones explained by their peers. Therefore, I bring two students together with different achievement levels. The one with high math achievement makes their peers study. Sometimes, students come near me and say that 'Teacher, I didn't understand when you explained, but I understood from my peer.' It doesn't disturb me, and I like this. (Teacher H, using peer support and peer modeling)

There are also some other instruction-related strategies adopted by teachers to regulate their students' emotions, including activities and games (*n*=7), drills and practices (*n*=3), teaching from basic to advanced level (*n*=6). The following quotes present the relevant practices to regulate students' emotions in mathematics, "*I explain from basic to advanced level. If you address each student's level and develop a feeling of accomplishment, students' interests could be garnered.*" (Teacher F, teaching from basic to advanced level)

> I apply the 'Para Puan System' in the class, and they may evaluate their performances. When I explain a topic, they start to solve questions. Each question has an already determined score. They should solve these questions within the given time to gain these scores. In the end, I provide answers. I then check the students' notebooks. If they solve the question correctly, they receive the score for this question… They may control their anxiety within a limited time, and they are encouraged to solve more problems with this system. (Teacher M, including activities and games)

> I prefer the following basic to advance patterns. Students' motivation increases when they notice their ability if they succeed in easy topics. As they get accomplished, their attitude toward difficult ones changes as well. They could be more successful if they believe in themselves. (Teacher I, teaching from basic to advanced level)

> Maybe both teachers would say the same thing, but I start asking questions from the basic level. I move on to the difficult one after they feel that they could

> do. Yes, some things need to be completed, but students' feelings and happiness are essential. That's why I prefer asking more straightforward and doable questions, so they learn the topic more easily. (Teacher M, teaching from basic to advanced level)

Teacher interviews also revealed some other instruction-related strategies, adjusting instruction according to students' mathematics levels (*n*=4), re-explaining the topic (*n*=4), and allocating extra time for mathematics teaching when necessary (*n*=3). Some of the teachers mentioned these strategies as follows, "*I ask questions proper to their mathematics levels to decrease their anxiety, increase their mathematics love, and make students say I can do this.*" (Teacher N, adjusting instruction according to students' mathematics levels), "*I try to increase their confidence by telling students the possibility of asking questions to me for the topics they didn't understand after mathematics classes, during breaks, and lunchtime*." (Teacher I, allocating extra time for mathematics teaching when necessary)

> For example, I don't reflect the questions to the board because I don't want students to concentrate on just one problem. I want each student to learn by their learning pace and knowledge, so I want students to look at the questions individually. (Teacher D, adjusting instruction according to students' mathematics levels)

Besides, mathematics teachers mentioned that they were employing different types of assessments (*n*=6), providing continuous feedback, correctives, and prompts (*n*=4), using supplementary sources (*n*=6), utilizing technology (i.e., smartboards, projection devices, videos) (*n*=6), and using social platforms for mathematics assistance (*n*=2). Some teachers indicated, "*To remove their test anxiety, I apply regular small quizzes with 4-5 questions for fifteen minutes.*" (Teacher I, employing different types of assessments), "*I tell students, 'Is it like that? Don't skip this or you couldn't see this part, there was a mistake, look it again.' If they solve the question, their motivation gets better.*" (Teacher M, providing continuous feedback, correctives, and prompts), "*If the topic is abstract, I try to make it concrete. The smartboard made our job easy because there are videos prepared for these topics. We display such appropriate videos, visuals or materials*." (Teacher G, utilizing technology). Some teachers also provided examples of using technology and social platforms for mathematics assistance

> I use technology, and I think it is necessary. ……. For geometry topics, for instance, students remember well if they see the figure. We use the Education Information Technologies (EBA) network, and I think it is beneficial. The topics are explained there, and we use supplementary sources for well-designed mathematics learning environments. (Teacher K, utilizing technology)

> I sometimes send high-level questions through WhatsApp and ask students which methods they will use to solve the problem. I also send them new generation questions and their answers. Students explain their reasoning while solving these questions. It is not I taught the class, and my job is over. I don't know other lessons, but there is no such success for mathematics (Teacher B, using social platforms for mathematics assistance).

Teachers also stated that they connected the mathematics subjects with other disciplines (*n*=2) and real-life (*n*=4). Some of the teachers underlined how to use these strategies during teaching:

> If I know something about the history of the topic, I use this knowledge. For instance, if I explain the Fibonacci series, I relate this to biology like rabbits' coupling. I storify how Thales developed a system to measure the height of pyramids in Egypt. I try to connect the mathematics to real-life to increase students' interests (Teacher F, connecting mathematics subjects with other disciplines)

> I assign projects to students regarding their interests. For instance, they like music; then I say 'There is mathematics in music, or someone loves cars, and I tell them, 'You need differential equations when designing cars, but you don't know this.' If there is such talk, they tend to pay their attention to math. (Teacher E, connecting mathematics with real-life)

Teacher interviews also led to affective support strategies employed by mathematics teachers to regulate their students' mathematics emotions. Accordingly, teachers expressed encouraging student engagement in mathematics (*n*=6), encouraging students to persist (*n*=6), making students experience success (*n*=6), giving students more responsibilities (*n*=2). To illustrate these, one teacher expressed encouraging student engagement as follows, "*I encourage students being active, but it doesn't mean* *interrupting the lesson. I mention them 'You would raise your hands, and you will be free, and everyone will smile.*" (Teacher B, encourage student engagement in mathematics). The following quotes present the use of given strategies.

> To me, no student tells me that 'Why you are calling me to the board, I don't wanna come!' because I tell them 'If you think you cannot do this, I will help you. If you think you make a mistake, don't be afraid of coming to the board. I may also make mistakes while solving the questions.' Then, the student would not feel anxiety. (Teacher F, encourage student engagement in mathematics)

> I try to persuade students to do math because they think that 'If I respond and make a mistake, I would be ashamed.' I generally try to calm down students who may ridicule their friends. I also persuade students about the idea that they may learn from their mistakes, and making mistakes is a common situation. Then they become more sympathetic. (Teacher I, encourage students to persist)

> You may not do mathematics. I can't do art, for example, or have musical skills. Mathematics is a skill; you have to put effort. You may not solve the problem, but you should try and think positively. (Teacher H, encourage students to persist)

Last, teacher interviews revealed that teachers were using some other affective support strategies, such as paying attention to their verbal and body language (n=8), calming students (n=8), and not giving any punishment to them (n=3), talking to students individually if necessary (n=3). Accordingly, some of the teachers mentioned these strategies as follows, "*First, I relax the student. If the student attempts to remember the knowledge, I try to emotionally support them and explain that the exam is not so important.*" (Teacher M, calming students), "*First, I try to not reprimand students when they ask a question. I think this is one of the most important things. Sometimes, they ask questions that make me freak out, but I don't reflect this to students. I don't demoralize them.*" (Teacher L, paying attention to their verbal and body language). Some teachers also commented on these strategies as in the following:

> … I pay attention to my body language very much. I don't adopt a strict attitude, a closed position during communication, or any defensive manner in my body language… I sit calmly and don't use mimics. I smile all the time and never increase my tone of voice toward the student. (Teacher B, paying attention to their verbal and body language)

> They get very anxious during the exams. I go near them and say, ‘You know this, just calm down, take a breath.’ I know that they will experience the same problem during the LGS. If they cope with their anxiety and stress with my persuasions, they will succeed in LGS. (Teacher D, calming students)

> I talk individually, especially while checking their exams. Students may have done something incorrectly. I call the student and ask what they have tried to do……I want students to feel about being valued. I motivate them by telling, ‘I know you understand, but I have to give this grade, but if you try hard, I will give you higher grades for your oral exam.’ (Teacher K, talking students individually if necessary)

4.7. Summary of the Results

The purpose of the study was three-folded. First, the study aimed to investigate the relationship between mathematics teachers’ academic emotions, self-efficacy, and burnout. Second, it was intended to explore the relationship between mathematics teachers’ academic emotions and their 7th and 8th-grade students’ mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and their achievement emotions in mathematics. Third, the reasons and the relevant processes behind students’ emotions in mathematics were uncovered by considering the learning process and students’ interactions with their mathematics teachers. The analyses revealed different results.

According to the first research question, the direct effects of the proposed structural model were examined. In this regard, teachers’ sense of personal accomplishment was a positive predictor of teachers’ self-efficacy for classroom management, student engagement, and instructional strategies. Besides, teachers’ emotional exhaustion was a negative predictor of teachers’ self-efficacy for student engagement. Teachers’ self-efficacy for classroom management and student engagement negatively predicted teachers’ anxiety and anger, while positively predicted teacher enjoyment in mathematics. By contrast, teachers’ self-efficacy for instructional strategies negatively predicted teacher enjoyment and positively predicted teacher anger and anxiety in mathematics. Except for direct effects, indirect effects were also examined. Accordingly, personal accomplishment had significant negative indirect effects on anxiety, anger, and a positive indirect effect on enjoyment through self-efficacy for classroom management, self-efficacy for student engagement, self-efficacy for instructional strategies.

For the second research question, the direct effects of the proposed structural model were examined Students' perceived teacher affective support and their perceptions of teachers' supportive presentation style positively predicted students' self-efficacy for self-regulated learning in mathematics. In contrast, students' perceptions of teachers' excessive lesson demands negatively predicted students' self-efficacy for self-regulated learning in mathematics. Regarding teaching quality dimensions, students' perceptions of teachers' supportive presentation style negatively predicted anger and anxiety in mathematics and positively predicted enjoyment in mathematics. Besides, students' perceptions of excessive lesson demands negatively predicted student enjoyment and positively predicted anxiety and anger in mathematics. Students' perceived teacher affective support, on the other hand, negatively predicted anger in mathematics. Last, there was no significant relationship between mathematics teachers' anger, anxiety, enjoyment, and students' anger, anxiety, and enjoyment in mathematics. Except for direct effects, perceived teacher affective support and students' perceptions of their mathematics teachers' supportive presentation style had significant positive indirect effects on enjoyment, and negative indirect effects on anger and anxiety in mathematics through self-efficacy for self-regulated learning. Besides, students' perceptions of excessive lesson demands had significant positive indirect effects on anger and anxiety, and a negative indirect effect on enjoyment in mathematics through self-efficacy for self-regulated learning in mathematics.

The qualitative interviews unraveled four main themes to explain how 7th and 8th-grade students' emotions were shaped through the learning process and students' interactions with their mathematics teachers. These themes might be given as in the following:

types of students' emotions in mathematics learning and teaching, sources of students' emotions in mathematics, consequences of students' emotions, and strategies to regulate students' emotions in mathematics. Students experienced many positive and negative emotions, including enjoyment, happiness, excitement, relief, passion, relaxation, satisfaction, anger, anxiety, fear, hopelessness, sadness, stress, and unhappiness. The sources of students' emotions might be divided into two categories considering their valence. Namely, students' positive emotions might stem from several teacher and student-related factors. In contrast, students' negative emotions generally arise due to parent, student, curriculum and instruction, and assessment-related factors. Experienced emotions also induced several physical symptoms and behavioral effects. Last, teachers employed several instruction-related and affective support strategies to regulate their students' emotions in mathematics classes. The summary of the main and sub-themes obtained from teacher interviews are presented in Figure 4.7.

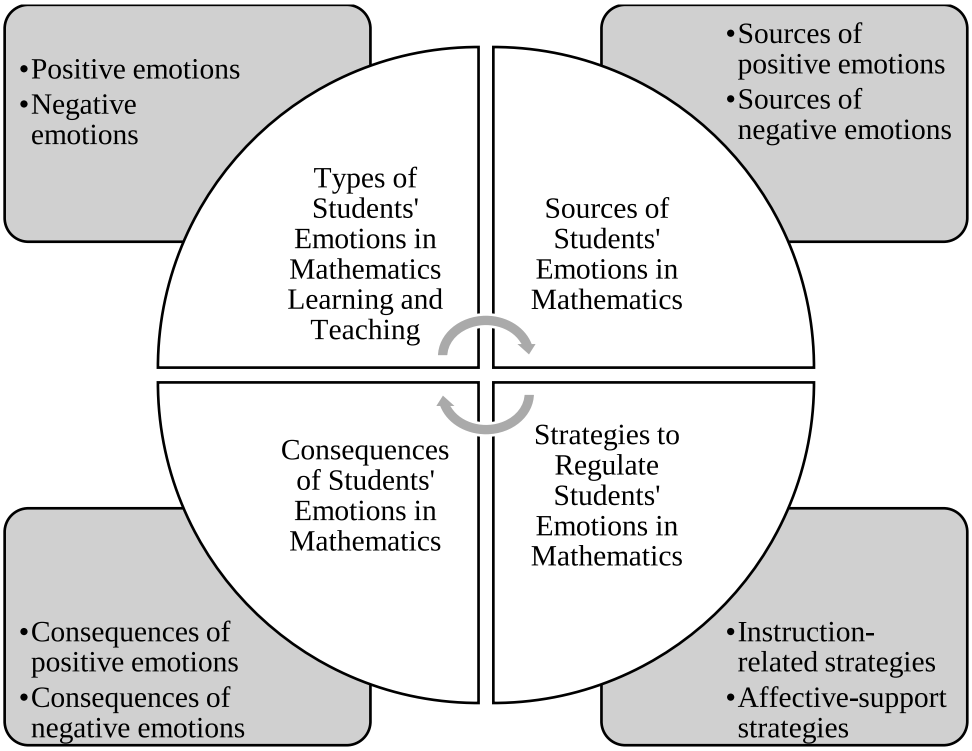

Figure 4.7.
Summary of the main and sub-themes of teacher interviews

CHAPTER 5

DISCUSSION

"You cannot prevent the birds of worry and care from flying from your head, but you can stop them from building a nest in your hair."
Proverb

The last chapter discusses the findings considering three critical points: teacher academic emotions and affect-related variables, students' achievement emotions and affect-related variables, and teachers' perceptions of student achievement emotions and emotion formation process. First, the findings were compared with the current literature, and the results were discussed. Second, the implications of the findings for education, theory, and research were presented. Afterward, the recommendations for further research were given regarding the limitations of the study.

5.1. Conclusion of the Results

This study encompassed three purposes. First, it was intended to reveal how middle school mathematics teachers'' academic emotions, self-efficacy, and their sense of burnout were related. Second, the findings would be essential to discuss the relationship between 7^{th} and 8^{th}-grade students'' achievement emotions in mathematics with their mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and their mathematics teachers' emotions. Along with the quantitative findings, the study also portrayed how students' emotions in mathematics are shaped through the learning process and students' interactions with their mathematics teachers.

Given that this study included a distinct group of participants and several data analysis methods, the employed measures for both student and teacher groups would also be different. In this regard, one of the study goals was to translate and adapt the Teacher Emotions Scale (TES) and Perceived Teaching Quality (PTQ) to the Turkish language and check their psychometric qualities. In light of the adopted theoretical framework, the current literature and the original scales, the hypothesized factor structures, and the internal consistency estimates were verified by the pilot and main study findings. Accordingly, the three-emotions factor model fit for TES with appropriate fit indices and reliability findings. Besides, the two-factor model worked well for the PTQ scale except for one-item, which had considerably lower reliability estimates across other items in both studies. This item was dropped from the scale, and one item was added to the final version of the scale. Consequently, TES and PTQ could measure teacher' emotions and students' perceptions of teaching quality. The study's findings were discussed regarding teacher and student groups in the next sections in line with the research questions.

5.1.1. Teacher Emotions and Affect-Related Variables

The proposed model revealed a positive relationship between personal accomplishment and the dimensions of teacher self-efficacy and negative relationships between emotional exhaustion and teacher self-efficacy for student engagement. These findings were supported by the majority of the studies in the literature (e.g., Aloe, Amo, & Shanahan, 2014; Egyed & Short, 2006; Evers, Brouwers, & Tomic, 2002; Fives, Hamman & Olivarez, 2007; Gastaldi, Pasta, Longobardi, Prino, & Quaglia, 2014; Sarıçam & Halis, 2014; Schwarzer, Schmitz, &Tang, 2000; Tabatabaee-Yazdi, Motallebzadeh, & Ashraf, 2014). Additionally, in Bümen (2010) and Lauermann and König's (2016) studies, the authors inversely examined the personal accomplishment dimension; in other words, they looked at the relationship between reduced personal accomplishment and teacher self-efficacy dimensions. According to the findings, there was a negative relationship between the stated variables, supporting this study.

Bandura's (1997) triadic reciprocal model might explain the bidirectional relationships in this study. In this model, personal, environmental, and behavioral factors are reciprocally related. For example, emotional exhaustion may stem from several contextual factors. These are related to classroom conditions, such as discipline problems, overcrowded classrooms, student failure, deficits in learning sources, and teaching materials (Bümen, 2010; Ercan Demirel & Cephe, 2014; Yıldız Durak & Seferoğlu, 2017; El Helau et al., 2016; Gavish & Friedman, 2010; Hastings & Bham, 2003; Payne McLain, 2005; Özdemir, 2009; Sezer, 2012). As a result, the emotional exhaustion would be associated with lower teacher self-efficacy for student engagement. In addition to this, these findings might also be explained by sources of self-efficacy. Among the four sources, people's physiological and affective arousal are influential in efficacy judgments. In other words, extreme levels of stress, fear, and anxiety might undermine people's capability judgments over the designated task (Bandura, 1997). In this regard, teachers' emotional exhaustion could also be a sign of overexploitation of emotional resources (Maslach, 2003). Such overexploitation may lead to a decline in self-efficacy for student engagement because of the feeling of drain and tiredness due to extreme arousal.

On the other hand, teachers' sense of personal accomplishment purports teachers' feelings of fulfillment in their intended goals. Presumably, these goals are closely related to student-related outcomes, so personal accomplishment might be the outcome of student success, which might be a contextual factor in the triadic reciprocity model. In addition to the triadic reciprocity model, personal accomplishment might be considered in line with Bandura's proposition of the mastery experience as the most influential self-efficacy source. As stated by Bandura (1997), people's enactive experiences, including accomplishments, play a critical role in their beliefs to their capabilities to complete a given task in the future. Teachers with success history will more likely believe in their knowledge and skills relevant to ensure classroom management, student engagement, and instructional strategies. That was also supported by several studies regarding the relationship between personal accomplishment and different teacher self-efficacy dimensions (Egyed & Short, 2006; Fives, Hamman & Olivarez, 2007; Sarıçam & Halis, 2014; Savaş, Bozgeyik & Eser, 2014). In this regard, personal accomplishment might influence teacher self-efficacy for classroom management, student engagement, and instructional strategies. Therefore, the findings clarified the proposed bidirectional relationships in the model.

Even though significant relationships were found for personal accomplishment and emotional exhaustion with the stated teacher self-efficacy dimensions, there was no relationship between emotional exhaustion and teacher self-efficacy for classroom management and instructional strategies. There was also no significant relationship between depersonalization and teacher self-efficacy dimensions. These findings, however, contradicted with the results of several studies (e.g., Aloe, Amo, & Shanahan, 2014; Brouwers & Tomic, 2000; Bümen, 2010; Egyed & Short, 2006; Dicke, Parker, Holzberger, Kunina-Habenicht, Kunter, & Leutner, 2015; Fives, Hamman, & Olivarez, 2007; Gastaldi, Pasta, Longobardi, Prino, & Quaglia, 2014; Khani & Mirzaee, 2015; Lauermann & König, 2016; Sarıçam & Halis, 2014; Savaş, Bozgeyik, & Eser, 2014; Schwartz, Schmitz, & Tang, 2000; Skaalvik & Skaalvik, 2010; Tabatabaee-Yazdi, Motallebzadeh, & Ashraf, 2014). This result might occur due to several reasons. First, several studies used different measures to assess teacher self-efficacy. In Egyed and Short's (2006) study, the relationship between teacher self-efficacy and burnout was examined to determine teachers' decisions on children's referral for special education. In this study, the teacher efficacy scale encompassed teaching and personal teaching efficacy dimensions. Therefore, the tendency to measure teacher self-efficacy was somewhat different from the current study, restricting further arguments. Similarly, Skaalvik and Skaalvik (2010) aimed to determine the relationship between teacher self-efficacy, collective teacher efficacy, teacher burnout, job satisfaction, and some other factors via a structural model. Teacher efficacy was measured by the researcher developed scale, which was comprised of a variety of dimensions such as instruction, motivating students, keeping discipline, adapting education to students' needs, coping with changes and challenges, and cooperating with colleagues and parents. As in Egyed and Short's (2006) study, the conceptualization of teacher self-efficacy was ultimately different from the current study. The contrasting nature of the findings could be tenable to some extent. On the other hand, Lauermann and König (2016) measured teacher self-efficacy with a unidimensional scale. Their study revealed negative relationships between teacher self-efficacy and emotional exhaustion, depersonalization, and reduced personal accomplishment. Again, the difference of employed instruments or the operationalization of teacher self-efficacy seemed to disclose differential findings that might not be surprising for people when considering statistical analyses.

The personal accomplishment also had indirect effects on teacher anger, teacher anxiety, and teacher enjoyment through teacher self-efficacy for student engagement, teacher self-efficacy for instructional strategies, and teacher self-efficacy for classroom management. The finding might be supported by several studies. For example, in Betoret's (2006) study, the researcher examined the mediator or moderator role of self-efficacy on the relationship between job stressors and burnout. Findings confirmed the moderator role of teachers' perceived self-efficacy among the association between job stressors and burnout. Similarly, the mediator role of self-efficacy was also questioned in Yu, Wang, Zhai, Dai, and Yang's (2015) research. Accordingly, self-efficacy seemed to mediate the relationship between job stress and burnout partially. Namely, teachers with low self-efficacy beliefs were more likely to make external attributions to their teaching accomplishments and neglect their ability and performance. Parallel to this study's findings, the personal accomplishment levels of teachers might indirectly influence teacher' emotions via teacher self-efficacy while considering personal accomplishment as a source of self-efficacy. 'In this study, a sense of personal accomplishment might be considered as enactive or mastery experiences on a given task. In this perspective, as teachers' feeling of accomplishment increases, their self-efficacy would more likely increase, which plays a predictor role in their emotions.

The current study also disclosed positive relationships between mathematics teachers' enjoyment and self-efficacy for classroom management and self-efficacy for student engagement. In contrast, the direction of the relationships was negative for anger and anxiety. The structure of the relationships was also supported by the findings of many studies in the literature (e.g., Brigido, Borrachero, Bermejo, & Mellado, 2013; Borrachero, Brigido, Costillo, Bermejo, & Mellado, 2013; Buric & Macuka, 2017; Chen, 2018; Gresham, 2009; Hasher & Hagenauer, 2016; Stephanou, Gkavras, & Doulkeridou, 2013; Swars, Daane, & Giesen, 2006). In social cognitive learning theory, personal, behavioral, and environmental factors are reciprocally and dynamically related. Self-efficacy affects people's thought patterns, choices, regulation of learning, perseverance, and physiological and affective arousal (Bandura, 1977, 1982, 1997). Therefore, observing meaningful relationships between teacher self-efficacy and emotions would be foreseeable. Furthermore, self-efficacy is an antecedent of emotions in Pekrun's (2006) control-value theory. In other words, emotions were more likely to be induced by self-efficacy. People experience more positive emotions unless their self-efficacy beliefs are low. On the other hand, negative emotions would likely occur under the conditions in which people experience low self-efficacy. In this regard, the given association between teacher self-efficacy for classroom management and student engagement and their anger, anxiety, and enjoyment seemed reasonable from the lens of theories.

The hypothesized structural model proposed the predictive role of self-efficacy on teachers' emotional states, which was theoretically and empirically supported. However, several studies focused on the predictive role of emotions on self-efficacy (Jablon, Stoehr & Olson, 2015; Ramirez, 2015; Williams, 2009). Although the ascribed role was different from the previous studies, the relationship direction was still the same. In other words, there was a positive relationship between self-efficacy and positive emotions and a negative relationship between negative emotions. The only exception was that emotional arousal would predict the degree of self-efficacy beliefs among people.

Along with Mills, Pajares, and Herron's (2005) assertion, there is a dynamic relationship between anxiety and self-efficacy. Corroborating the primary sources of self-efficacy, the physiological and affective arousal directly influence people's self-efficacy beliefs. In these cases, the extreme level of stress, anxiety, and distress would diminish beliefs toward accomplishing the given tasks or beliefs to cope with the challenges (Usher & Pajares, 2008; Pajares, 2006). Therefore, the studies inquiring the predictive role of emotions on people's self-efficacy would not be so inconceivable, which requires looking at the proposed association through a non-recursive perspective. That is, the reciprocal nature of the relationships might be studied deliberatively.

Interestingly, the inverse relationships between teacher self-efficacy for instructional strategies and teacher enjoyment, anxiety, and anger were unexpected findings in this study. Namely, there was a negative relationship between teacher self-efficacy for instructional strategies and teacher enjoyment. In contrast, a positive relationship was found between teacher self-efficacy for instructional strategies and teacher anxiety and anger. The findings might be the flaws of the employed statistical analysis, but several arguments might still be asserted for this issue. First, several studies found non-significant or inverse relationships among the abovementioned constructs. For example, Etheridge (2016) investigated the extent to which elementary grade teachers' mathematics anxiety and mathematics self-efficacy explain their mathematics teaching efficacy. The findings unveiled no significant relationship between mathematics anxiety and mathematics teaching self-efficacy. Işıksal (2009), on the other hand, investigated the relationship between mathematics teaching efficacy, mathematics anxiety, and mathematics self-concept of elementary school pre-service teachers. According to the results, there was a positive relationship between pre-service teachers' mathematics test anxiety and their mathematics teaching outcome expectancy beliefs. While thinking about the fostering role of a moderate level of physiological arousal on people's self-efficacy beliefs (Bandura, 1997), this relationship might be reasonable and meaningful for anxiety. Usher and Pajares's (2006a, 2006b) studies, for example, revealed the quadratic nature of sixth-grade students' physiological states on their academic self-efficacy. In other words, anxiety seemed to induce the increase of academic self-efficacy to a point. After this point, self-efficacy seemed to decline based on increased anxiety and became more stable. Parallel to the main findings, Usher and Pajares (2009) also confirmed the curvilinear relationship between physiological states and mathematics self-efficacy beliefs of middle school students. Despite the differences between the participant groups, a fair amount of anxiety seemed beneficial for self-efficacy. Therefore, the positive association between teachers' anxiety and their self-efficacy for instructional strategies might be considered in this manner.

Second, Usta's (2015) findings indicated a different standpoint for this study. The research investigated school and student-level factors and their relations with high school students' self-efficacy in Turkey, Greece, and China-Shanghai based on PISA 2012 results. According to the findings, although mathematics anxiety was negatively related to mathematics self-efficacy in China-Shanghai and Greece, the relationship was positive for Turkey. This finding might be a cultural issue. In Usta's (2015) study, Turkish students may view themselves as capable of doing mathematics. Still, their anxiety levels were high, which is remarkably similar to the current study. In this study, Turkish mathematics teachers may consider themselves capable of employing instructional strategies in their classrooms, but they may also experience high anxiety. Succinctly stated, lack of self-efficacy for instructional strategies might not be deleterious for the experience of positive emotions and non-experience of negative emotions. However, more research is still needed to understand the cultural factor in the relationship between teachers' self-efficacy and academic emotions.

5.1.2. Student' Achievement Emotions and Affect-Related Variables

The hypothesized model revealed a non-significant relationship between mathematics teachers'' anxiety, anger, enjoyment, and seventh and eighth-grade students'' anxiety, anger, and enjoyment in mathematics. Emotional transmission is a newly emerging era in educational psychology. The studies mostly focused on the predictive role of teacher emotions on their students' emotions, but alas, the findings contradicted the common literature in this nascent field (e.g., Becker, Goetz, Morger, & Ranelluci, 2014; Frenzel, Becker-Kurz, Pekrun, Goetz, & Lüdtke, 2017; Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009). However, it should be noted that the number of studies was small and consistently increasing. Even so, several things might be considered while comparing the results with the findings of these studies. First, most studies employed experience sampling or an intraindividual approach to testing the emotional interaction between student and teacher groups. Through the experience sampling approach, the time in which participants were deeply at the moment could be easily grasped by recording the students'' and teachers'' momentary feelings in a given case. In other words, the experience sampling approach could provide an opportunity to explore more activity emotions while self-report measures retrospectively examined people's emotions.

Additionally, some of the studies also longitudinally examined the presumed interaction. For instance, in Frenzel et al.''s (2017) study, the reciprocal relationship between student and teacher emotions was analyzed by employing a three-wave longitudinal design. The findings revealed that teacher enjoyment was positively associated with student perceived teacher enthusiasm, which was also reflected in student mathematics enjoyment. Even though the researchers could not grasp participants' momentary feelings for a specific case as in the experimental sampling approach, the actual interaction would occur as the data were collected at more than one-time points. Therefore, the longitudinal design might increase the likelihood of the imbodying of activity emotions and outcome emotions.

Moving forward, the studies with cross-sectional designs focused more likely on one specific emotion. To illustrate this, Frenzel et al. (2009) examined whether teacher enjoyment is contagious by looking at the interrelation between teacher and student enjoyment in mathematics. In this study, only enjoyment as an academic emotion was regarded. In another study, Keller, Goetz, Becker, Morger, and Hensley (2014) focused on whether teacher enthusiasm is related to student enjoyment in four different secondary school domains. Again, one academic emotion was selected. The finding in this study might be due to the statistical limitations. As the number of outcome variables increases, the shared variance would be parsed out that the relationships among the variables might be easily obscured, or relatively stronger relationships may suppress the effects of lower ones. Thereby, the non-significant association between teacher and student emotions should be considered by thinking about the limitations of statistical analyses within the perspective of cross-sectional designs.

On the other hand, there was a significant relationship between students' perceptions toward teaching quality and their mathematics self-efficacy. A positive relationship was inspected between students'' perceived teacher affective support, their perceptions toward their teachers' using supportive presentation style, and their mathematics self-efficacy. In contrast, the relationship was negative for students' perceptions toward their teachers' using excessive lesson demands and their mathematics self-efficacy beliefs. Klieme, Pauli, and Reusser (2009) stated that providing a supportive climate was one of the instructional quality dimensions. Such classroom climates were assumed to include teacher caring, constructive feedback, displaying tolerance toward students'' learning errors, and ensuring positive student-teacher interactions (Brophy, 2000; Klieme et al., 2009). As regarded in this study, these aspects were related to teachers' affective support, and generally, the findings were supported by the literature. For example, in Sakiz, Pape, and Woolfolk-Hoy (2012) and Sakiz''s (2017) studies, positive relationships were found between perceived teacher affective support and their academic self-efficacy in middle school science and elementary school mathematics classes, respectively. As criticism of the social cognitive learning theory, the researchers examined the potential association between academic self-efficacy and psychosocial classroom factors in the form of teacher caring, teacher encouragement, interest, fairness, valuing, and respect, and holding high expectations for their students. These factors seemed to be closely related to sources of self-efficacy. Accordingly, teachers would be evaluated by middle school students as credible and expert people in their fields. While thinking about students' psychological development periods, they would unarguably view their teachers as role models in their lives. From this perspective, teachers'' manner would preserve a high value for students' judgments over their capabilities. Therefore, teacher recommendations, persuasions, listening, intimacy, and fairness may increase student academic self-efficacy. Besides, in this case, teachers also use social persuasions and promote students'' vicarious learning experiences by internalizing supportive behaviors and physically and verbally supporting their students. Consequently, students may adopt these behaviors in their lives and display a high sense of self-efficacy in their mathematics capabilities.

Besides, teaching quality was also examined by looking at some essential teaching characteristics such as understandability, illustration, enthusiasm, fostering attention, lack of clarity, difficulty, pace, and expectation level. The findings revealed that positive teaching characteristics seemed to increase students'' mathematics self-efficacy, while negative ones made a decline in their self-efficacy beliefs. Liu, Zhen, Ding, Liu, Wang, Jiang, and Xu (2018) found a similar finding in their study with elementary and middle school students. Accordingly, academic support made a positive contribution to students' academic self-efficacy in mathematics. Similarly, Sanchez-Rosas and Esquivel (2016) examined the potential relationship between college students' instructional teaching quality and self-efficacy beliefs. Organization, clarity, illustration/interaction, and the teaching rhythm appeared to increase student' self-efficacy beliefs. Indeed, this is also related to control-value theory because the structure and the delivery of the instruction in terms of teacher clarity, difficulty, pace, understandability, expectations, enthusiasm, illustration, enhancement of student attention may influence control appraisals (i.e., Becker et al. 2014; Goetz, Keller, Lüdtke, Nett & Lipnevich, 2019; Goetz, Lüdtke, Nett, Keller & Lipnevich, 2013). Based on the fluctuations in these characteristics, students' academic self-efficacy, which one of the control appraisals in Pekrun's (2006) control-value theory, would be influenced correspondingly.

According to this theory, student' self-efficacy was expected to influence their emotions in the relevant subject domain. In line with this assertion, a positive relationship was found between student' mathematics self-efficacy and enjoyment in mathematics, while the relationship was negative for anxiety and anger. The cited literature mostly supported the findings. Although the current research mainly focused on anxiety and its relationship with self-efficacy (e.g., Cooper & Robinson, 1991; McMillian, 2017; Nie, Lau, & Liau, 2011; Roick & Ringeisen, 2017; Spaniol, 2017; Yıldırım, 2011), several studies also examined the given association by including distinct emotions.

Pekrun, Goetz, Frenzel, Barchfeld, and Perry (2011), and Pekrun, Goetz, Perry, Kramer, Hochstadt, and Molfenter (2011) explored the predictive role of academic self-efficacy in college-level students' joy, hope, pride, relief, anger, shame, hopelessness, boredom, and anxiety. The findings confirmed the presumed hypothesis that academic self-efficacy positively predicted positive emotions, while the results were negative for negative emotions. Çalık (2014) also investigated the relationship among middle school students' achievement emotions, self-efficacy, and learning strategy in mathematics based on the control-value theory framework. The findings indicated positive associations between middle school students' mathematics self-efficacy, enjoyment, and pride. In contrast, the relationship was negative for anger, anxiety, shame, boredom, hopelessness, and mathematics self-efficacy. Likewise, Luo, Ng, Lee, and Aye (2016) explored the relation of eighth-grade students'' self-efficacy, enjoyment, pride, boredom, and anxiety in mathematics. Self-efficacy was denoted as a control-appraisal for mathematics emotions. The results corroborated the assumption that self-efficacy positively predicted enjoyment and pride while negatively predicting boredom and mathematics anxiety.

Zhen, Liu, Dig, Wang, Liu, and Xu (2017) also inquired on the interrelation between competence, autonomy, relatedness, satisfaction, academic self-efficacy, positive and negative academic emotions, learning, and engagement in middle school mathematics, Chinese and English classes. Although the adopted variables were different from previous studies, the findings were not surprising that academic self-efficacy was a positive predictor of students' enjoyment and pride and a negative predictor of their anger, anxiety, and boredom in mathematics, English, and Chinese classes. As in this study, authors might have built their research on more than one theoretical framework to test their assumptions. For instance, Heckel and Ringeisen (2019) utilized both control-value and social cognitive learning theory to explain the potential relationship between college students' control and value appraisals and their academic emotions. The findings were in line with many of the research. Accordingly, self-efficacy and pride were positively related, whereas the relationship was negative for anxiety.

Even though the presumed relationships were confirmed by many studies that adopted different but relatively similar theoretical frameworks, most of the research mostly examined one-directional relationships. Control-value theory postulated the role of self-efficacy on the formation of academic emotions; however, bi-directional relationships might be taken into account regarding this model's dynamic nature. Besides, Mills et al. (2005) also posited that anxiety could be a source and an outcome for self-efficacy beliefs. Why not this assumption is valid as well for the other achievement emotions? Along with this assertion, Villavicencio and Bernardo (2013) explored the extent to which students' anger, anxiety, hopelessness, and shame moderate the relationship between their self-efficacy and academic performance in a trigonometry course. The results pointed out the moderator role of academic emotions in the relationship between academic self-efficacy and students' academic performances in trigonometry. Namely, the decrease in self-efficacy was related to lower student achievement with the experience of negative emotions. On the other hand, any increase in self-efficacy was related to higher achievement by experiencing less anger, anxiety, shame, and hopelessness.

Contrary to these findings, a few studies also found a non-significant or reverse relationship between self-efficacy and academic emotions. In Artino, La Rochelle, and Dunning's (2010) longitudinal study, the authors sought the relationship between medical students' motivational beliefs, achievement emotions, and academic achievement. Although there was a negative relationship between self-efficacy and anxiety, no significant association was inspected for enjoyment and boredom. This result might stem from the suppressing effects of some emotions on others due to the decline of shared variance resulting from increased emotions. For instance, Villavicencio and Bernardo (2016) found a positive relationship between enjoyment, pride, and self-efficacy for trigonometry learning after controlling anxiety effects. Suffice to say that the prevalence of some emotions may obscure other' effects in an association research.

Interestingly, Usta (2015) found a positive relationship between mathematics self-efficacy and mathematics anxiety in her multilevel study comparing the relationship between school and student-level factors in Turkey, Greece, and China-Shangai. Through using PISA 2012 data, the author confirmed the presumed relationships for the examined constructs except for Turkey. In Turkey, students with high self-efficacy in mathematics appeared to experience a high level of anxiety. This finding might be related to the curvilinear relationship between anxiety (Usher & Pajares, 2006a, 2006b, 2009). Besides, this finding could be a result of a cultural issue. Therefore, the research should not be restricted within the boundaries of one culture, and cross-cultural comparisons should be made to figure out and frankly talk about the universality of such relationships.

The observed relationships between teaching quality and achievement emotions in mathematics should be scrutinized by addressing the direct and indirect effects of perceived teaching quality and perceived teacher affective support. According to the findings, teachers' characteristics of using supportive presentation style (i.e., understandability, illustration, enthusiasm, fostering attention) induced enjoyment in mathematics and decreased anger and anxiety in mathematics. On the other hand, teachers' excessive lesson demands (i.e., lack of clarity, difficulty, pace, and level of expectation) tended to increase students' anxiety and anger in mathematics while yielding a decrease in mathematics enjoyment. According to the control-value theory model, teaching quality might be categorized in cognitive and motivational instruction quality as the individual and environmental determinants of emotions. Accordingly, understandability, using illustrations, displaying high enthusiasm, and keeping students' attention at a high level during the teaching process would more likely increase students' competency and capability beliefs. This connection would trigger their positive emotions and dampen the effects of negative ones. However, unclear instruction, lack of optimal level of difficulty and pace in classes, and extremely high expectations regardless of students' current levels may diminish students' capability judgments. This connection might result in more negative and less positive emotions in the relevant subject domain. According to the control-value theory, self-efficacy is a control appraisal that may intervene in the effects of teaching quality. That might also explain the potential reasons for the indirect effects of supportive presentation style and excessive lesson demands on mathematics achievement emotions through mathematics self-efficacy.

Supportive presentation style and excessive lesson demands dimensions also directly affected students' achievement emotions in mathematics. This finding is also reasonable considering the dynamic nature of the control-value theory. Therefore, the direct effects of teaching quality elements on students' mathematics emotions would not be so surprising. These findings were also supported by many of the literature (e.g., Bieg, Goetz, Sticca, Brunner, Becker, Morger, & Hubbard, 2017; Goetz et al., 2013, 2019; Kunter, Klusmann, Baumert, Richter, Voss, & Hachfeld, 2013; Lazarides & Buchholzb, 2019). In Bieg et al. (2017), Goetz et al.'s (2013) and (2019) studies, the experience sampling approach was employed to obtain momentary experiences of students while examining the abovementioned relationships, so state emotions based on teaching characteristics would be more accurately evaluated. For instance, Bieg et al. (2017) examined the potential impact of teaching methods on high school students' enjoyment, pride, anger, anxiety, and boredom in mathematics. Compared to direct instruction, which resulted in less enjoyment and greater boredom, working individually, in small groups or pairs revealed more enjoyment and pride. Yet, no difference was accounted for anxiety levels of students across these teaching methods. Goetz et al. (2013) and (2019) also explored the relationship between teaching characteristics and students' achievement emotions in mathematics, physics, German, English, and French. Teachers' using a supportive presentation style was positively related to students' pleasant emotions and negatively associated with their unpleasant emotions. Besides, teachers' excessive lesson demands were negatively related to students' pleasant emotions and positively associated with their unpleasant emotions. These findings both corresponded to the results of this study.

This study's unexpected finding was the no significant relationship between perceived teacher affective support and students' enjoyment and anxiety in mathematics. On the other hand, a significant negative relationship was identified between mathematics anger and perceived teacher affective support. However, Sakiz (2012) and Sakiz et al. (2012) found meaningful and positive relationships between perceived teacher affective support and academic enjoyment. A negative association was noted between perceived teacher affective support and academic hopelessness in college middle school students. Likewise, Sakiz (2017) found a significant and positive relationship between perceived teacher affective support and academic enjoyment in science. In contrast, the relationship was negative for academic anxiety and hopelessness in science for the fourth and fifth-grade students.

Although the perceived teacher affective support's direct effects seemed to contradict the current literature, the indirect effects should also be considered. Accordingly, mathematics self-efficacy appeared to mediate the relationships between students' perceived teacher affective support and their achievement emotions in mathematics.

These findings became noteworthy regarding control-value theory, social cognitive learning theory, and self-determination theory.

Thinking back on Linnenbrink-Garcia, Patall, and Pekrun's (2016) suggestions toward the instructional principles to promote students' motivation and emotions, the authors recommended teachers to provide competency and autonomy support, sense of relatedness for their students by displaying enthusiasm, friendliness, caring, attention, and sincerity. Besides, teachers might provide challenges optimally and more smartly and give positive and constructive feedback. These all would contribute to students' mastery feelings as they would get an idea that they can do mathematics. They had the opportunity to control their learning, so their self-efficacy for self-regulated learning in mathematics would increase accordingly. If students experience high mathematics self-efficacy, their emotions in this subject domain would be more positive and less negative, correspondingly.

5.1.3. Students' Achievement Emotions and Emotion Formation Process

In this study, how students' mathematics emotions are shaped through the learning process, and teacher-student interaction were also examined through teacher interviews. Based on the interviews, results indicated that 7th and 8th-grade students seemed to experience numerous positive and negative emotions. Teachers' description of their students' feeling states in mathematics confirmed the assumption that students experience many distinct emotions during their learning process. As discussed beforehand, emotions were classified regarding their valence, activation, and object focus dimensions. In this regard, they could be positive or negative when the valence dimension was considered. As in this study, several positive and negative emotions were portrayed by students in mathematics learning and teaching process.
According to Weiner (2010), people try to determine the potential determinants of their and 'others' behaviors. While trying to understand these determinants, they tend to make attributions to identify the possible causes. These attributions are done based on stability, locus, and perceived controllability dimensions. In this study, the outcomes,

emotions, in this case, would more likely be interpreted from the teachers' lens. To illustrate this, students may experience anxiety after exams if they attribute their failure to a lack of effort as an internal, unstable, and controllable factor. They may attribute their enjoyment during mathematics classes to the difficulty level as external, stable, and uncontrollable. Therefore, students' reasoning over the possible causes of their outcomes may lead them to experience distinct emotions, and these causes preserve the most crucial part of their emotion formation process. In other words, the potential sources of emotions in mathematics would be critical for student progress in mathematics and the quality of interactions with their teachers.

From this perspective, the sources of positive emotions were portrayed as related to some teacher and student-related factors. Among teacher-related factors, teachers' instructional and supportive practices were proclaimed to be the primary factors for positive student emotions, confirmed by the quantitative findings. Accordingly, teachers' understandability, enthusiasm, using illustrations, and fostering their students' attention or lack of clarity, too much difficulty and pace on their instructions, and setting a very high level of expectations were pointed out to be directly related to students' mathematics achievement emotions. As a result of the interview findings, on the other hand, students generally enjoy if they actively take part in the learning process and build their mathematics knowledge. As a supportive argument, Paoloni (2014) pointed out the role of designing cooperative learning environments to increase student autonomy and curiosity levels, which might be substantially effective for arousing pleasant emotions. Herein, the mathematics curriculum and instruction design have the utmost importance for students' motivation and emotions (Schukajlow, Rokoczy, & Pekrun, 2017).

As well as teaching quality and instructional design, teachers' attitude and manner during the teaching process would be determinative of students' emotions. Despite the non-significant findings on the relationship between teachers' affect supportive behaviors and students' enjoyment in mathematics, the qualitative findings indicated the role of teachers' supportive practices as the potential sources of positive emotions. Accordingly, using humor during instruction, teachers' friendliness, and sincerity to their students' problems would effectively maintain a positive classroom atmosphere. Similarly, Yan, Evans, and Harvey's (2011) study confirmed these findings. The authors explored the emotional content of teacher-student interactions via observations of elementary school classrooms. According to the results, the authors indicated that teachers had positive classroom environments by focusing on their relationships with their students, such as getting to know their students, using humor, and positive language. In addition to this, teachers established clear classroom rules by providing consistency, supporting decision-making, and praising. They cared for fairness and showed respect for their students to foster classroom harmony. Lastly, teachers seemed to be mindful of their students' emotions and were conducive to possessing relevant knowledge and skills to coach them.

On the other hand, student-related factors seemed to advocate teacher-related factors. Based on the interviews with teachers, it was found that students' pre-requisite knowledge in mathematics, ability to understand mathematics topics, their perceptions of math topics as easy or well-known, and their love of mathematics teachers were related to teachers' instruction styles. Students experience more positive and less negative emotions in classrooms where the instruction was understandable, clear, optimally challenging, and fast, and when the teachers were enthusiastic.

In addition to describing student-related factors, students'' sense of accomplishment was contended to be one reason for positive emotions regarding the qualitative findings. Students feel competent when they accomplish a given task, so one of the psychological needs would be fulfilled. Students would be intrinsically motivated, as indicated in self-determination theory (Ryan & Deci, 2000). They will gain mastery experiences if they succeed, and their self-efficacy would increase as well. On the other hand, students' comparison and competition feelings were also described as a reason for positive emotions. However, such comparisons should not be considered in an aversive manner. By contrast, this might also feed one of the self-efficacy sources of students. In this case, students may identify their role models, which may enrich their vicarious learning experiences during the mathematics learning process. Therefore, these mechanisms would add students' capability judgments, and students' self-efficacy would increase accordingly. That would not be so surprising to make interpretations of self-efficacy as the sources of positive emotions for the qualitative findings while thinking about quantitative results.

On the other hand, several parent-related, student-related, classroom and instruction-related, and assessment-related factors were revealed as the common sources of students'' negative emotions in mathematics. Students may experience various negative emotions for the former category if their parents display a strict manner for their children's mathematics grades, hold differential expectations for students' mathematics learning, and compare their children with others. All of these factors are somewhat related to each other. Considering the education system in Turkey, testing has become a reality almost at each level of education. Specifically, middle school students strive to get high points and moving on top of high schools. Such schools require serious selection and placement processes. Among the presence of national examinations, mathematics was given comparably greater attention than other subject domains. According to many national and international examinations, students fall behind in mathematics compared to other subject domains (e.g., OECD, 2013, 2016, 2019). That might be related to students' difficulties due to the abstract nature of mathematics. Therefore, parents may possess false beliefs or place a high priority on mathematics compared to other disciplines. They may think that students would not be successful if they cannot receive higher grades in mathematics. Such beliefs may create a kind of pressure on their children, so children may often appreciate their parents, which may negatively influence their motivation and emotions in mathematics.

Along with the parent-related factors, students' negative emotions were also based on assessment-related factors. As discussed beforehand, testing is a reality in the Turkish educational system. However, the assessment system in Turkey had a changing nature. Students took a national exam twice a year in the Transition from Primary to Secondary Education System (TEOG). In addition to these national examination scores, students' middle school grade point averages were used to build their final scores, and the students were selected based on these final scores. In 2018, the TEOG system was abolished, and a new system, "Transition to High School," or called LGS, was brought to select students to top high schools. According to this system, 8th-grade students would take this exam in six main courses, including mathematics. For the selection process, 20% of the grade point average for the 6th and 7th-grades and 60% of the grade point average for the 8th grade would be computed. The computed scores are added to LGS scores. According to their final scores, students would be selected to the schools that they have listed. However, this exam is only valid for a limited number of schools. If students do not want to take this examination, they would be placed in the schools closest to their residence in line with their preferences (Kuzu, Kuzu, & Gelbal, 2019; MoNE, 2018). The system's changing nature and some problems and uncertainties of the new system create tension among students, teachers, and parents. Based on the teacher interviews, the mismatch of the questions in the mathematics curriculum and LGS was portrayed as one reason for students' negative emotions. Indeed, the new generation questions in LGS were criticized by teachers due to not being consistent with the problems in textbooks. Güler, Aslan, and Çelik (2019) also raised this critique. In their study with middle school mathematics teachers, the authors tried to understand teachers' thoughts about LGS. According to the results, most mathematics teachers described LGS as a challenging exam; LGS questions are long, peculiar, and hard to understand. Some of the teachers also mentioned the inconsistency between the questions and the mathematics curriculum objectives. LGS questions were classified as higher-order thinking level questions, while the mathematics curriculum questions were mostly in lower-order thinking. Such problems and uncertainties would negatively influence students' affect and motivation in mathematics. Like this study, Demir and Yılmaz (2018) worked on revealing the pros and cons of Transition to the High School System from parents' perspectives. In this study, parents criticized the new high school placement system due to schools' classification into qualified and non-qualified and the limited number of allocated quotas to enter such eligible schools. This process might result in an extreme increase in competition among students, leading them to experience high anxiety and stress. Besides, registration based on the residence was also criticized because students would have been obliged to register to the closest school to their home if they cannot be selected for these qualified schools.

Parallel to the assessment-related factors, students' negative emotions arose due to curriculum and instruction-related factors, such as the increasing difficulty level of mathematics topics, the difficult nature of 7th-grade mathematics curriculum, and direct instruction while teaching mathematics. In the literature, the nature of this discipline was stated to be a reason for mathematics anxiety (e.g., Byrd, 1982). In this regard, mathematics discipline has its language, full of abstractions, so the design and the presentation of mathematics subjects would matter for students. Considering the mathematics curriculum's spiral nature, the difficulty and intensity increase as the grade level increases. Such an increase in the complexity may challenge students to experience negative affect toward mathematics. Besides, implementing the mathematics lessons regarding utilized methods and strategies will influence students' emotions in mathematics. As discussed on the sources of positive emotions, providing active learning environments leads to positive emotions, so the experience of boredom as a negative emotion would be unavoidable under the influence of more traditional methods like direct instruction. It was also reported that the employed methods and strategies during mathematics teaching might cause anxiety and fear in mathematics (e.g., Bekdemir, Işık & Çıkılı, 2004; Frank, 1990; Jackson & Leffingwell, 1999). In line with the control-value theory framework (Pekrun, 2006) , the cognitive quality of instruction directly or indirectly influences students' achievement emotions in the relevant subject domain. Therefore, students would more likely experience anxiety, boredom, and frustration in mathematics classes in which the lessons are held at relatively imperfect classrooms regarding teaching quality.

Student-related factors were also mentioned to have a considerable impact on negative emotions compared to other factors. These might be explained by the control-value theory and its corollaries and assumptions. According to the interview findings, students experienced negative emotions in mathematics because of their lower level of mathematics self-efficacy and self-confidence, unwillingness to persist, and bias against mathematics. These findings are related to students' perceived control beliefs. Perceived or subjective control was defined as how well students work toward attaining the desired outcomes and keep themselves from the undesired ones (Pekrun, 2006). From this perspective, self-efficacy and self-confidence under the subjective control category are antecedents of achievement emotions in control-value theory. Consistent with the quantitative findings, lack of self-efficacy in mathematics would result in negative achievement emotions in mathematics. This finding seemed to be valid for self-confidence too. Besides, students' willingness to persist on a given task is closely related to their self-efficacy levels. Namely, if students have a higher self-efficacy level to accomplish a designated task, they will be more eager to work on this task. However, if they have a lower self-efficacy level, they will more easily give up on doing the task (Bandura, 1997). In this regard, students with a lower self-efficacy level will also have a lower desire to cope with the challenges. That might result in negative feeling states. On the other hand, students'' possible biases may create false beliefs on their mathematics capabilities. Thus, they may underestimate their competency and mathematics skills.

Students' negative emotions in mathematics also stem from the value they attribute to mathematics. According to the control-value theory, students may participate in an activity as they enjoy regardless of any needs or long-term goals, which refer to the intrinsic value. On the other hand, students may put effort into a task as the task will be beneficial for themselves, or gain something at the end of its accomplishment, described as external value. As revealed from the interviews, students' disinterest toward mathematics and questioning its utility could be related to their ascribed value to this subject domain. If students cannot attribute either internal or external value to the relevant subject domain, their emotions would change accordingly in a negative direction.

As the control-value theory framework is a dynamic model through the feedback loops, the model's back and forth functioning may alter the role of consequences and antecedents. Namely, learning strategies and self-regulation of learning are influenced by people's emotions; however, their learning strategy and self-regulated learning might also affect their subsequent emotions via feedback mechanisms. According to the qualitative findings, study skills and students' adaptation problems to their teachers' teaching styles were related to how well they utilize learning strategies. As described in the literature, positive emotions foster flexible learning strategies, whereas negative emotions trigger more superficial learning strategies, such as simple rehearsal or memorization of the facts (Pekrun, 2006; Pekrun & Linnenbrink-Garcia, 2012). Bearing the model's dynamic functioning in mind, students who had problems using effective learning strategies would undisputedly reflect negative feelings in mathematics.

Students' inability to understand abstract concepts, and their intelligence was also revealed from the interviews as the reasons for negative emotions. Not surprisingly, these findings had a place in the control-value model. According to the model, intelligence, genes, and temperament seemed to affect both emotions and learning-related outcomes (please see Pekrun, 2006, p.328). Notwithstanding, the role of intelligence in negative emotions should be considered more carefully under the progress of the implicit theory of intelligence. Students' judgments on their abilities to do mathematics might be related to their inability to develop their mathematics capabilities through their efforts and strategies. This judgment is called in the literature a fixed-mindset (Dweck, 2016). The findings were articulated from the teachers' lens, so it was impossible to delve into students' mindsets to elaborate on this issue more. Therefore, echoing the word "intelligence" as a reason for students' negative emotions might be deficient and faulty. From this perspective, it should be approached more cautiously.

According to the interviews, students' puberty period problems were also given as one reason for negative emotions in mathematics. This finding sounds reasonable not only for the mathematics domain of study but also in different subject areas. Considering Erikson's psychosocial development stages, students may experience the conflict of identity versus role confusion regarding their ages in this period. They generally ask the question of "Who am I?" during the transition to adulthood. Thus, they will search for their identity to build themselves (Woolfolk, 2017). The puberty period generally corresponds to the latest middle school years, and students experience such identity crises. Such crises would also have an impact on their psychology and motivation for learning. They also face various emotional challenges, and their attention could easily be distracted during this period. Therefore, the arousal of negative emotions in mathematics seemed quite understandable for students in the puberty period.

Last, students' negative mathematics emotions are also related to their fear of failure, their previous experiences with mathematics teachers, and their lack of study. These factors sound reasonable as well because students with unfortunate learning experiences would more easily develop learned helplessness. In line with social cognitive learning theory (Bandura, 1997), enactive experiences of people may feed their self-efficacy beliefs; however, their beliefs might suffer under the experience of failure (Çapa-Aydın, Uzuntiryaki-Kondakçı, Temli & Tarkın, 2013). Based on the well-known association between self-efficacy and its sources and the relationship between self-efficacy and emotions regarding the quantitative findings, talking about the possibility of experiencing negative emotions resulting from fear of failure and students' unfortunate experiences with mathematics teachers seemed considerable.

According to the interview results, students' emotions triggered both physical symptoms and behavioral effects on students. Pekrun et al. (2011) identified emotions as psychological processes, including physiological components within. In addition to this, people express their feelings through facial, vocal, and visceral ways (Feldman Barrett, 2012). Some of these ways were claimed to be universal, as demonstrated in Ekman and Izard's studies (Matsumoto, Keltner, Shiota, O'Sullivan & Frank, 2008). Therefore, students' smiling, sweating, shaking, or crying were natural outcomes under the arousal of positive and negative emotions in mathematics.

Other than the physical symptoms, students also displayed behavioral outcomes concerning positive or negative emotions in mathematics. According to the social cognitive learning theory (Bandura, 1997), students may be more motivated and feel more positive emotions based on their enactive learning experiences. They would most probably reflect their feelings to their behaviors, such as increasing engagement level and sharing their feelings with their teachers. The absence of such experiences may also reflect on their behaviors too. However, this time students may give up studying or display a variety of off-task behaviors. They may try to suppress their feelings states not to show their negative feelings in a passive-aggressive manner. Differently, some students seemed to be more problem-oriented and look for potential solutions to their problems, such as help-seeking and studying more. The influence of each emotion on people's behaviors might be different for each human being.

Given that anxiety has a curvilinear relationship with individuals' performances, the reflection of different emotions might result in differential outcomes. Different mechanisms on the brain may function to deal with the problems and the negative feeling states. Besides, students may employ different strategies to cope with the challenges and remove these emotions. As a result, the used strategies become more critical when reconsidering the model and the interview findings.

In emotional research, the complicated nature of the emotions and their influence on people's behaviors might necessitate teachers to use some strategies to preserve their students' well-being, mental health, and academic success (Lee, Pekrun, Taxer, Schutz, Vogl & Xie, 2016). In Pekrun's (2006) control-value theory, emotion-regulation was presented in different forms. According to interview findings, teachers seemed to have been using situation-oriented and competency-oriented regulation strategies. They have modified the learning environments and learning tasks (situation-oriented regulation) and changes regarding students' success and failure states (competency-oriented regulation). Furthermore, employed emotion regulation strategies seemed to be closely related to the sources of emotions. Accordingly, teachers mentioned having been using student-centered practices, utilizing peer support and peer modeling. These would increase students' enactive and vicarious learning experiences as two of the primary sources of self-efficacy. Such practices were also reported to be the sources of students' positive emotions in the control-value theory. As any increase in efficacy sources would positively influence students' self-efficacy judgments, which contributes to more positive emotions. The inclusion of activities, games, and drills in mathematics instruction was also specified as one of the instructional practices to regulate students' emotions. Since activities and games were referred to as one reason for positive emotions in mathematics, adapting to the instructional designs by adding such teaching components would be more feasible.

Additionally, adjusting the lessons' difficulty level to students' mathematics levels and teaching from basic to advanced level was also supported by quantitative findings. The difficulty, understandability, illustration, and pace of the lesson were reported to be significantly related to students' emotions in mathematics. This might be linked to providing optimal classroom challenges because students might easily get bored in math classes with no challenge or might be highly anxious in extremely challenging classrooms. Therefore, teachers should know their students' mathematics background to make adjustments well in their classes. In addition to this, teachers mentioned having allocated extra time for teaching or re-explain the topic and have provided continuous feedback to their students. These are also related to fostering students' competence in mathematics learning. The connection of mathematics with other disciplines and real-life might be an endeavor to increase mathematics's utility value due to students' questioning its usefulness as sources of negative emotions. From this perspective, Schweinle, Meyer, and Turner (2016) pointed out these elements' roles. Accordingly, providing constructive feedback, the optimal level of challenge, emphasizing task importance, and supporting positive affect and social relationships with peers were contended to have individual and multiplicative impacts on motivation and affect in mathematics. Moreover, teachers employed different assessment types, utilized supplementary sources, and used technology to promote positive emotions and decrease negative ones. These strategies were also linked to fostering teaching quality in drawing students' attention, increasing the clarity of mathematics lessons, and providing more vivid and concrete illustrations for in-depth understanding.

Teachers also expressed their affective support strategies, such as encouraging students' engagement and persistence, giving students more responsibilities, and making students experience success. These practices attempt to increase students' enactive learning experiences to increase their self-efficacy beliefs. That would add students' perceived control beliefs, which may yield positive emotions. Besides, students would also experience autonomy by taking more responsibilities. As an environmental determinant, autonomy support might change students' emotions through changing their control and value beliefs that would affect emotions accordingly, as depicted in Pekrun's (2006) model. On the other hand, given that fear of failure was a source of negative emotions, making students experience success would help students remove such feelings from their minds.

Teacher interviews also revealed that teachers have been employing several affective support strategies to regulate their students' emotions. For instance, teachers emphasize effectively using their verbal and body language, calming students, and talking with them individually if necessary. Teachers do not display an offensive manner toward their students. These behaviors might be conceptualized as teachers' affective support strategies. As Sakiz (2012) (2017) and Sakiz et al. (2012) found significant and positive relationships between perceived teacher affective support and students' positive emotions, and negative relationships for negative emotions, teachers' actions to preserve students' positive emotions toward mathematics were reasonably practicable. Although the quantitative findings resulted in non-significant results for the direct effects of perceived teacher affective support on students' mathematics emotions, the indirect effects of students' mathematics self-efficacy beliefs cannot be neglected. The qualitative results also support those.

Overall, when thinking Linnenbrink-Garcia and her colleagues' (2016) suggestions to foster motivation and emotions of students, teachers' attempts to regulate their students' emotions corresponded to given principles of providing competency and autonomy support, displaying caring, attention, and sincerity, ensuring an optimal level of challenge and constructive feedback. In this regard, mathematics teachers have been employing instructive and affect supportive practices to prevent students from experiencing negative mathematics emotions.

5.2. Implications for Education, Theory, and Research

This study unveiled the relationship between mathematics teachers' academic emotions, self-efficacy beliefs, and sense of burnout, and the relationship between students' mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and their mathematics teachers' academic emotions and students' achievement emotions in mathematics. Along with the disclosed relationships, the reasons behind the achievement emotions were uncovered by considering the teaching-learning process and student and teacher interactions.

Many motivational processes co-occur in theory. However, the interrelation of several motivational constructs (e.g., self-efficacy and emotions) has not been studied by adding different informants in practice (i.e., students, teachers) (Anderman & Klassen, 2016). This perspective may bring such isolation to the field that may suppress the merging of theory and developing advanced methodologies. Therefore, using multilevel models in this study paved the way for describing how emotion transmission occurs between teacher and student groups. Participants' selection for follow-up interviews to carefully explore how students' emotions in mathematics arise and how those emotions are managed during the teaching and learning process enlightened a nascent and murky field in motivation and education research. In other words, the study findings supported Neville's (2013) assertion on the integrated role of cognition and emotions for the well-functioning mechanism of human beings. Therefore, there is a need for more emotion research in education to clarify the jingle and jangle fallacy in emotion research and enhance mathematics teaching and learning motivation.

First, teachers' awareness of burnout and their self-efficacy for classroom management, instructional strategies, and student engagement could be enhanced through in-service professional development activities, such as academic workshops, seminars, and conferences. These activities could allow in-service teachers to develop their professional capabilities in using effective classroom management and instructional strategies in their classes and effective communication skills that are substantially important while talking with students and parents. In this regard, faculty-school cooperation is necessary for organizations of these activities led by experts in the field. Furthermore, the sustainability of such activities across academic semesters is also critical for following the recent developments in this era. Second, social platforms could be developed to share their experiences and strategies to solve emerging problems. In such venues, teachers would have the opportunity to receive feedback, follow the offered strategies to cope with the issues and feel connected to their profession by sharing their accomplishment stories. That might be essential to remedy burnout signs and develop their sense of belongingness to their jobs and professional communities.

Pre-service teacher education programs might place more emphasis on teacher burnout. Practicum and classroom management courses in teacher education programs could be organized to provide vivid practices for pre-service teachers to prevent teacher candidates from experiencing “reality shock” when they start their careers. For this purpose, there is a need for building strong and sustainable cooperation between schools and education faculties, which, in return, would ensure the transfer of the theory into practice.

Several things should also be considered by teachers, parents, and policymakers for students’ academic success and psychological well-being. Regarding quantitative and qualitative findings, the design of learning environments, teaching quality, and employed instruction methods in mathematics classrooms gain the utmost importance over students’ mathematics self-efficacy and emotions. Therefore, teachers should pay attention to their cognitive and motivational quality of instruction proposed by control-value theory (Pekrun, 2006; Pekrun, 2018). Unless the classroom instruction meets students’ needs, mathematics self-efficacy, and mathematics emotions would be affected negatively. From this perspective, student-centered teaching practices might be utilized in mathematics classes. Students might be given more autonomy support to take their responsibility for learning by setting their goals and identifying their strengths and weaknesses in active learning settings. That would also increase students’ perceived control and self-regulated learning practices (Pekrun, 2018).

Students might also be provided with learning opportunities to make connections with real life. Namely, students could figure out where they would apply the mathematics knowledge and their skills and how they would use it in real life. Besides, teachers should provide clear, direct, and constructive feedback and optimal challenges in their classes (Artino, 2012; Paoloni, 2014; Scweinle, Meyer, & Turner, 2006). Students’ self-efficacy would decrease under harsh and deconstructive feedback and extremely challenging classes. Also, the lack of challenge, discussion, and thought-provoking questions in a classroom environment may lead students to experience boredom and give up studying further. In this regard, teachers may use social or peer modeling to take students' attention and interests toward mathematics. As Bandura (1998) set forth the substantial role of supportive relationships on people's self-efficacy, benefiting from peer modeling during mathematics teaching might provide vicarious learning experiences for students to observe how to manage and cope with learning problems. That would contribute to students' competency. Teaching something could be considered a decent way to evaluate one's mastery. The student who is tutoring their peers would also benefit from this experience by displaying their competence. In addition to this, students would be more likely to experience being valued and supported, contributing to feelings of connectedness or belongingness to their classes (Paoloni, 2014). Therefore, students'' enthusiasm, satisfaction, and emotions would be influenced accordingly. To improve their pedagogical and instructional skills, teachers may follow the recent developments in this era by participating in academic workshops, online training, and conferences. In-service professional development activities might emphasize how to provide feedback, improve questioning skills, incorporate student-centered practices, facilitate students' active participation in class, and effectively use instructional technologies in mathematics teaching.

Teachers'' pedagogical skills should also be touched upon by teachers as practitioners and researchers as theory-builders in the shade of well-known debate toward whether pedagogy is an art or science of teaching. Along with the findings, there is a considerable need to design learning environments regarding cognitive and motivational quality, so teachers' affective support might be re-configured. Teachers'' affective support would substantially contribute to building emotionally sound learning environments, as Sakız (2012) indicated. For this purpose, teacher training should address improving teachers' affective skills in enhancing their emotional awareness, coping, and managing their own and students' emotions. Herein, teacher education programs require much more attention than in-service professional development activities.

Given that teacher education programs do not adequately cover emotions and emotion-regulation, pre-service teachers are more likely to graduate with a lack of understanding of this controversial and hot topic. Therefore, making predictions on teachers' inability to coach their students' emotions would not be difficult. In this regard, the courses in teacher education programs might be tailored to cover these issues. Some elective courses might be offered to increase pre-service teachers' awareness of their own and student emotions.

The qualitative findings also portrayed parents' critical status on student emotions, so there should be collaborative work between teachers and parents to decrease students' negative emotions and increase the positive ones as much as possible. From this perspective, school counselors play a mediator role in effective interaction between parents, teachers, and students. For instance, a seminar series regarding positive and negative mathematics emotions and strategical tips to overcome negative ones might be carried out by school counselors for students, teachers, and parents.

Last, students' negative emotions seemed to arise due to the new high school assessment system. A comprehensible needs assessment study could be done toward this new placement system to explore the alignment between the mathematics curriculum and the types of questions asked in the standardized examination. That would delineate malfunctioning elements of the assessment system and the possible ways to improve it.

5.3. Recommendations and Future Directions

The purpose of the study aimed to explore the relationship between mathematics teachers' academic emotions, self-efficacy, and sense of burnout. Second, the study considered the relationship between mathematics teachers' academic emotions and their 7^{th} or 8^{th}-grade students' mathematics self-efficacy, perceived teaching quality, perceived teacher affective support, and achievement emotions in mathematics. According to the quantitative findings, the study also intended to tease out the possible reasons and the processes behind students' achievement emotions in mathematics. Based on the research purposes, theoretical and methodological limitations, several recommendations were brought for further research.

First, the quantitative part focused on the relationship between teacher and student-related variables, so cause and effect inferences cannot be exerted between these variables. Experimental designs, including effective interventions and manipulations, could be adopted for further studies to test the causality or causal relationships. Besides, the cross-sectional nature of data provides a snapshot of teachers' and students' academic emotions and their relations with other psychological constructs. However, setting time lags between the measures would provide better estimates, especially for dynamic models. This issue indicates the essential role of longitudinal research to address the gap for future studies.

Second, this study primarily investigated anxiety, anger, and enjoyment. However, both student and teacher groups might experience many other distinct emotions so that future research might enclose such emotions. For this purpose, the current measures should be checked first. For instance, there are only three emotion dimensions (i.e., anxiety, anger, enjoyment) in the Teacher Emotions Scale. This measure might be revised, or new measures could be constructed to assess teacher emotions. The original version of the Achievement Emotions Questionnaire (AEQ; Pekrun et al., 2011), including nine distinct emotions, might be utilized in future studies.

Third, this study attempted to include self-report measures and face-to-face interviews to assess students' emotions in mathematics and triangulate the findings within the body of mixed-methods research. However, those methods were based on students'' and teachers' retrospective thinking that may not address students'' and teachers'' momentary expressions. The experience sampling approach might be utilized to measure students'' and teachers'' momentary feelings in a given case by recording and analyzing their responses to remove this limitation. Besides, further studies might incorporate classroom observations, interviews with students and parents, peripheral and physiological measures, and observations of nonverbal behavior and prosodic behavior of nonverbal speech as some of the multi-method approaches in measuring emotions (Frenzel & Stephens, 2013; Goetz, Zirngibl, Pekrun & Hall, 2003; Pekrun, 2006, 2009).

Fourth, the study could be extended to all middle school levels. Namely, fifth and sixth-grade students and their mathematics teachers could also be included to generalize the findings to middle school levels. Elementary, high school, and college-level students' emotions and their relationship with self-efficacy, perceived teaching quality, perceived teacher affective support deserve to be examined for future research. Similarly, teachers'' or instructors'' emotions in these levels require substantial attention, considering the link between academic emotions, self-efficacy, and sense of burnout. The current research questions might also be studied in different subject domains. The existing literature supports the idea of the domain-specific nature of academic emotions (e.g., Frenzel, Thrash, Pekrun & Goetz, 2007; Goetz, Frenzel, Pekrun & Hall, 2006; Goetz, Frenzel, Pekrun, Hall & Lüdtke, 2007; Goetz, Pekrun, Hall & Haag, 2006). Therefore, exploring the proposed relationships with different courses might provide an opportunity to check the assumptions over the domain-specific nature of the control-value theory.

Fifth, the study was restricted to the selected districts in Istanbul, so the findings could only be generalized to these districts. That is a kind of limitation for ecological generalizability, which might be overcome by adding different cities to be examined in future studies. Moreover, cross-cultural comparisons could be made to make sound arguments over the findings because the majority of the studies on academic emotions were performed in individualist cultures such as Germany and the U.S. However, there is a need to increase the number of studies done in different cultures. Along with this need, the combination of research in both cultures would contribute to making sound reasoning on the nature of academic emotions and their antecedents and consequences.

Last, this study attempted to explain how teachers' emotions relate to their self-efficacy and burnout. In addition to the first aim, this study was also intended to answer how students' emotions are related to their self-efficacy, perceived teaching quality, perceived teacher affective support, and teachers' emotions through the lens of the control-value theory framework. In combination with many motivational theories, there are still many other antecedents and consequences of academic emotions. For example, achievement goals, subjective control, and values, emotion-regulation strategies are the antecedents of achievement emotions (Pekrun, 2006). Furthermore, achievement, learning strategies, and self-regulated learning are the outcomes of achievement emotions. Among these variables, achievement as a cognitive outcome variable might be examined in future studies. Overall, integrating these variables on the proposed models might bring broader and more holistic perspectives to further research findings.

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APPENDIX A. APPROVAL FORM FROM METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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02 OCAK 2018

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın DOç.Dr. Yeşim ÇAPA-AYDIN;

Danışmanlığını yaptığınız Başak ÇALIK'ın " **Öğretmen duyguları ve öğrenci duyguları: Duygu düzenleme stratejileri, öz-yeterlik inançları, öğretmen tükenmişliği ve öğretimin niteliği nasıl ilişkililer?"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **2017-EGT-217** protokol numarası ile **02.01.2018-28.06.2019** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Ş. Halil TURAN
Başkan V

Prof. Dr. Ayhan SOL
Üye

Prof. Dr. Ayhan Gürbüz DEMİR
Üye

Doç. Dr. Yaşar KONDAKÇI
Üye

Doç. Dr. Zana ÇITAK
Üye

Yrd. Doç. Dr. Pınar KAYGAN
Üye

Yrd. Doç. Dr. Emre SELÇUK
Üye

APPENDIX B. APPROVAL FORM FROM MONE FOR PILOT STUDY

T.C.
İSTANBUL VALİLİĞİ
İl Millî Eğitim Müdürlüğü

Sayı : 59090411-44-E.5166712 12.03.2018
Konu: Anket Araştırma İzni

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Öğrenci İşleri Daire Başkanlığı)

İlgi: a) 07.02.2018 tarih ve 1694 sayılı yazınız.
b) Valilik Makamının 08.03.2018 tarih ve 4911154 sayılı oluru.

Üniversiteniz Eğitim Bilimleri Enstitüsü doktora programı öğrencisi Başak ÇALIK'ın **"Öğretmen Duyguları ve Öğrenci Duyguları: Duygu Düzenleme Stratejileri, Öz-Yeterlik İnançları, Öğretmen Tükenmişliği ve Öğretimin Niteliği Nasıl İlişkililer"** konulu araştırma çalışması hakkındaki ilgi (a) yazınız ilgi (b) valilik onayı ile uygun görülmüştür.

Bilgilerinizi ve araştırmacının söz konusu talebi; bilimsel amaç dışında kullanmaması, **uygulama sırasında bir örneği müdürlüğümüzde muhafaza edilen mühürlü ve imzalı veri toplama araçlarının kurumlarımıza araştırmacı tarafından ulaştırılarak uygulanılması,** katılımcıların gönüllülük esasına göre seçilmesi, araştırma sonuç raporunun müdürlüğümüzden izin alınmadan kamuoyuyla paylaşılmaması koşuluyla, gerekli duyurunun araştırmacı tarafından yapılması, okul idarecilerinin denetim, gözetim ve sorumluluğunda, eğitim-öğretimi aksatmayacak şekilde ilgi (b) Valilik Onayı doğrultusunda uygulanması ve işlem bittikten sonra 2 (iki) hafta içinde sonuçtan Müdürlüğümüz Strateji Geliştirme Bölümüne rapor halinde bilgi verilmesini arz ederim.

M. Nurettin ARAS
Müdür a.
Müdür Yardımcısı

EK:1- Valilik Onayı
2- Ölçekler

İl Milli Eğitim Müdürlüğü Binbirdirek M. İmran Öktem Cad.
No:1 Eski Adliye Binası Sultanahmet Fatih/İstanbul
E-Posta: sgb34@meb.gov.tr

A. BALTA VHKİ
Tel: (0 212) 455 04 00-239
Faks: (0 212)455 06 52

Bu evrak güvenli elektronik imza ile imzalanmıştır. https://evraksorgu.meb.gov.tr adresinden 5ff2-f177-3131-9190-2d7f kodu ile teyit edilebilir.

APPENDIX C. APPROVAL FORM FROM MONE FOR MAIN STUDY

T.C.
İSTANBUL VALİLİĞİ
İl Millî Eğitim Müdürlüğü

Sayı : 59090411-44-E.2163240 31.01.2019
Konu : Anket ve Araştırma İzni

Sayın: Başak ÇALIK

ilgi: a) 14.12.2018 tarihli ve 2418546 Gelen Evrak No'lu dilekçeniz.
b) Valilik Makamının 29.01.2019 tarih ve 1987915 sayılı oluru.

"Öğretmen Duyguları ve Öğrenci Duyguları: Duygu Düzenleme Stratejileri Öz-Yeterlik İnançları, Öğretmen Tükenmişliği ve Öğretimin Niteliği Nasıl İlişkililer?" konulu araştırma çalışmanız hakkındaki ilgi (a) dilekçe ve ekleri ilgi (b) valilik onayı ile uygun görülmüştür.

Bilgilerinizi ve söz konusu talebiniz; bilimsel amaç dışında kullanmaması, **uygulama sırasında bir örneği müdürlüğümüzde muhafaza edilen mühürlü ve imzalı veri toplama araçlarının kurumlarımıza araştırmacı tarafından ulaştırılarak uygulanılması,** katılımcıların gönüllülük esasına göre seçilmesi, araştırma sonuç raporunun müdürlüğümüzden izin alınmadan kamuoyuyla paylaşılmaması koşuluyla, gerekli duyurunun araştırmacı tarafından yapılması, okul idarecilerinin denetim, gözetim ve sorumluluğunda, eğitim-öğretimi aksatmayacak şekilde ilgi (b) Valilik Onayı doğrultusunda uygulanması ve işlem bittikten sonra 2 (iki) hafta içinde sonuçtan Müdürlüğümüz Strateji Geliştirme Bölümüne rapor halinde bilgi verilmesini rica ederim.

Abdurrahman ENSARİ
Müdür a.
Şube Müdürü

EK:
1- Valilik Onayı
2- Ölçekler

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APPENDIX D. SAMPLE ITEMS FROM TEACHER QUESTIONNAIRE IN TURKISH

Değerli öğretmenim,

Bu anket öğretmenlerin akademik duygu ve düşüncelerini 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.

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BÖLÜM I

Aşağıda bir öğretmen olarak deneyimlerinizi anlatan ifadeler bulunmaktadır. Lütfen, bu seneki 7. ya da 8. sınıf öğrencilerinizi düşünerek aşağıdaki maddeleri cevaplayınız.

	Kesinlikle Katılmıyorum			Kesinlikle Katılıyorum
2. Bu sınıftaki öğrencilere öğretimimin yolunda gitmeyeceğine ilişkin sıklıkla kaygılanırım.	1	2	3	4
6. Bu sınıftaki öğrencilere ders anlatmaktan genellikle o kadar çok zevk alırım ki dersimi istekle hazırlar ve öğretirim.	1	2	3	4
11. Bu sınıftaki öğrencilere şevkle ders anlatırım.	1	2	3	4

BÖLÜM II

Lütfen, aşağıdaki sorulara cevap verirken 1 ile 9 arasındaki derecelendirmede size uygun olan rakamı işaretleyiniz.

	Yetersiz		Çok az yeterli		Biraz yeterli		Oldukça yeterli		Çok yeterli
3. Sınıfta dersi olumsuz yönde etkileyen davranışları kontrol etmeyi ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9

BÖLÜM III

Lütfen, aşağıda verilen maddelerin karşısındaki seçeneklerden size en uygun gelen seçeneği işaretleyiniz.

	Hiçbir zaman	Yılda birkaç kez	Ayda bir kez	Ayda birkaç kez	Haftada bir kez	Haftada birkaç kez	Hergün
7. Öğrencilerimin sorunlarıyla çok etkin bir şekilde ilgileniyorum.	0	1	2	3	4	5	6
14. Öğretmenlikte iş yükümün çok fazla olduğunu hissediyorum.	0	1	2	3	4	5	6
22. Öğrencilerin bazı sorunlarından dolayı beni suçladıklarını hissediyorum.	0	1	2	3	4	5	6

BÖLÜM IV

1. **Cinsiyetiniz**: ☐ Kadın ☐ Erkek

2. **Yaşınız**: ……………………………...

3. **En son aldığınız eğitim dereceniz**:

   ☐Ön Lisans
   ☐Lisans
   ☐Yüksek Lisans
   ☐Doktora

4. **Mezun olduğunuz fakülte**:

   ………………………………………………………………….

5. **Öğretmenlik tecrübeniz (ay/yıl olarak):** ………………………

6. ***Şu an görev yaptığınız okulda kaç yıldır çalışıyorsunuz?***

   ……………………………………………………………..

ÇALIŞMAMIZA KATILDIĞINIZ İÇİN TEŞEKKÜR EDERİZ. ☺

APPENDIX E. STUDENT QUESTIONNAIRE IN TURKISH

Sevgili öğrenciler,

Bu anket okulda aldığınız matematik dersleri hakkındaki duygu ve düşüncelerinizi araştırmayı amaçlamaktadır. Lütfen soruları dikkatle okuyup şu ana kadar aldığınız matematik derslerindeki bütün deneyimlerinizi göz önünde bulundurun ve soruların 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.

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BÖLÜM I

DERSTEN ÖNCE *Aşağıdaki sorular matematik dersine katılmadan önce 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 rakamı işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
4. Matematik beni o kadar korkutur ki bu yüzden okula <u>gitmemeyi</u> tercih ederim.	1	2	3	4	5
DERS SIRASINDA *Aşağıdaki sorular matematik dersi sırasında yaşayabileceğiniz duyguları içermektedir. Lütfen, matematik dersinde genellikle nasıl hissettiğinizi işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
10. Matematik dersi sırasında o kadar sinirlenirim ki dersten çıkmak isterim.	1	2	3	4	5

BÖLÜM II

ÇALIŞMADAN ÖNCE *Aşağıdaki sorular matematik konularını tekrar etmeden ve ödevleri yapmadan önce 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 rakamı işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
13. Matematik ödevlerimden öyle korkarım ki onlara başlamamayı tercih ederim.	1	2	3	4	5
ÇALIŞIRKEN *Aşağıdaki sorular matematik konularını tekrar ederken ve matematik ödevlerini yaparken yaşayabileceğiniz duyguları içermektedir. Lütfen, matematik konularını tekrar ederken ya da matematik ödevlerini yaparken genellikle nasıl hissettiğinizi işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
20. Konuyu tamamen anlayıp anlayamayacağımdan endişe duyarım.	1	2	3	4	5

BÖLÜM III

SINAV OLMADAN ÖNCE *Aşağıdaki sorular matematikte sınav olmadan önce yaşayabileceğiniz duyguları içermektedir. Lütfen, matematikte sınav olmadan önce genellikle nasıl hissettiğinizi işaretleyiniz. 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 rakamı işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
23. Çok gerginim.	1	2	3	4	5

SINAV SIRASINDA *Aşağıdaki sorular matematikte sınav olurken yaşayabileceğiniz duyguları içermektedir. Lütfen, matematikte sınavı olurken genellikle nasıl hissettiğinizi işaretleyiniz.*	Kesinlikle Katılmıyorum	Katılmıyorum	Ne Katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
28. Matematikten sınav olmaktan keyif alırım.	1	2	3	4	5

BÖLÜM IV

Aşağıdaki her bir ifadeyi dikkatle okuyunuz ve belirtilen ölçeği kullanarak size en çok uyan cevabı işaretleyiniz. 1'den 6'ya kadar herhangi bir rakamı işaretleyebilirsiniz.	Hiç iyi değilim					Çok iyiyim
1. Matematik ödevinizi zamanında bitirmede ne kadar iyisiniz?	1	2	3	4	5	6
6. Matematik çalışmanızı ne kadar iyi organize edebilirsiniz?	1	2	3	4	5	6
10. Matematik dersinde ne kadar iyi not tutabilirsiniz?	1	2	3	4	5	6

BÖLÜM V

Matematik dersi sırasında öğretmeninizin farklı yapıcı duygusal desteği ile karşılaşabilirsiniz. Anketin bu bölümünde matematik dersinde öğretmeninizden görebileceğiniz farklı yapıcı duygusal destek şekillerini içermektedir. Eğer sorularda verilen ifade sizin içim tamamen doğruysa, 5'i işaretleyiniz. Eğer ifade sizin için hiç doğru değilse, 1'i işaretleyiniz. Bu iki durum dışında ise 1 ve 5 arasında sizi en iyi tanımladığını düşündüğünüz rakamı işaretleyiniz.	Hiç Doğru Değil	Doğru Değil	Biraz Doğru	Doğru	Tamamen Doğru
5. Öğretmenim hiçbir ayrıcalık göstermeksizin diğer öğrencilerine olduğu gibi bana da adaletli ve dürüst davranır.	1	2	3	4	5

BÖLÜM VI

Aşağıda matematik öğretimiyle ilgili çeşitli ifadeler yer almaktadır. Lütfen, her bir ifadeyi dikkatle okuyunuz ve geçen yıl ya da bu yılki matematik dersinizi düşünerek size en çok uyan cevabı işaretleyiniz. Eğer 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 rakamı işaretleyiniz.	Kesinlikle Katılmıyorum				Kesinlikle Katılıyorum
2. Bu derste, öğretmenimizin yönergeleri o kadar belirsiz ki ne yapmam gerektiğini <u>bilemem</u>.	1	2	3	4	5
6. Bu derste, öğretmenimiz konuyu şevkle anlatır.	1	2	3	4	5
9. Bu derste, ne yapmamız gerektiğini anlamakta sıkıntı yaşarım.	1	2	3	4	5

BÖLÜM VII

7. **Cinsiyetiniz**: □ Kız □ Erkek

8. **Sınıfınız:** □ 7. sınıf □ 8. Sınıf

9. **Geçen yılki matematik karne notunuz**: ______________________________

ÇALIŞMAMIZA KATILDIĞINIZ İÇİN TEŞEKKÜR EDERİZ.
☺

APPENDIX F. TEACHER INTERVIEW SCHEDULE

ÖĞRETMEN GÖRÜŞME FORMU

Görüşülen Kişi (takma isim):

Okul:

Tarih/Saat:

Merhaba,

Ben ODTÜ Eğitim Fakültesi Eğitim Bilimleri Bölümü Eğitim Programları ve Öğretimi Anabilim Dalında doktora öğrencisi Başak Çalık. Yürütmekte olduğum doktora tez çalışmasının amacı daha önce anket yoluyla görüşlerine ulaştığım ortaokul matematik öğretmenlerinin 7. ya da 8. sınıf öğrencilerinin matematiğe yönelik duygularının sebepleri hakkında derinlemesine bilgi sahibi olmaktır. Bu görüşmede, soracağımız sorularla sizin bu konudaki görüşlerinizi almak istiyoruz. Alanda çalışan bir öğretmen olarak sizin görüşleriniz bu çalışma için büyük bir önem taşımaktadır.

Öncelikle çalışmama gönüllü olarak katıldığınız için çok teşekkür ederim. Görüşme kapsamında kişisel bilgileriniz tamamen gizli tutulacak ve araştırmacı dışında başka hiç kimseyle paylaşılmayacaktır. Görüşme kapsamında sizi yanıltacak ya da size zarar verecek herhangi bir durum söz konusu olmamakla birlikte istediğiniz an görüşmeyi sonlandırabiliriz.

Görüşme yaklaşık olarak 30-35 dakika sürecektir. Görüşmeye başlamadan önce araştırma hakkında sormak istediğiniz bir soru varsa memnuniyetle cevap verebilirim. Vakit ayırdığınız ve görüşlerinizi paylaştığınız için şimdiden çok teşekkür ederim.

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Eğitim Bilimleri Bölümü
Doktora Öğrencisi
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ÖĞRETMEN KİŞİSEL BİLGİ FORMU

1. Cinsiyetiniz: ☐ Kadın ☐ Erkek
2. Yaşınız: ……………………………...
3. En son aldığınız eğitim dereceniz:

☐Ön Lisans ☐ Lisans ☐ Yüksek Lisans ☐ Doktora

4. Mezun olduğunuz fakülte:
5. Öğretmenlik tecrübeniz (yıl/ay olarak):
6. Görev yaptığınız okulda kaç yıldır çalışıyorsunuz?

GÖRÜŞME SORULARI

1. Okul ortamınızı nasıl tanımlarsınız?

a) Okulun konumu, fiziki koşulları ve altyapısı

b) Öğrenci mevcudu ve öğrenci profili (başarı, SES, öğrenmeye dönük motivasyonları)

c) Yönetici, öğretmen, veli ve öğrenci karşılıklı ilişkisi (birbirlerine destek olup olmama, karar alma süreçlerine katılım)

2. Okuldaki matematik öğrenme ve öğretim ortamlarını düşündüğünüzde matematik öğretimine yönelik inançlarınızdan bahsedebilir misiniz?

a) Dersinizi planlamaya yönelik

b) Dersinizde kullandığınız öğretim stratejilerinize yönelik

c) Öğrencilerinizin derse katılımını sağlamaya yönelik

d) Öğrenme ortamını olumsuz etkileyen davranışları ortadan kaldırmaya yönelik

3. Bu dönem dersine girdiğiniz ………sınıfı düşündüğünüzde

a) Sınıf ortamını (fiziki altyapı, öğrenci mevcudu)

b) Öğrenci profili (devamsızlık oranı, genel ve matematik başarısı, öğrenmeye yönelik motivasyon)

c) Öğrenci-öğretmen, öğrenci-öğrenci, veli-öğretmen ilişkisini

d) Velinin, öğrenci ve öğretmenden beklentilerini nasıl tanımlarsınız?

4. Bu dönem dersine girdiğiniz 7. ve 8. sınıfları düşündüğünüzde öğrencilerinizin matematiğe ilişkin duyguları nelerdir?

a) Öğrenciler matematik dersinde hangi durum, ortam ve zamanlarda bu duyguları hissediyorlar? Ders sırası, ders öncesi ve sonrası ve sınav zamanlarını düşündüğünüzde neler söyleyebilirsiniz?

b) Öğrenciler matematik dersinde bu duyguları hissettiklerinde ne yapıyorlar? Bu duyguları davranış ya da performanslarına nasıl yansıtıyorlar? Bu duyguları sınıf içi iletişiminize nasıl yansıtıyorlar?

c) Sizce öğrencilerinizin matematiğe yönelik hissettikleri bu duyguların sebepleri neler olabilir?

d) Öğrenciler matematik dersine yönelik bu duygularını düzenlemek, yenmek ve onunla başa çıkmak için ne gibi yöntem ve stratejiler uyguluyorlar?

e) Öğrencilerin bu duygularını düzenlemek için sınıflarınızda ne tür yöntem ve stratejiler uyguluyorsunuz? Mevcut öğretim yöntem ve stratejilerinizde herhangi bir değişiklik yapıyor musunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

f) Öğrencilerin bu duygularını düzenlemek için öğrencilerinizle iletişiminizde (kullanılan dil, beden dili) ne gibi faktörlere dikkat ediyorsunuz?

g) Öğrencileriniz matematik dersinde hissettikleri bu duyguları size nasıl yansıtıyorlar? Bunu nasıl anlıyorsunuz? Bu duygu durum(ları) karşısında siz neler hissediyorsunuz? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

i. Kendi duygularınızı kontrol etmek ya da düzenlemek için ne gibi yöntemler kullanıyorsunuz? Neden bu yöntemleri tercih ediyorsunuz?

5. Bu dönem dersine girdiğiniz 7. ve 8. sınıflar içerisinde matematiğe yönelik kaygı duyduğunu düşündüğünüz öğrencileriniz oldu mu?

a) Öğrenciler matematik dersinde hangi durum, ortam ve zamanlarda kaygı duyuyorlar? Ders sırası, ders öncesi ve sonrası ve sınav zamanlarını düşündüğünüzde neler söyleyebilirsiniz?

b) Öğrenciler matematik dersinde kaygılandıklarında ne yapıyorlar? Bu duyguyu nasıl ortaya koyuyorlar? Bu duyguyu sınıf içi iletişiminize nasıl yansıtıyorlar?

c) Sizce öğrencilerinizin hissettikleri matematik kaygısının sebepleri neler olabilir? Sizce öğrenciler matematikten neden korkarlar?

d) Öğrenciler matematik kaygılarını yenmek ve onunla başa çıkmak için ne gibi yöntem ve stratejiler uyguluyorlar?

e) Öğrencilerin matematik kaygısını azaltmak için sınıflarınızda ne tür yöntem ve stratejiler uyguluyorsunuz? Mevcut öğretim yöntem ve stratejilerinizde herhangi bir değişiklik yapıyor musunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

f) Öğrencilerin matematik kaygısını azaltmak için öğrencilerinizle iletişiminizde (kullanılan dil, beden dili) ne gibi faktörlere dikkat ediyorsunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

g) Öğrencileriniz, matematik dersinde hissettikleri kaygıyı size nasıl yansıtıyorlar? Bunu nasıl anlıyorsunuz? Bu duygu durumu karşısında siz neler hissediyorsunuz? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

i. Kendi duygularınızı kontrol etmek ya da düzenlemek için ne gibi yöntemler kullanıyorsunuz? Neden bu yöntemleri tercih ediyorsunuz?

6. Bu dönem dersine girdiğiniz 7. ve 8. sınıfları düşündüğünüzde öğrencilerinizin matematiğe öfke duyduklarını düşündüğünüz oldu mu?

a) Öğrenciler matematik dersinde hangi durum, ortam ve zamanlarda öfke duyuyorlar? Ders sırası, ders öncesi ve sonrası ve sınav zamanlarını düşündüğünüzde neler söyleyebilirsiniz?

b) Öğrenciler matematikte öfke duyduklarında ne yapıyorlar? Bu duyguyu nasıl ortaya koyuyorlar? Bu duyguyu sınıf içi iletişiminize nasıl yansıtıyorlar?

c) Sizce öğrencilerinizin matematiğe yönelik hissettikleri bu öfkenin sebepleri neler olabilir?

d) Öğrenciler matematiğe yönelik öfkelerini davranış ya da performanslarına nasıl yansıtıyorlar?

e) Öğrenciler matematiğe duydukları öfkelerini kontrol etmek için ne gibi yöntem ve stratejiler uyguluyorlar?

f) Öğrencilerinizin matematiğe olan öfkelerini azaltmak için sınıflarınızda ne tür yöntem ve stratejiler uyguluyorsunuz? Mevcut öğretim yöntem ve stratejilerinizde herhangi bir değişiklik yapıyor musunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

g) Öğrencilerin matematiğe olan öfkelerini azaltmak için öğrencilerinizle iletişiminizde (kullanılan dil, beden dili) ne gibi faktörlere dikkat ediyorsunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

h) Öğrencileriniz matematiğe olan öfkelerini size nasıl yansıtıyorlar? Bunu nasıl anlıyorsunuz? Bu duygu durumu karşısında siz neler hissediyorsunuz? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

i. Kendi duygularınızı kontrol etmek ya da düzenlemek için ne gibi yöntemler kullanıyorsunuz? Neden bu yöntemleri tercih ediyorsunuz?

7. Bu dönem dersine girdiğiniz 7. ve 8. sınıfları düşündüğünüzde öğrencilerinizin matematikten hiç keyif aldıklarını düşünüyor musunuz?

a) Sizce öğrencileriniz hangi durum, ortam ve zamanlarda matematik dersinden keyif alırlar? Ders sırası, ders öncesi ve sonrası ve sınav zamanlarını düşündüğünüzde neler söyleyebilirsiniz?

b) Öğrenciler matematik dersinden keyif aldıkları zaman ne yaparlar? Bu duyguyu nasıl ortaya koyuyorlar? Bu duyguyu sınıf içi iletişiminize nasıl yansıtıyorlar?

c) Öğrenciler matematik dersinden daha çok keyif almak için ne gibi yöntem ve stratejiler uyguluyorlar?

d) Öğrencilerinizin matematikten keyif almaları için (Matematiği zevkli hale getirmek için) sınıflarınızda ne tür yöntem ve stratejiler uyguluyorsunuz? Mevcut öğretim yöntem ve stratejilerinizde herhangi bir değişiklik yapıyor musunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

e) Öğrencilerin matematikten keyif almaları için (Matematiği zevkli hale getirmek için) öğrencilerinizle iletişiminizde (kullanılan dil, beden dili) ne gibi faktörlere dikkat ediyorsunuz? Neden? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

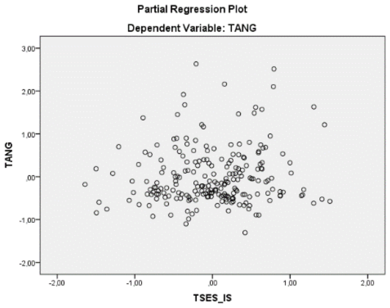
f) Öğrencileriniz matematiği zevkle çalıştıkları zaman bu duygularını size nasıl yansıtıyorlar? Bunu nasıl anlıyorsunuz? Onlar keyifle çalıştıkça siz neler hissediyorsunuz? Deneyimlerinizden bahsedebilir misiniz? Bu durumla ilgili aklınıza gelen unutamadığınız bir örnek var mı?

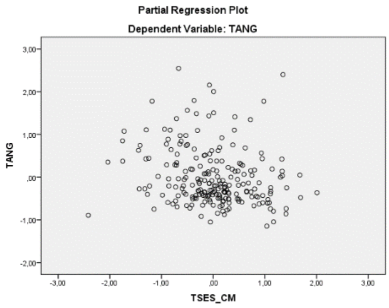
i. Kendi duygularınızı kontrol etmek ya da düzenlemek (Siz de matematiği keyifle çalışmak/ kendiniz için zevkli hale getirmek) için ne gibi yöntemler kullanıyorsunuz? Neden bu yöntemleri tercih ediyorsunuz?

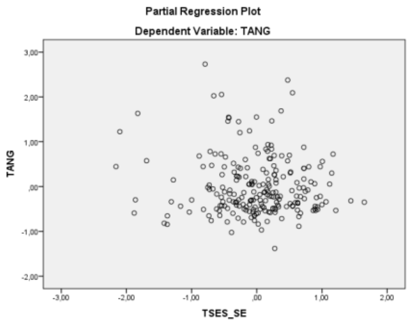
8. Söz ettikleriniz dışında bu dönem dersine girdiğiniz 7. ve 8. sınıfları düşündüğünüzde öğrencilerinizde gözlemlediğiniz başka duygu durumları oldu mu?

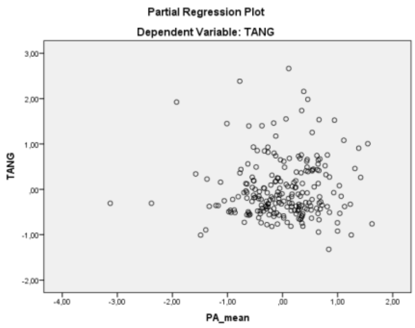
APPENDIX G. RESIDUAL PLOTS

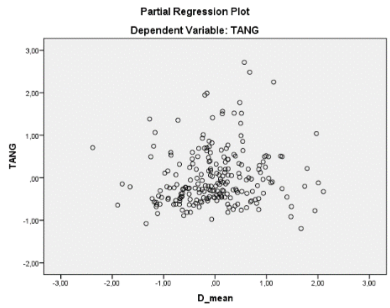
Partial Regression Plots-Teacher Sample

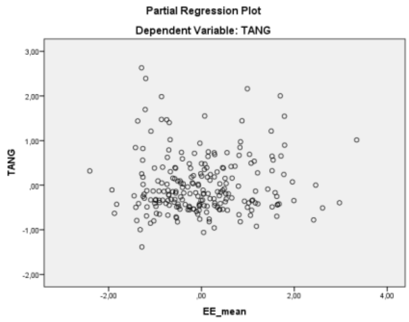


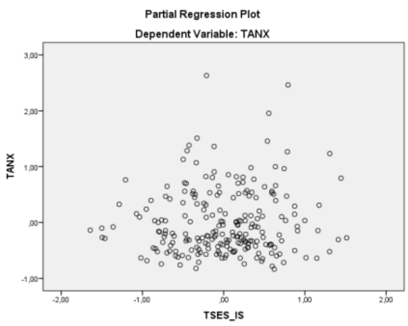


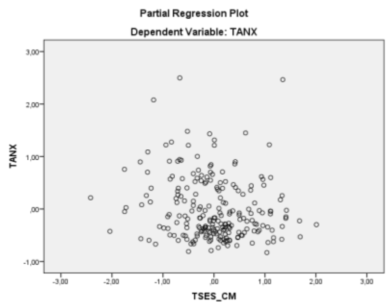


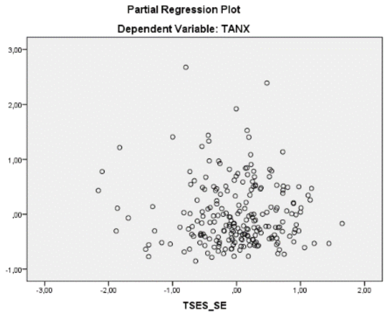


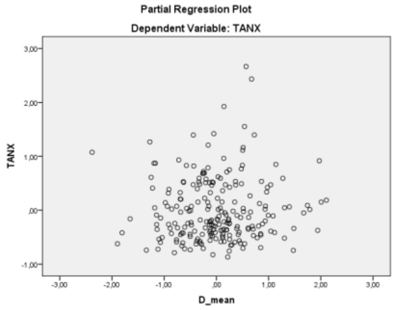









Partial Regression Plot
Dependent Variable: TANX
TANX
TSES_SE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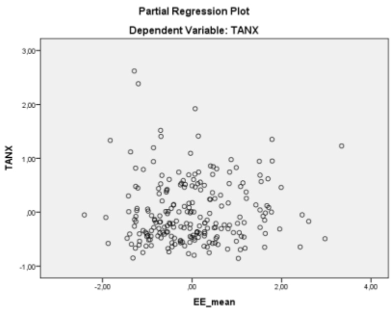
TANX
D_mean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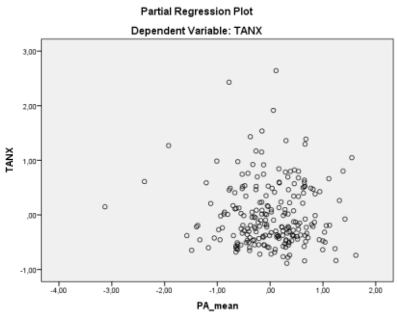
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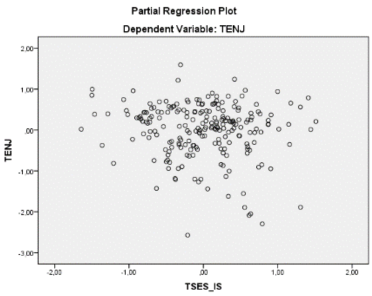
PA_mean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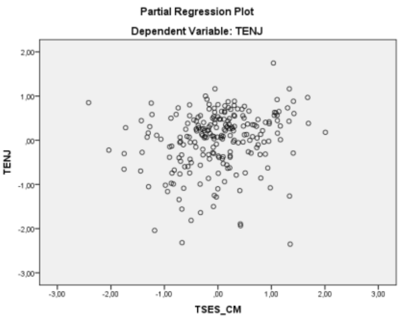
TENJ
TSES_IS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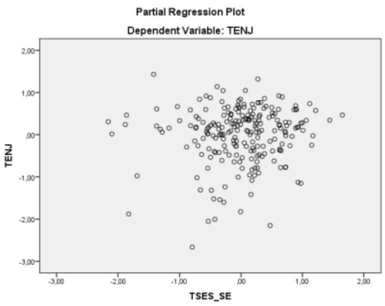
Dependent Variable: TENJ
TENJ
TSES_CM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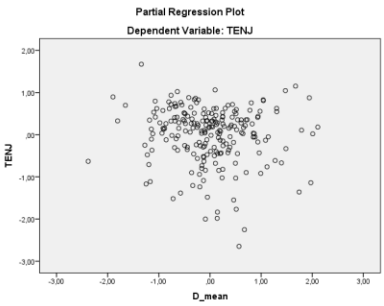
TSES_SE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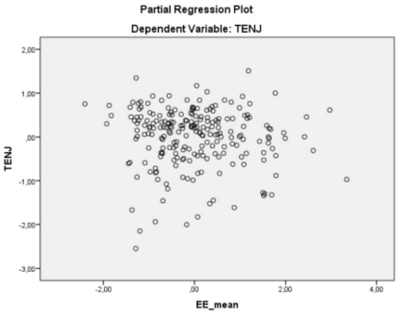
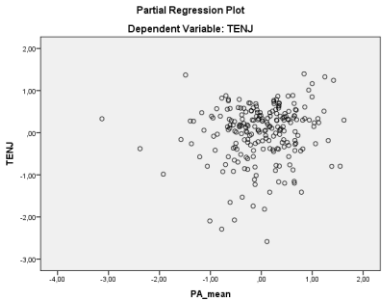
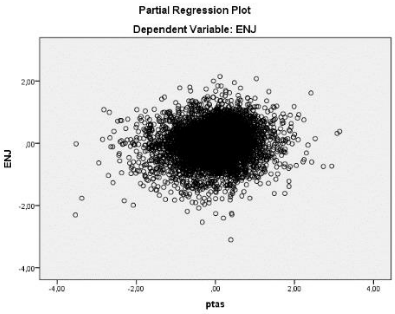
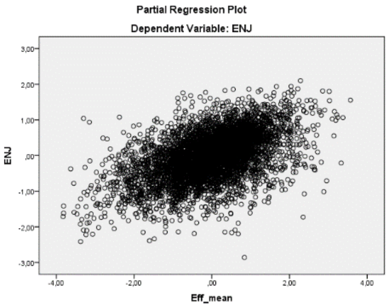
D_mean

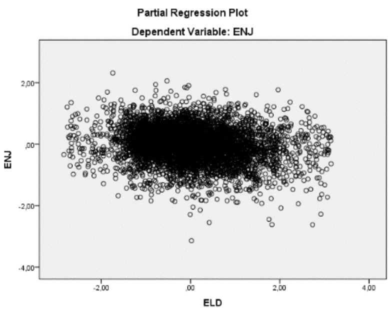


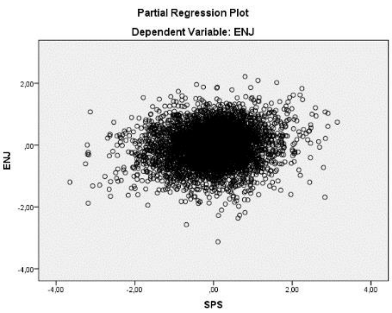


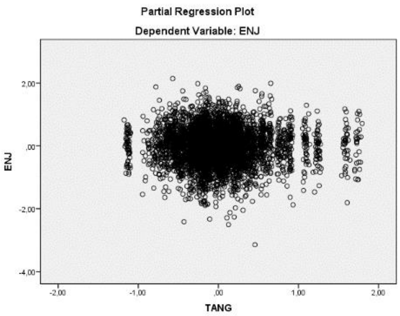
Partial Regression Plots-Student Sample

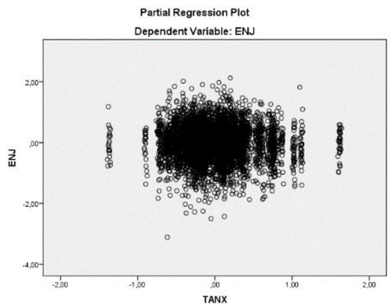


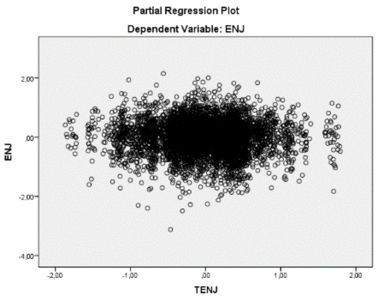








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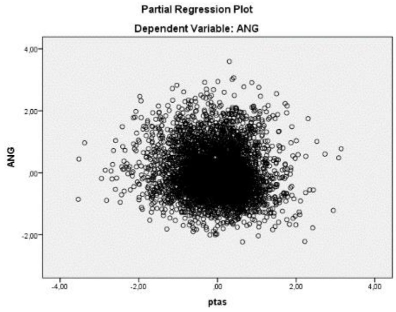
ENJ
TENJ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ANG
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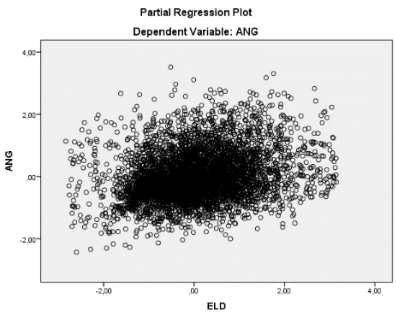
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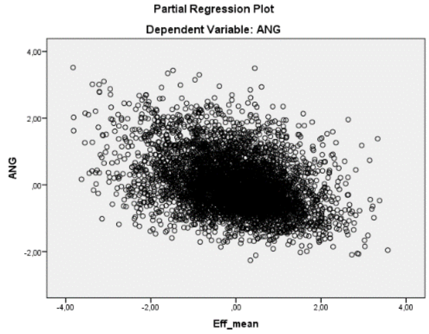
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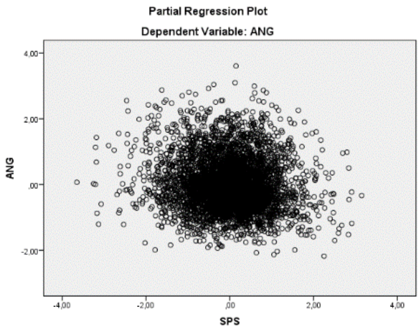
ANG
Eff_mean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ANG
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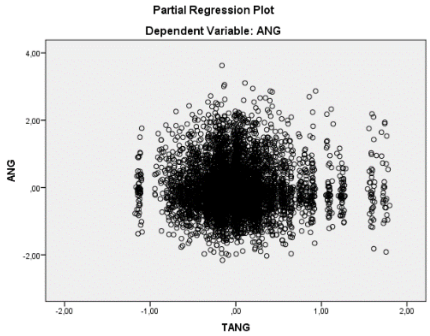
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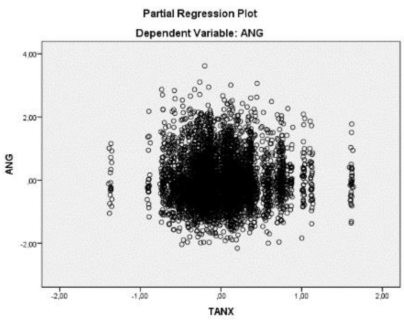
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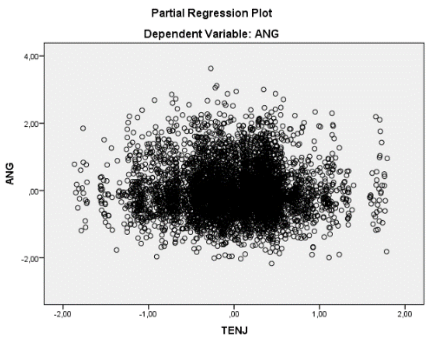
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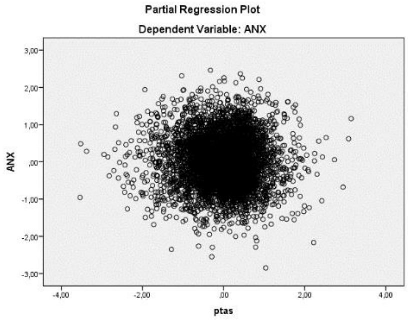
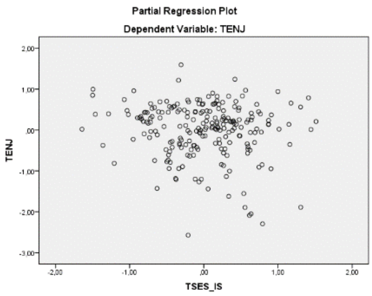
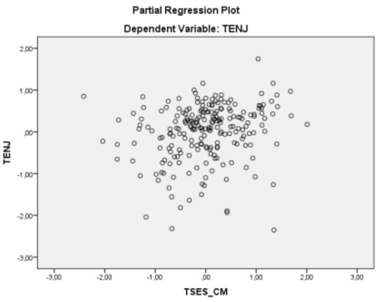
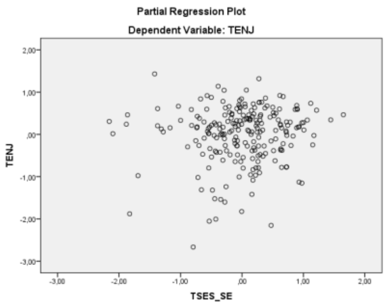
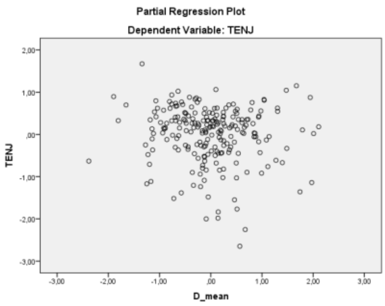


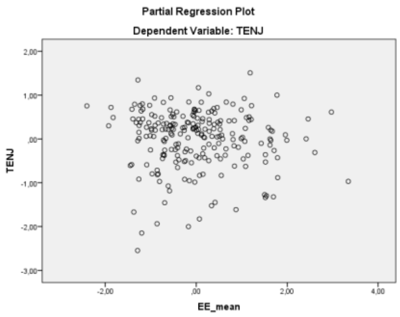
Partial Regression Plots-Teacher Sample

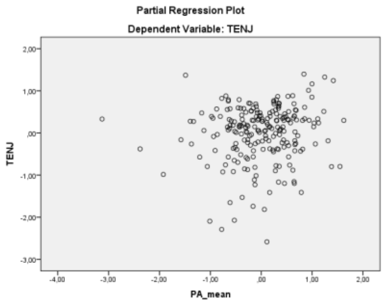




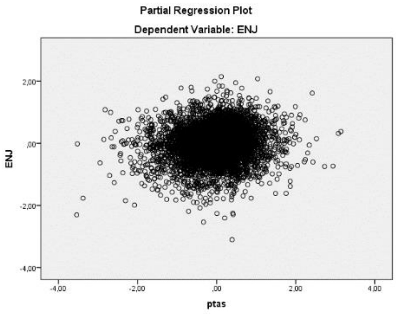


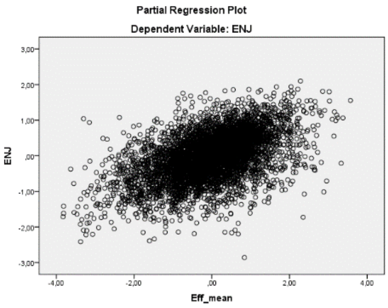


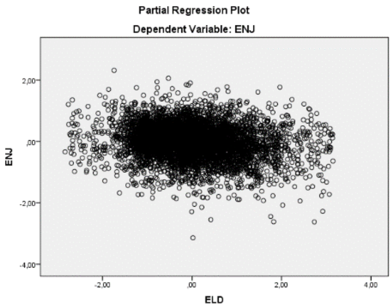


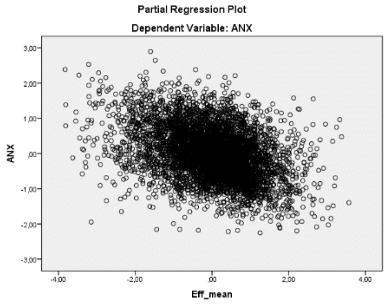


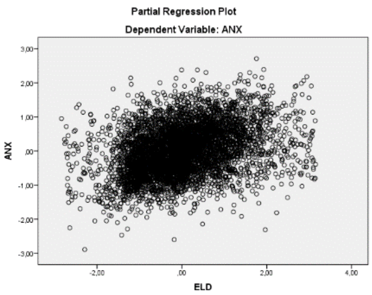
Partial Regression Plots-Student Sample

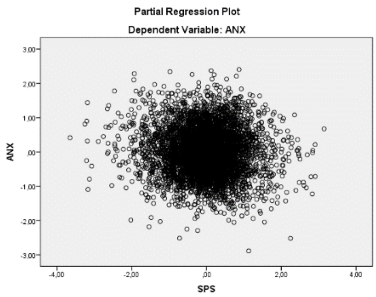


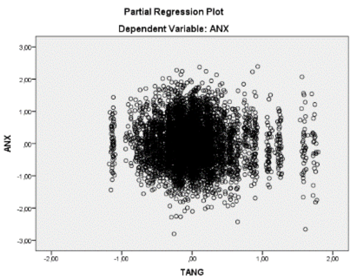


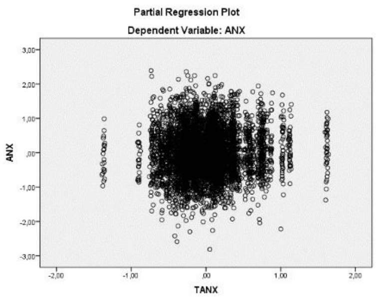


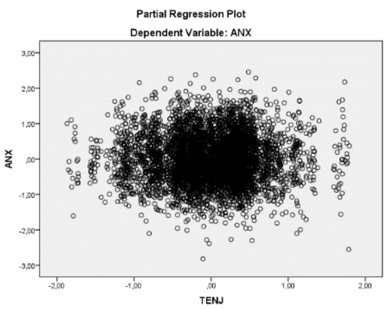




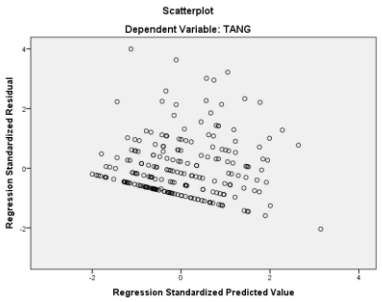


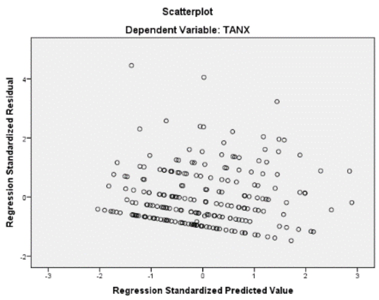


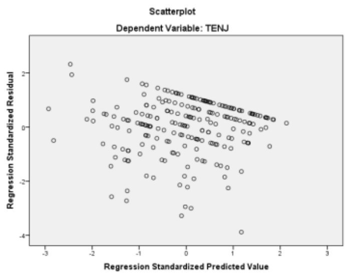




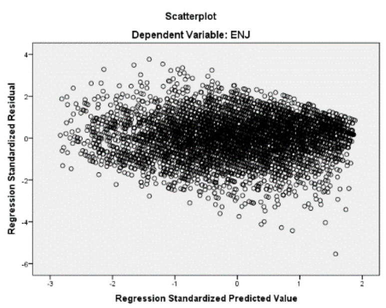
Scatterplots-Teacher Sample

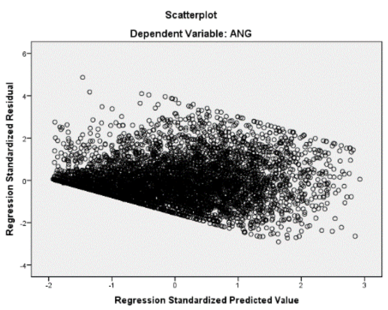


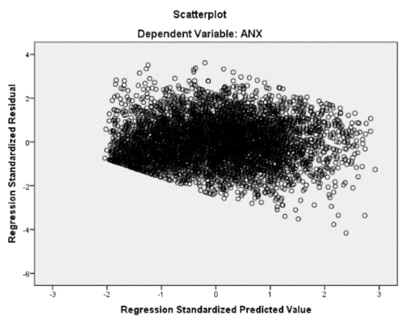




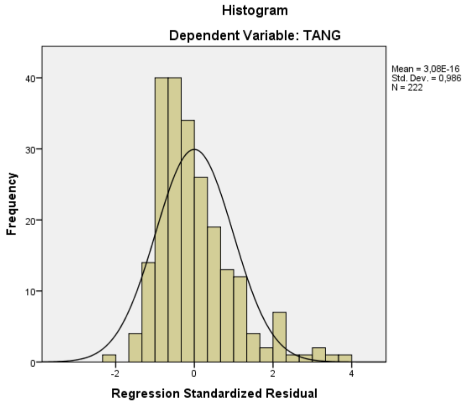
Scatterplots-Student Sample

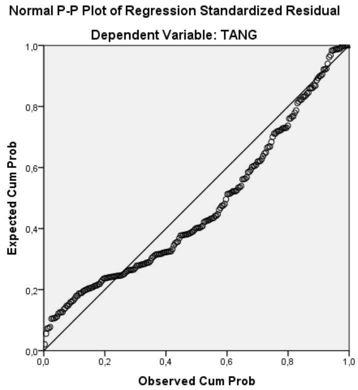


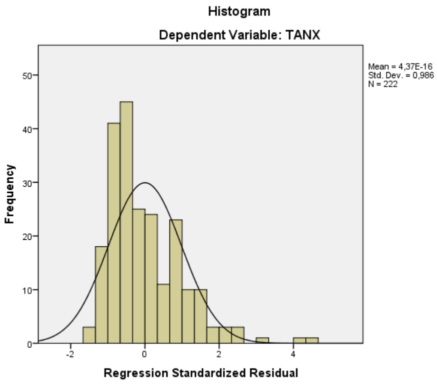


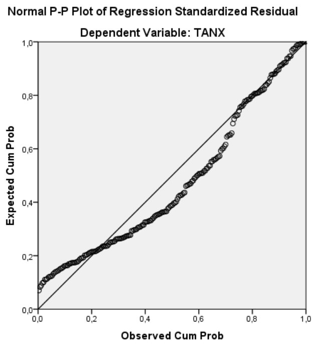


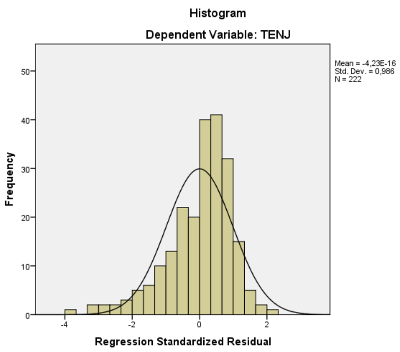
Histogram, Normal P-P Plot of Residuals- Teacher Sample

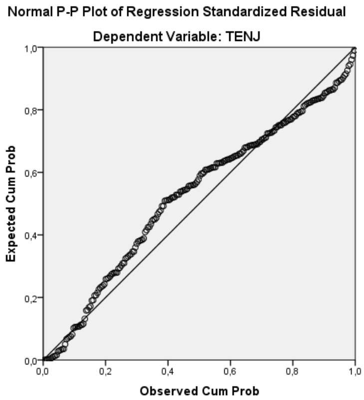




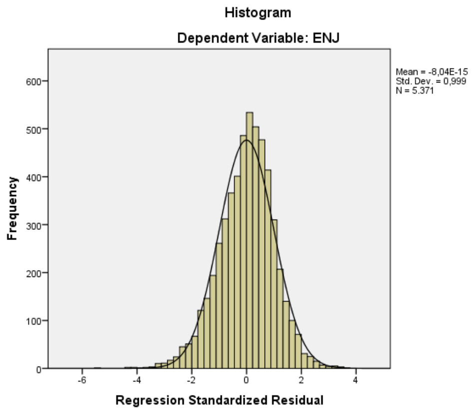


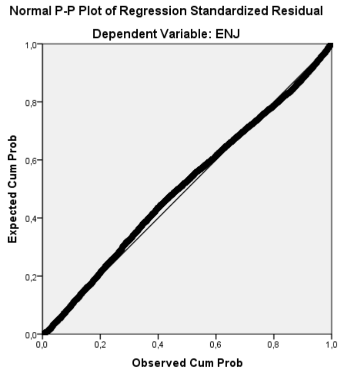


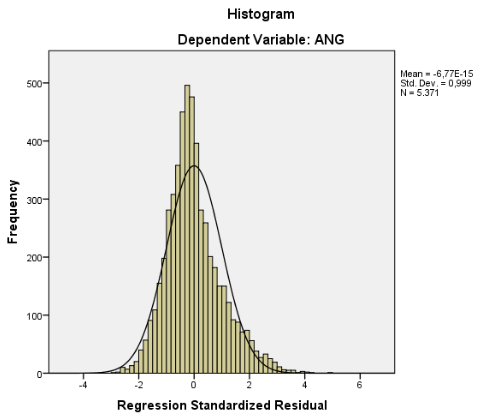


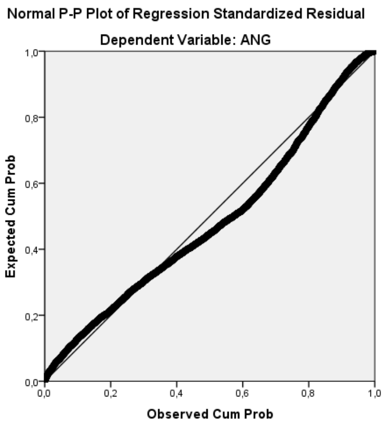


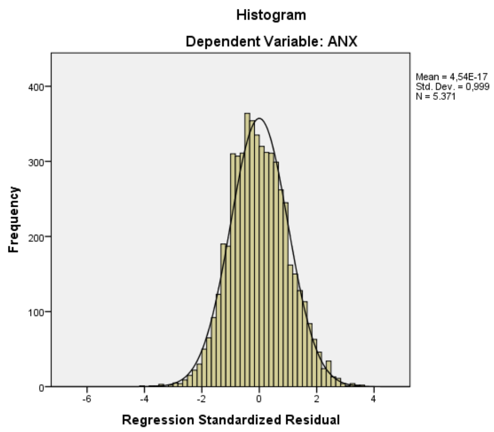
Histogram, Normal P-P Plot of Residuals- Student Sample

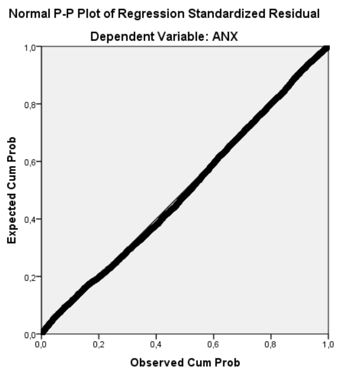












APPENDIX H. CURRICULUM VITAE

BAŞAK ÇALIK
basak.calik@medeniyet.edu.tr
Istanbul Medeniyet University,
Educational Sciences Faculty, 34862
Istanbul/TURKEY

Education

September, 2014 – ongoing (Doctor of Philosophy, Ph.D.)	Middle East Technical University (METU) Education Faculty Department of Educational Sciences **Curriculum and Instruction**
September, 2012 – August, 2014 (Master of Science, M.S.)	Middle East Technical University (METU) Education Faculty Department of Educational Sciences **Curriculum and Instruction**
September, 2006 – June, 2011 (Bachelor of Science, B.S.)	Boğaziçi University Primary Education **Mathematics Education Program**

Main Academic Positions

June, 2013 – January, 2018	**Research Assistant** Middle East Technical University (METU) Education Faculty Department of Educational Sciences **Curriculum and Instruction**
January, 2018-ongoing	**Research Assistant** Istanbul Medeniyet University (IMU) Educational Sciences Faculty Department of Educational Sciences **Curriculum and Instruction**
September, 2019- May, 2020	**Visiting Research Scholar** Educational, School, and Counseling Psychology Educational Psychology **University of Kentucky**

Selected Peer-Reviewed Journal Articles

Çalık, B., & Çapa-Aydın, Y. (2019). Turkish adaptation and validation of mathematics achievement emotions questionnaire (AEQ-M) for middle school students. *Turkish Psychological Counselling and Guidance Journal*, *9*(53), 523-545.

Çalık, B., Kılıç, K, & Akar, H. (2019). Evaluation of the current school-parent partnership policy in two public primary schools. *Elementary Education Online, 18* (1), 1-19.

Akin, S., **Calik, B.** & Engin-Demir, C. (2017). Students as change agents in the community: developing active citizenship at schools. *Educational Sciences: Theory & Practice*, *17*(3), 809-834.

Çalık, B., & Aksu, M. (2018). A systematic review of teachers' questioning in Turkey between 2000-2018. *Elementary Education Online, 17*(3), 1548-1565.

Selected Conference Presentations

Calik, B. & Usher, E. L. (2020). *Achievement emotions and self-efficacy in mathematics: How are they related?* Paper presented at Spring Research Conference, Cincinnati: University of Cincinnati, Ohio, U.S.

Calik, B. & Capa Aydin (2019). *An investigation of emotions, self-efficacy, and learning strategy use in mathematics.* Paper presented at the 18th Biennial Conference for Research on Learning and Instruction (EARLI), Aachen, Germany.

Capa-Aydin, Y. & **Calik, B.** (2018). *University students' perceptions toward feedback.* Paper presented at The European Association for Research on Learning and Instruction (EARLI) Sig 1 Assessment and Evaluation Conference, Helsinki: University of Helsinki, Finland.

Calik, B. & Yildirim, A. (2018). *Teacher educators' emotions: A phenomenological study of university teachers' emotional experiences.* Paper presented at The European Conference on Educational Research (ECER), Bolzano: The Free University of Bozen-Bolzano, Italy.

Çalık, B. & Ok, A. (2017). *An evaluation study of the graduate level Educational Statistics I course.* Paper presented at V. International Curriculum and Instruction Congress, Mugla-Marmaris, Turkey.

Calik, B. & Capa-Aydin Y. (2017). *The association between mathematics self-efficacy beliefs and self-regulated learning strategies of middle school students.* Paper presented at The European Conference on Educational Research (ECER), Copenhagen: University College UCC, Denmark.

Akar, H., **Calik, B.**, Gulmez-Dag, G., & Yilmaz, E. (2017). *A survey on how faculty perceive and quest for modes of internationalization in a private higher education institution.* Paper presented at ICE 2017: 19th International Conference on Education, Berlin, Germany.

Calik, B. & Capa- Aydin, Y. (2016). *Modeling the relationship between pre-service teachers' emotions and their self-efficacy beliefs.* Paper presented at The European Association for Research on Learning and Instruction (EARLI) Sig 11 Teaching and Teacher Education Conference, Zurich: University of Zurich, Switzerland.

Calik, B. & Capa-Aydin, Y. (2015). *Mathematics achievement emotions: Do they differ by gender and grade level?* Paper presented at The European Conference on Educational Research (ECER), Budapest: Corvinus University, Hungary.

Engin-Demir, C., Akin, S., & **Calik, B.** (2015*). From school to community: empowering students as active citizens in Turkish context.* Paper presented at American Educational Research Association Conference (AERA), Chicago, USA.

Calik, B. & Capa-Aydin Y. (2014). *Development of visual mathematics literacy self-efficacy scale for prospective teachers.* Paper presented at The European Conference on Educational Research (ECER), Porto: Porto University, Portugal.

Calik, B. & Capa-Aydin Y. (2014). *The role of mathematics achievement emotions on the metacognitive strategy use of eighth grade students*. Paper presented at The European Association for Research on Learning and Instruction (EARLI) Sig16 Metacognition Conference, Istanbul: Boğaziçi University, Turkey.

Research Experience

August, 2018-ongoing	*Research Team Member Achievement Emotions and Motivation (AEM) Research Group [Directed by Assoc. Prof. Dr. Yeşim Çapa-Aydın] Middle East Technical University, Turkey
September, 2019- May, 2020	*Research Team Member P20 Motivation &Learning Lab Research Group [Directed by Prof. Dr. Ellen Usher] University of Kentucky
November 2019-May, 2020	*Research Team Member Applied Psychometric Strategies (APS) Lab [Directed by Prof. Dr. Michael Toland] University of Kentucky
May, 2018– ongoing (METU Research Fund)	Teacher emotions and student emotions: How are they related to emotion-regulation strategies, self-efficacy beliefs, teacher burn-out and teaching quality? *Researcher

May, 2018– May, 2019 (METU Research Fund)	Empowerment of teachers for inclusive schools *Researcher
May, 2016 – December, 2018 (METU Research Fund)	Internationalization of Higher Education: A Case Study *Researcher
January, 2016 – December, 2017 (METU Research Fund)	Students' perceptions regarding feedback in college courses *Researcher
April, 2014 – February, 2015 (EU)	Democratic Citizenship and Human Rights Education (HRE) "From School to Community: Children and Students as Change Agents in the Community" *Researcher

Awards and Scholarships

2019-2020	Turkish National Science Foundation (TUBITAK)- International Research Fellowship Programme, $10.400
2017	METU Development Foundation Article Award
2014- ongoing	Turkish National Science Foundation (TUBITAK)- Domestic PhD Scholarship
2012- 2014	Turkish National Science Foundation (TUBITAK)- Domestic Master Scholarship
2011	High honor degree, Faculty of Education, Boğaziçi University

Ad-Hoc Reviewer

British Journal of Educational Psychology (April 2020; September, 2020)
International Journal of Educational Methodology (April 2020)
American Educational Research Association (AERA) Motivation Sig-Motivation in Education
American Educational Research Association (AERA) Division C - Learning and Instruction/Division C - Section 2a: Cognitive and Motivational Processes

APPENDIX I. TÜRKÇE ÖZET (TURKISH SUMMARY)

Giriş

Duyuş; motivasyon, inanç, ruh hali, benlik algısı ve duygu gibi bilişsel olmayan birçok yapıyı içine alan genel bir terim olarak kullanılmaktadır. Ortaya konulan bu ayrım çerçevesinde duygu kavramı ise "çok boyutlu, duyuşsal, bilişsel, motivasyonel, dışavurumsal ve fizyolojik süreçleri içeren eş-güdümlü psikolojik alt sistemler" (Pekrun, 2006, sf. 316) olarak tanımlanmaktadır. Duyguların başta öğrenci ve öğretmenler olmak üzere öğrenme ve öğretme süreçleri üzerinde nasıl rol oynadığını açıklamak için sınav kaygısı (Zeidner, 1998) haricinde çok az sayıda çalışma bulunmaktadır. Halbuki, ilgi, merak, zevk, öfke, gurur, utanç, bıkkınlık, umut ve umutsuzluk gibi duyguların eğitim ve öğretim ortamlarından bağımsız olarak düşünülmesi mümkün olmamaktadır. Duygular üzerine yapılan çalışmalar eğitim alanında diğer disiplinlerle karşılaştırıldığında daha az sayıda olmasına rağmen, günümüzde bu alanda dikkate değer bir çabanın sarf edilmeye başlandığı görülmektedir (Pekrun ve Linnenbrink- Garcia, 2014).

Eğitim ve öğretim sisteminin temel elemanları olarak öğrenci ve öğretmenler, öğrenme ortamlarında çeşitli duyguları deneyimlemektedirler. Özellikle insanlarla iletişim kurmanın diğer mesleklere göre daha fazla olduğu öğretmenlik mesleğinin duygu yoğunluğu yüksek bir meslek olduğu bilinen bir gerçektir. Bu duyguların çeşitliliği ve yoğunluğu öğrenme ve öğretim ortamlarına göre değişiklik gösterebilmektedir. Örneğin, öğrencilerin sınıf düzenini bozacak davranışlar gösterdiği bir sınıfta öğretmen öfke ve bıkkınlık duyarken; öğrencilerin öğretilen konuya karşı ilgi seviyesinin yüksek olduğu bir sınıfta öğretmenin ders anlatmaktan duyduğu zevk ve haz ise ortalamanın üstü bir seviyede olacaktır. Bu kapsamda, öğretmen duyguları ve öğretmen tükenmişliği ilişkisi de sorgulanmaktadır (Frenzel, 2014).

Tükenmişlik, Freudenberger (1974) tarafından "Enerji, güç ve kaynaklar üzerindeki aşırı taleplerden dolayı kişinin başarısız olması, yıpranması ve tükenmiş hale gelmesi" (s. 159) olarak tanımlanmaktadır. İnsanlarla iletişimin sürekli olduğu mesleklerde sıkça deneyimlenen tükenmişliğin bireyler üzerinde psikosomatik rahatsızlıklar, depresyon, agresif davranışlar sergileme, işe yönelik doyumsuzluk ve negatif tutum gibi birçok olumsuz etkisi bulunmaktadır (Çağlar, 2011; Frenzel ve Stephens, 2013). Öğretmenlik mesleğinin, öğrenci, veli ve okul yönetimi gibi birçok insanla sürekli iletişim gerektiren bir meslek olmasından dolayı öğretmenler muhtemel risk grubunun içerisindedirler. İş kaynaklı yoğun stres ve tükenmişlik sendromu en uç düzeyde mesleği bırakmaya neden olmaktadır. Tükenmişlik, örgütsel ve etkileşimsel olmak üzere birçok faktörün karşılıklı etkileşimi sonucu ortaya çıkmaktadır. Öğretmen tükenmişliği, sınıfla, okulla, öğretim programı ve yönetimle ilgili ve kişisel sebepler olmak üzere makro ve mikro düzeyde çeşitli faktörlerden etkilenmektedir (Cephe, 2010; El Helau, Nabhani ve Bahouri, 2016; Kelchtermans ve Strittmatter, 1999; Kottler, Zchm ve Kottler, 2005; Watts ve Robertion, 2011). Öğretmen özyeterlik inançlarının da öğretmen tükenmişliğini önlemede önemli bir rol oynadığı söylenebilir (Durr, Chang ve Carson, 2014). Leiter (1993, aktaran Yu, Wang, Zhai, Dai ve Yang, 2015) tükenmişliği özyeterlik krizi olarak tanımlarken aslında özyeterlik inançlarındaki eksikliğin tükenmişlik sendromunu tetiklediğinin altını çizmektedir. Mevcut çalışmalarda, özyeterlik ve öğretmenlerin mesleki tükenmişlik düzeyleri arasında negatif bir ilişki olduğu ve özyeterlik inançlarındaki düşüşün öğretmen tükenmişliğini tetiklediği savunulmaktadır (Chwalisz, Altmaier ve Russell, 1992).

Öğretmen duygularının öğretmen pedagojik alan bilgisi oluşumu (Brigido, Couso, Gutieres ve Mellodo; 2013), iyi oluş ve öğretimden duyulan haz (Chang, 2009), öğretmenlerin kimlik oluşumu (Bair, Bair, Mader, Hipp ve Hakim, 2010), öğretimin niteliği (Frenzel, 2014; Frenzel, Becker-Kurz, Pekrun ve Goetz, 2015; Frenzel, Goetz, Stephens ve Jacob, 2009; Frenzel, Pekrun, Goetz, Daniels, Durksen, Becker-Kurz ve Klassen; 2016; Hagenauer ve Volet, 2014; Klassen, Perry ve Frenzel, 2012; Sutton, 2005; Sutton ve Wheatley, 2003, Taxer ve Frenzel, 2015; Trigwell, 2012) gibi birçok değişkenle ilişkili olduğu bilinmektedir. Ayrıca, öğretmen duygularının, öğretmen-öğrenci ilişkileri (Hagenauer, Hascher ve Volet, 2015), öğrenci duyguları (Becker, Goetz, Morger ve Ranellucci, 2014; Linnenbrink ve Pintrich, 2002), öğrenme stratejilerinin kullanımı (Linnenbrink ve Pintrich, 2002) ve öğrencilerin başarısı (Pekrun, Goetz, Titz ve Perry, 2002a; Sutton ve Wheatley, 2003) üzerinde dikkate değer bir etkiye sahip olduğu görülmektedir.

Öğretmen duygularının yukarıda bahsedilen değişkenlerle yakın ilişkisi duygusal bulaşma kuramı ile açıklanabilir. Bireylerin psikolojik ve duyusal durumlarının bilinçli ya da farkında olmadan beden dilleri, mimik, jest ve hareketleri yolu ile karşılarındaki bireylere aktarılması anlamına gelen duygusal bulaşma (Hatfield, Cacioppo ve Rapson, 1994) özellikle öğretmen duygularının öğrenci duyguları üzerindeki etkisine dikkat çekmektedir. Alan yazında öğretmenlerin olumlu ya da olumsuz olarak deneyimledikleri birçok farklı duygunun öğrenci duygularını tetiklediğine yönelik çeşitli çalışmalar mevcuttur (Becker, Goetz, Morger ve Ranellucci, 2014; Frenzel, Goetz, Lüdtke, Pekrun ve Sutton, 2009).

Reinhard Pekrun tarafından ortaya konulan denetim-değer kuramına (2006) göre "akademik faaliyet ya da çıktılarla doğrudan ilişkili duygular" (sf. 317) olarak tanımlanan başarı duyguları kavramı öğrencilerin bir dersi dinlerken ve çalışırken, ödev yaparken, sınav olurken ya da bahsedilen tüm bu akademik faaliyetler kapsamında başarılı ya da başarısız olma hallerinde deneyimledikleri duygular olarak kabul görmektedir (Pekrun, 2006). Diğer bir deyişle denetim-değer kuramı, süreç ve sonuç odaklı akademik duygulara aynı anda odaklanmaktadır (Pekrun vd.,2011). Duygular, bu kurama göre değer, etkinlik derecesi ve nesne odaklılık boyutları olmak üzere üç boyutlu taksonomiye göre sınıflandırılmaktadır (Pekrun, 2006). Bu kapsamda, haz, gurur, umut ve rahatlama gibi duygular pozitif; kaygı, öfke, utanç, umutsuzluk ve bıkkınlık duyguları ise negatif duygular kategorisinde yer almaktadır. Etkinlik derecesine göre ise haz, gurur ve umut pozitif etkin, rahatlama pozitif etkin olmayan; kaygı, öfke ve utanç negatif etkin, bıkkınlık ve umutsuzluk ise negatif etkin olmayan duygular olarak sınıflandırılmaktadır. Bu bağlamda pozitif etkin duyguları deneyimleyen öğrenciler öğrenme süreçlerini kolaylıkla yönetebilmekte iken pozitif etkin olmayan duyguları deneyimleyen öğrenciler öğrenme hızlarını görece azaltma eğilimi göstermektedirler. Öte yandan, negatif etkin duyguları deneyimleyen öğrenciler zorluklarla mücadele yoluna gitmekte ve olası başarısızlıklardan kaçınma eğilimi göstermektedirler. Son olarak negatif etkin olmayan duygular öğrencilerin yeteneklerine dönük algılarını olumsuz olarak etkilemektedir (Chiang ve Liu, 2014). Nesne odaklılık boyutuna göre ise üzerinde çalışılan etkinliğe duyulan haz, bıkkınlık ve öfke gibi duygular faaliyet odaklı duygular iken bu faaliyetin neticesinde hissedilen umut, gurur, rahatlama, kaygı, umutsuzluk ve utanç gibi duygular sonuç odaklı duygular olarak belirtilmektedir. Sonuç odaklı duygular kendi arasında ileriye ve geriye dönük sonuç odaklı duygular olarak ikiye ayrılmaktadır (Pekrun, 2006; Pekrun ve Stephens, 2010; Pekrun vd., 2002a; 2011).

Denetim-değer kuramı ve bu kuram kapsamında ortaya konulan başarı duyguları modeline göre başarı duygularının oluşumunda bilişsel değerlendirmeler olarak kabul gören öznel denetim ve öznel değer bileşenlerinin etkisi büyüktür. Öğrencilerin herhangi bir etkinliğe yönelik gösterdikleri çaba ve eylemleri ya da bu etkinlik neticesinde elde edilen sonuçların algılanan değerleri olarak ifade edilen öznel değer, içsel ya da dışsal kaynaklı olabilmektedir. Buna göre, içsel değer eylem ya da sonuçların getireceği fayda düşünülmeksizin değerlendirilmesi iken dışsal değer, eylem ya da sonuçların getireceği faydaya göre değerlendirilmesidir (Pekrun, 2006; Pekrun, Frenzel, Goetz ve Perry, 2007). Öte yandan, öznel denetim öğrencilerin ulaşmak istediği sonuçlara ne kadar etkili bir şekilde ulaşabileceklerini ve istemedikleri sonuçlardan kendilerini ne kadar etkin bir şekilde koruyabilecekleri anlamına gelmektedir (Frenzel ve Stephens, 2013; Pekrun, 2006; Pekrun vd., 2007; Pekrun vd., 2002a). Bu kapsamda, bireylerin özyeterlik inançları öznel denetim değerlendirmeleri olarak değerlendirilebilir. Bandura (1997) tarafından kişinin herhangi bir faaliyeti gerçekleştirebileceğine yönelik inancı olarak tanımlanan özyeterlik, bireylerin eylemlerini ve seçimlerini etkilemenin yanında onların karşılaştıkları zorluklarla baş etmeye yönelik gösterdikleri direnç ve sarf ettikleri çabayı da etkilemektedir. Ayrıca, özyeterlik inançları yüksek bireyler başarısız oldukları hallerde bu durumu sarf ettikleri çabanın yetersiz oluşu ya da bilginin yanlış kullanımı gibi durumlara bağlarken, özyeterlik inançları düşük kimseler ise başarısızlık durumlarını kendi beceri ya da yeteneklerine dönük eksikliğe bağlamaktadırlar. Dolayısıyla, özyeterliği düşük grubun stres ya da kaygı gibi negatif duygu durumlarını deneyimleme durumu öz-yeterliği yüksek bireylere göre daha fazladır (Pajares, 1996). Mevcut çalışmalar incelendiğinde öğrencilerin akademik özyeterlik inançları ile öğrencilerin başarı duyguları arasında karşılıklı bir ilişki olduğu görülmektedir. Bu ilişkinin olumlu duygular için pozitif, olumsuz duygular için ise negatif yönde olduğu bu çalışmaların sonuçları arasındadır (i.e., Marchand & Gutiernes, 2012; Nie, Lau ve Liau; 2011; Pekrun, Goetz, Perry, Kramer, Hochstat ve Molfenter, 2004).

Denetim-değer kuramı kapsamında öne sürülen başarı duyguları modeline göre denetim ve değer değerlendirmeleri dışında bilişsel nitelik, motivasyonel nitelik, özerklik desteği, hedef yapıları ve beklentileri, dönüt ve başarı sonuçları, başarı hedefleri ve inançlar gibi bireysel ve çevresel olmak üzere diğer faktörler de başarı duygularının oluşumunda önemli rol oynamaktadır. Özellikle, öğretimin bilişsel ve duyusal niteliğinin öğrencilerin denetim ve değer değerlendirmeleri dolayısıyla başarı duyguları üzerindeki etkisi büyüktür. Örneğin, öğretmenlerin konuları kapsamlı ve açık bir şekilde ve gerçek hayatla bağlantılar kurarak anlatması ve öğretmenlerin ders anlatmaktan duyduğu memnuniyet öğrencilerin denetim ve değer öncüllerini etkilerken öğrencilerin akademik duyguları da bu doğrultuda etkilenmektedir (Becker vd.,2014; Bieg, Goetz, Sticca, Brunner, Becker, Morger ve Hubbard, 2017). Eğer öğretimin zorluk derecesi, öğrencilerin yetenekleri ve aldıkları destek onların ihtiyaçlarını karşılamıyorsa, öğrencilerin yaptıkları işe yönelik denetim ve değer değerlendirmeleri düşük olmakta ve akademik duyguları da buna bağlı olarak olumsuz anlamda değişmektedir (Pekrun, 2009).

Öğrencilerin gelişim özellikleri dikkate alındığında 7. ve 8. sınıf öğrencilerinin ergenlik dönemine yeni girmeleri ve bu dönemin öğrenciler üzerindeki psikolojik, fizyolojik ve çevresel etkilerinin yanında bu yılların ortaöğretime geçişte prestijli bir lise ve sonrasında iş garantisi olan bir bölüme girebilmek ve uzun vadede başarılı bir kariyer sahibi olabilmek için çok önemli zaman aralıkları olarak görülmesi öğrencilerin hissettikleri baskıyı daha da artırmakta ve öğrenciler öğrenme ortamlarında çok çeşitli duyguları deneyimlemektedir. Denetim-değer kuramı kapsamında, denetim ve değer değerlendirmelerinin konu alanına bağlı olarak değişmesinden dolayı bu öncüllerin bir ürünü olan akademik duyguların da konu alanına bağlı olarak değiştiği düşünülmektedir (i.e., Goetz, Frenzel, Pekrun ve Hall, 2006; Goetz, Frenzel, Pekrun, Hall ve Lüdtke, 2007; Goetz, Frenzel, Hall ve Pekrun, 2008). Matematik bu alanlardan biri olmakla birlikte duyusal değişkenlerden bir hayli etkilenmektedir. Ayrıca, matematik dersi yapısı itibariyle mevcut öğretim programı içerisinde diğer disiplinlere göre bir adım öne çıkmaktadır. Çünkü matematik; fen, istatistik, mühendislik ve sanat gibi birçok farklı disiplinle yakından ilişkili olmasına rağmen ilkokul, ortaokul, lise ve yükseköğretim de dahil olmak üzere farklı yaş grubu ve kültürden öğrenci için korkulan bir bilim dalıdır. Özellikle PISA (Uluslararası Öğrenci Değerlendirme Programı) ve TIMMS (Uluslararası Matematik ve Fen Eğilimleri Araştırması) gibi öğrencilerin çok yönlü bilgi ve beceri düzeylerini belirlemek amacıyla yapılan uluslararası sınavlarda Türkiye matematikte uluslararası ortalamanın gerisinde kalmaktadır. Benzer şekilde, TIMMS sonuçları değerlendirildiğinde ise Türkiye'deki sekizinci sınıf öğrencileri matematik başarısında katılımcı ülkeler içerisinde 2011 ve 2015 yıllarında 24. sırada ve TIMMS ortalamasının altındadır (MEB, 2014; MEB, 2016). Bu durum Türkiye'deki öğrencilerin diğer ülkelerle karşılaştırıldığında matematik alan yeterlilikleri açısından beklenilen düzeyde olmadığını göstermektedir. Özellikle, matematik dersine ilgi duyan, matematik öğrenmeyi seven ve matematik dersinde kendine güvenen öğrencilerin sayıları tüm öğrenciler içerisinde daha az bir yüzdelik dilime sahip olmakla birlikte bu öğrencilerin başarı ortalamalarının 2011 ve 2015 yıllarında birbirleri ile tutarlı bir şekilde diğer öğrencilerden daha yüksek olduğu sonucu (MEB,

2016) matematik başarısında duyusal değişkenlerin önemine dikkat çekmektedir. Benzer şekilde, OECD verilerine göre Türkiye'deki öğrencilerin matematik özyeterliklerinin OECD ortalamasının gerisinde; matematik kaygılarının ise OECD ortalamasının üstünde olduğu görülmektedir (Eğitim Reformu Girişimi, 2013). Bu bağlamda, 7. ve 8. sınıf öğrencilerinin matematik dersinde deneyimledikleri duygu ve özyeterliklerini derinlemesine incelemek matematik başarısını artırmada akademik duygulardan nasıl yararlanabileceğine yönelik çıkarımlarda bulunmak açısından önem kazanmaktadır.

Öte yandan, öğretmenliğin sosyal ve kişiler arası etkileşim gerektiren bir meslek olduğu gerçeği, dikkati öğretmenlerin sahip olması gereken bazı kişilik özelliklerine çekmektedir. Bu kişilik özellikleri arasında öğretime yönelik yüksek özyeterlik ve öz-güven, hoşgörülü, ılımlı, pozitif, esprili, insancıl ve dinamik olma gibi 21. yy. öğretmen yeterlikleri arasında gösterilen bazı önemli kişilik özellikleri yer almaktadır (Akın, 2017). Öğretimin duygu yoğunluğu yüksek bir meslek olduğu düşünüldüğünde öğretmenler sahip oldukları kişilik özellikleri ile ilintili olarak öğrenme ve öğretim ortamlarında çok çeşitli duyguları deneyimlemektedir. Öğretmenlerin deneyimledikleri duyguların onların meslek doyumu ya da mesleklerinde başarılı olabileceklerine yönelik inançları üzerindeki etkisi yadsınamaz bir gerçektir. Bu durum konu alanına bağlı olarak incelendiğinde, TIMMS sonuçlarına göre, matematik öğretmenlerinin meslek doyumu ve matematik öğretiminde kendilerine güvenlerinin artmasının öğrencilerinin matematik başarılarına olumlu yönde etki ettiği sonucu bulunmuştur (MEB, 2014, 2016). Öğretmen duyguları, öğretimin niteliği ve öğretmenlerin sınıflarında uyguladıkları öğretim yöntem ve stratejileri ile yakın bir ilişki içerisindedir. Öğretmenin dersi açık ve anlaşılır bir şekilde anlatması, öğretilen konu ile gerçek hayattan bağlantılar kurması, öğretmenin öğretmeye dönük heves ve isteği öğrencilerinin denetim ve değer değerlendirmeleri ve dolayısıyla başarı duyguları üzerinde etkilidir (Becker vd., 2014; Bieg vd., 2017; Goetz, Lüdtke, Nett, Keller ve Lipnevich, 2013). Bu kapsamda, öğretmenlerin öğretim özellikleri ve öğrenci duyguları arasındaki ilişkinin matematik, fizik ve yabancı diller gibi farklı disiplin ve yaş gruplarında nasıl değiştiğini anlamaya yönelik çalışmalarda öğretmenlerin derste anlaşılırlığı, dersi örneklerle açıklaması, ders anlatma şevki, öğrencinin dikkatini toplayabilmesi gibi öğretim özellikleri ile öğrencilerin zevk ve gurur duyguları arasında pozitif; öfke, çaresizlik ve bıkkınlık duyguları arasında ise negatif yönde bir ilişki bulunmuştur. Öte yanda, öğretimin açık olmaması, zorluk derecesi, temposu ve öğretmenin öğrencilerden beklenti seviyesi boyutları ile öğrencilerin öfke, çaresizlik ve bıkkınlık duyguları arasında pozitif; zevk ve gurur duyguları arasında ise negatif yönde bir ilişki bulunmuştur (Goetz ve ark, 2013, 2019).

Öğretmenlerin öğretim özelliklerinin yanı sıra öğrencilere sağladığı duyusal destek de öğretimin niteliğini etkileyen değişkenlerden biri olarak kabul gören destekleyici ortam çerçevesinde değerlendirilebilir. Buna göre öğretmenlerin öğrencilere gösterdiği ilgi, alaka, saygı, yakınlık, verdiği değer ve destek öğrencilerin olumlu duyguları ve ilgili derse dönük başarıları ile pozitif, olumsuz duyguları ile ise negatif bir ilişki içerisindedir (Den Brok, Fisher ve Scott, 2005; Fisher, Waldrip ve Den Brok, 2005; Patrick, Turner, Meyer ve Midgley, 2003; Telli, Den Brok ve Cakiroglu, 2010; Sakız, Pape ve Woolfolk-Hoy, 2012; Sakız, 2012, 2017). Dolayısıyla, öğretmenlerin öğrencilerine sağladığı duyusal destek öğrencilerin bilişsel, duygusal ve motivasyonel iyi oluşları üzerinde kritik bir öneme sahiptir (Sakız vd., 2012) ve öğretmenlerin öğretimlerinde öğrencilerini destekleyici, ödüllendirici ve aktif olarak onları dinleyen bir tutum sergilemeleri öğrencilerin kaygı gibi ilgili derse yönelik olumsuz duygu durumlarını en aza indirmelerine yardımcı olurken (Palmer, 2007) öğrencilerin öğrenme ve derse katılımlarına katkıda bulunmaktadır (Becker ve Luthar, 2002).

Alan yazında, ortaokul ve lise öğretmenlerinin ilkokul ve okul öncesi düzeydeki öğretmenlerle karşılaştırıldığında öğretmen ve öğrenci ilişkisine yeteri kadar önem vermedikleri göze çarpmaktadır (Sakız,2017). Bu bağlamda, öğrencilerin akademik anlamda deneyimledikleri duyguları ve bu duyguların sebep ve sonuçlarını daha kapsamlı olarak açıklayabilmek adına ortaokul düzeyinde öğretmen ve öğrenci duygularının ilişkisini ortaya koyan çalışmalara ihtiyaç duyulmaktadır. Özellikle öğrenciler açısından yukarıda bahsedilen tüm bu süreçler göz önüne alındığında matematik öğretmenlerinin akademik duyguları diğer disiplinler içerisinde daha dikkat çekici bir hale gelmektedir.

Mevcut alan yazın düşünüldüğünde, öğretmen ve öğrenci duyguları arasındaki ilişkinin bahsedilen değişkenler açısından ele alan çalışmaların ulusal literatürde yeni yeni yer almaya başlaması ve uluslararası literatürde ise çoğunlukla bireysel kültürlerde çalışılması, Hofstede'nin (1980) kültürel boyutlar teorisine göre kolektivist bir kültür olan Türkiye'de bu çalışmanın yürütülmesi ulusal düzeyde yapılacak diğer çalışmalara ışık tutmasının yanında uluslararası boyutta bu konuda yapılacak kültürel karşılaştırma çalışmalarına olanak sağlaması açısından da önemlidir. Bu bağlamda, öğrenci duygularının oluşumunda rol oynayan muhtemel sebepler, öğretmen-öğrenci ilişkisi ve öğretimin niteliğine yansımalarına dönük çıkarımların yapılması hususunda alan yazına katkıda bulunması amaçlanmıştır. Ayrıca, Öğretmen Duyguları Ölçeği ve Öğretimin Algılanan Niteliği Ölçeği'nin Türkçe'ye çeviri ve uyarlaması bu araştırma kapsamında gerçekleştirilmiştir. Son olarak, araştırmanın nicel boyutunda önerilen teorik modellerin bulguları ışığında öğrenci duygularının sebeplerini öğrenme-öğretim süreçleri ve öğrenci-öğretmen etkileşimi bağlamında derinlemesine incelemek için nitel verilerden yararlanılmıştır. Dolayısıyla bu çalışma, araştırma gruplarının çeşitliliği, mevcut araştırma problemi ve araştırma sorularına cevap vermek için uygulanan araştırma deseni ve veri analiz yöntemi açısından ulusal ve uluslararası alan yazına katkıda bulunmaktadır. Bu bağlamda, araştırma soruları aşağıda verilmektedir.

Araştırma Soruları

1. Ortaokul matematik öğretmenlerinin akademik duyguları, özyeterlik ve tükenmişlik hissi arasında nasıl bir ilişki bulunmaktadır?
2. Yedinci ve sekizinci sınıf öğrencilerinin matematik özyeterlik inançları, öğretimin algılanan niteliği, algılanan öğretmen duygusal desteği ve matematik öğretmenlerinin akademik duyguları, öğrencilerin matematik başarı duyguları ile nasıl ilişkilidir?

a. Yedinci ve sekizinci sınıf öğrencilerinin matematik özyeterlik inançları, öğretimin algılanan niteliği, algılanan öğretmen duygusal desteği ve matematik başarı duyguları nasıl ilişkilidir?
b. Yedinci ve sekizinci sınıf öğrencilerinin matematik başarı duyguları ile matematik öğretmenlerinin akademik duyguları nasıl ilişkilidir?

3. Öğretmenlerin, öğrencilerinin matematik başarı duygularının, öğrenim süreci ve matematik öğretmenleri ile etkileşimi yoluyla nasıl şekillendiğine yönelik algıları nelerdir?

Yöntem

Desen

Bu çalışmada, Leech ve Onwuegbuzie'nin (2009) üç boyutlu karma desen taksonomisine göre kısmi, sıralı ve nicel ağırlıklı karma yöntem uygulanmıştır. Diğer bir deyişle, çalışmanın nicel boyutu tüm araştırma kapsamında baskın olarak görülmekle birlikte nitel bulgular nicel bulgulara destek sağlamak ve öğrencilerin matematik dersinde deneyimledikleri duyguların mevcut sebeplerini öğrenme-öğretim süreci ve öğrenci-öğretmen ilişkileri bağlamında derinlemesine incelemek amacıyla yürütülmüştür.

Örneklem

Çalışmanın evrenini İstanbul'da devlet ortaokullarında çalışan matematik öğretmenleri ve onların 7. ve 8. sınıf öğrencileri oluşturmaktadır. İstanbul'da tüm ilçelere ulaşımın zaman ve maliyet açısından zorluğu düşünülüp, okul sayılarının ilçelere göre dağılımı ve ilçeler arasındaki sosyoekonomik ve bölgesel farklılıklar da göz önünde bulundurulmuştur. Çalışmanın ulaşılabilir evrenini Bahçelievler, Beyoğlu, Beşiktaş, Esenler, Eyüp, Fatih, Kağıthane, Pendik, Şişli, Üsküdar ve Zeytinburnu ilçelerindeki devlet ortaokullarında görev yapan matematik öğretmenleri ve onların 7. ve 8. sınıf öğrencileri oluşturmaktadır.

İstanbul İl Milli Eğitim Müdürlüğü (2017) verilerine göre ulaşılabilir evren içerisinde toplam 1100, seçili ilçelerde ise toplam 235 devlet ortaokulu bulunmaktadır. Ulaşılabilir evren içerisinde örneklemi belirleyebilmek için ilk olarak bu ilçelerdeki devlet ortaokulları sayısının %25'ine ulaşılmaya çalışılmıştır. Araştırma kapsamında her bir ilçedeki toplam okul sayısının evren içindeki oranı düşünüldüğünde 59 okul küme örnekleme yöntemi ile seçilmiş ve bu okullardan 53 tanesi çalışmaya gönüllü olarak katılmıştır.

İstanbul İl Milli Eğitim Müdürlüğü (2017) verilerine göre örneklem içerisindeki devlet ortaokullarında toplam 1383 matematik öğretmeni çalışmaktadır. Sonuçları ulaşılabilir evrene genelleyebilmek için bu çalışmada Dillman'ın (2007) %95 güven aralığı ve ±%5 hata payı formülüne göre 300 matematik öğretmenine ulaşılması planlanmıştır. Öte yanda, araştırma soruları kapsamında 7. veya 8. sınıf matematik öğretmenlerinin katılımı sağlanmaya çalışıldığından ulaşılması planlanan öğretmen sayısının altında bir sayının katılımı sonuçların genellenebilirliği açısından bir sorun teşkil etmemektedir. Bu bağlamda, katılımcı okullar içerisinde 222 ortaokul yedinci ve sekizinci sınıf matematik öğretmeni gönüllü olarak bu çalışmaya katılmıştır. Katılımcıların %66,7'sini kadın öğretmenler (n = 148) oluşturmaktadır. Ayrıca, öğretmenlerin %87,8'i lisans (n=195), %11,7'si lisansüstü (n=26), %0,50'si ise ön lisans derecesine sahiptir. Öğretmenlik meslek deneyimleri ise ortalama 11 yıldır. Katılımcı öğretmenlerin 7. ya da 8. sınıf öğrencileri de çalışmanın öğrenci örneklemini oluşturmaktadır. Bu bağlamda, 5475 ortaokul yedinci ya da sekizinci sınıf öğrencisi bu çalışmaya katılmıştır. Öğrencilerin %46,5'i (n=2547) erkek öğrencidir. Ayrıca, çalışmaya yedinci sınıftan 2981 (%54,4), sekizinci sınıftan 2494 (%45,6) öğrenci katılmıştır. Öğrencilerin bir önceki yılki ortalama matematik başarı puanları 79,54'tür.

Elde edilen nicel verilerin ön analizi yapılarak araştırmanın nitel boyutu kapsamında görüşme yapılacak öğretmenler maksimum çeşitlilik ve kolay ulaşılabilir durum örneklemesi ile seçilmiştir. Bu bağlamda, çalışmanın birinci aşamasında öğrencilere uygulanan Matematik Başarı Duyguları Ölçeği'nde yer alan kaygı, öfke ve zevk boyutlarının katılımcı sınıflar için ortalamaları hesaplanmış ve ortalaması en yüksek ve en düşük olan üçer sınıfın matematik öğretmenleri yüz-yüze görüşme yapmak üzere seçilmiştir. Maksimum çeşitlilik örneklemesi ile seçilen öğretmenler dışında nicel verilerin toplanması esnasında yüz-yüze görüşmeye katılmayı çok istediğini belirten öğretmenler de bu örnekleme dahil edilmiştir. Sonuç olarak, araştırmanın ilk aşamasının yürütüldüğü Beşiktaş (*n*=1), Fatih (*n*=2), Eyüp (*n*=2), Kağıthane (*n*=4), Üsküdar (*n*=3) ve Şişli (*n*=2) ilçelerinde görev yapmakta olan 14 ortaokul matematik öğretmeni ile yüz-yüze görüşmeler yürütülmüştür. Katılımcı öğretmenlerin büyük bir çoğunluğu kadın öğretmenlerden oluşmaktadır (*n*=12). Öğretmenlerin mesleki deneyimleri 30-35 yıl arasında değişmektedir. Görüşmeye katılan öğretmenlerden beşi lisansüstü eğitim, dokuzu ise üniversitelerin matematik ya da matematik eğitimi bölümlerinden lisans derecelerine sahiptir.

Veri Toplama Araçları

Araştırmada nicel veriler öğretmen ve öğrenci anketleri, nitel veriler ise öğretmen görüşme formu aracılığıyla toplanmıştır. Öğretmen ve öğrenci anketlerinin ilk geçerlik ve güvenirlik analizleri için iki ayrı pilot çalışma yürütülmüştür. İlk pilot çalışmada seçili bölgelerdeki matematik öğretmeni sayısı ve öğretmen ölçeklerinde yer alan toplam madde sayıları düşünüldüğünde, ölçekler matematik, sosyal bilgiler, fen ve teknoloji ve Türkçe olmak üzere dört ana dersin öğretmenlerine uygulanmıştır. Bu kapsamda, Beyoğlu (*n*=5), Kartal (*n*=4), Üsküdar (*n*=4), ve Şişli (*n*=2) ilçelerindeki devlet ortaokullarında çalışan toplam 164 öğretmenin gönüllü katılımı sağlanmıştır. Öğretmenlerin %67,7'si kadın öğretmenlerden (*n*=111) oluşmaktadır. Katılımcı öğretmenlerin konu alanlarına göre dağılımı şu şekildedir: Türkçe (*n*=56; %34,1), matematik (*n*=50; %30,5), fen ve teknoloji (*n*=32; %19,5) ve sosyal bilgiler (*n*=18; %11).

Öğrenci ölçekleri düşünüldüğünde Beyoğlu (*n*=5), Kartal (*n*=3), Üsküdar (*n*=2) ve Şişli (*n*=2) ilçelerindeki devlet ortaokullarında öğrenim görmekte olan toplam 493 yedinci sınıf öğrencisi birinci pilot çalışmaya katılmıştır. Öğrencilerin cinsiyete göre dağılımları birbirine yakın olmakla birlikte öğrencilerin %51,3'ü erkektir. Geçerlik ve güvenirlikle ilgili ortaya çıkan sorunları çözmek amacıyla yürütülen ikinci pilot çalışmaya ise Kartal (*n*=1) ve Üsküdar (*n*=2) ilçelerinden toplam 490 öğrenci katılmıştır. Katılımcılardan %64,9'u yedinci sınıf (*n*= 318), %35,1'i ise sekizinci sınıf öğrencisidir (*n*= 172). Öte yandan, katılımcıların %49,6'sı erkek öğrencidir (*n*=243).

Pilot çalışmalar kapsamında öğretmen ve öğrenci anketlerinde yer alan ölçeklerin ilk geçerlik ve güvenirlik analizleri yürütülmüştür. Ayrıca, ana çalışmada uygulanan ölçeklerin geçerlik ve güvenirlik analizleri tekrar edilmiş ve raporlanmıştır.

Öğretmen Duyguları Ölçeği: Frenzel vd. (2016) tarafından öğretmenlerin genel ve belli bir öğrenci grubuna yönelik akademik duygularını ölçmek için geliştirilen ölçeğin Türkçe'ye çeviri ve uyarlaması araştırmacı tarafından yürütülmüştür. Bu araştırma kapsamında belli bir öğrenci grubuna dönük akademik duygular bölümü kullanılmıştır. Ölçek; zevk (4 madde), kaygı (4 madde) ve öfke (4 madde) olmak üzere üç temel duygu durumunu ölçmektedir. Ölçek maddeleri "kesinlikle katılmıyorum" (1) dan "kesinlikle katılıyorum" (4) a doğru değişen yanıtlama sistemine göre cevaplandırılmaktadır. Yapı geçerliğini sağlamak için uygulanan Doğrulayıcı Faktör Analizi (DFA) ile elde edilen sonuçlar üç boyutlu duygu modelini (CFI= .96, NNFI= .95, RMSEA= .065, SRMR=.05) desteklemektedir. Ayrıca, ölçekteki her bir duygu boyutunun iç tutarlık katsayıları şu şekildedir: zevk (α= .90), öfke (α= .87), ve kaygı (α= .75).

Öğretmen Özyeterlik Ölçeği: Tschannen-Moran ve Woolfolk Hoy (2001) tarafından öğretmen ve öğretmen adaylarının özyeterlik inançlarını ölçmek amacıyla geliştirilmiştir. Ölçeğin Türkçe'ye çeviri ve uyarlaması Çapa-Aydın, Çakıroğlu ve Sarıkaya (2005) tarafından yapılmıştır. 24 maddelik uzun ve 12 maddelik kısa versiyonları mevcut olan ölçekte her bir madde 9'lu derecelendirme skalasına göre cevaplandırılmaktadır. Ölçek, öğrenci katılımına dönük özyeterlik, öğretim stratejilerine dönük özyeterlik ve sınıf yönetimine dönük özyeterlik olmak üzere üç boyuttan oluşmaktadır. Araştırma kapsamında 24 maddelik uzun versiyon kullanılmıştır. Yapı geçerliğini sağlamak için yapılan DFA ile elde edilen değerler orijinal ölçekle uyum içerisinde ve şu şekildedir: CFI= .99, NNFI= .98, RMSEA= .067, SRMR= .02. Ayrıca, her bir boyut için bakılan iç tutarlılık katsayıları şu şekildedir: öğrenci katılımına dönük özyeterlik (8 madde, α= .85), öğretim stratejilerine dönük özyeterlik (8 madde, α= .89), sınıf yönetimine dönük özyeterlik (8 madde, α = .93).

Maslach Tükenmişlik Envanteri-Eğitimci Formu: Eğitimcilerin tükenmişlik seviyelerini ölçmek için Maslach vd. (2010) tarafından geliştirilen envanterin Türkçe'ye çeviri ve uyarlaması İnce ve Şahin (2015) tarafından yapılmıştır. Envanter 7'li Likert tipinde, 22 madde ve üç boyuttan oluşmaktadır. Bu boyutlar: duygusal tükenme (9 madde), duyarsızlaşma (5 madde) ve bireysel başarıdır (8 madde). Her bir boyuttan alınabilecek en düşük puan 0 (hiçbir zaman) ve en yüksek puan ise 6 (her gün)'dır. Türkçe adaptasyonun yapı geçerliği hakkında bilgi sağlamak amacıyla yapılan DFA neticesince elde edilen uyum iyiliği değerleri şu şekildedir: CFI= .91, NNFI= .90 ve RMSEA= .058, SRMR= .08. Ayrıca, Cronbach alpha katsayıları kişisel başarı boyutu için .73, duyarsızlaşma boyutu için .73 ve duygusal tükenme boyutları için .91 olarak bulunmuştur.

Matematik Başarı Duyguları Ölçeği: Pekrun vd. (2005) tarafından farklı yaş gruplarında ve öğrenim seviyelerinde öğrenim görmekte olan öğrencilerin matematiğe yönelik yedi farklı duygu durumunu ölçmek amacıyla geliştirilmiştir. Ölçeğin, Türkçe'ye çeviri ve uyarlaması Çalık ve Çapa-Aydın (2019) tarafından yapılmıştır. 5'li Likert tipinde 60 maddeden oluşan ölçek, öğrencilerin derse yönelik (18 madde), öğrenmeye yönelik (19 madde) ve sınava yönelik (23 madde) olmak üzere farklı öğrenme ortamlarında deneyimledikleri duygu durumlarını ölçmektedir. Bu çalışmada, kaygı, öfke ve zevk olmak üzere üç duygu durumuna bakılmıştır. Ölçeğin psikometrik özellikleri hakkında bilgi sağlamak amacıyla yapılan DFA neticesinde elde edilen uyum indeks değerleri şu şekildedir: CFI= .96, NNFI= .93, RMSEA= .12 ve SRMR= .03. Ayrıca, iç tutarlılık katsayıları şu şekildedir: α= .84 (zevk,10 madde), α= .89 (öfke, 9 madde), α= .91 (kaygı, 15 madde).

Öz-Düzenlemeye Yönelik Özyeterlik Ölçeği: Bandura'nın (2006) Çokboyutlu Özyeterlik Ölçeği'nden yararlanılarak Usher (2007) tarafından öğrencilerin matematik dersinde öz-düzenlemeye yönelik özyeterlik inançlarını ölçmek amacıyla geliştirilmiştir. Ölçeğin Türkçe'ye çeviri ve uyarlaması araştırmacı tarafından yapılmıştır (Çalık, 2014). Toplam 11 maddeden oluşan ölçekte cevaplar 6'lı derecelendirme tipinde "hiç iyi değilim" (1) den "çok iyiyim" (6) e doğru yanıtlanmaktadır. Yapı geçerliğini sağlamak için gerçekleştirilen DFA sonuçları ölçeğin tek boyutlu yapısını doğrulamaktadır (CFI= .97, NNFI= .96, RMSEA= .042, SRMR= .03) Ölçeğin iç tutarlılık katsayısı .89'dur.

Öğretimin Algılanan Niteliği Ölçeği: Goetz vd. (2013) tarafından öğretimle ilgili çeşitli özelliklerin ölçüldüğü ilgili çalışmalarda kullanılan ölçek maddelerinin adaptasyonuyla tek bir ölçek içerisinde toplanmıştır. Bu kapsamda, anlaşılırlık, örneklerle açıklama seviyesi, öğretmenin şevki, dikkati toplama, açıklıktan uzaklık, zorluk, tempo ve beklenti derecesi olmak üzere sekiz farklı öğretim özelliğine değinilmektedir. 5'li Likert tipinde olan ölçek destekleyici sunuş biçimi ve aşırı ders talepleri olmak üzere iki boyuttan oluşmaktadır. I. pilot çalışma sonucunda aşırı ders talepleri boyutunun güvenirliğini yükseltmek amacıyla bu boyuta bir madde eklenmiş ve ikinci pilot çalışma yapılmıştır. Pilot ve ana çalışmalar neticesinde aşırı ders talepleri boyutunda problem gösteren bir madde ölçekten çıkarılmıştır. Ölçeğin yapı geçerliğini test etmek amacıyla yapılan DFA sonucunda ölçek maddeleri orijinal ölçekle uyum göstermektedir (CFI= .95, NNFI= .92, RMSEA= .0857 ve SRMR= .53). İç tutarlılık katsayıları ise sırasıyla şu şekildedir: destekleyici sunuş biçimi (4 madde, α=.79) ve aşırı ders talepleri (4 madde, α= .67).

Öğretmen Yapıcı Duygusal Desteği Ölçeği: Sakız (2017) tarafından öğretmenlerin duyusal karakter özelliklerinin öğrencileri tarafından nasıl algılandığını ölçmek amacıyla daha önce Sakız (2007) tarafından geliştirilen 9 maddelik ölçeğin alan yazın bağlamında üç madde daha eklenmesi ile son haline getirilmiştir. Ölçek, 5'li Likert tipinde 12 maddeden oluşmaktadır. Yapı geçerliğini sağlamak amacıyla yapılan DFA sonuçları ölçeğin tek boyutlu yapısını doğrulamaktadır (CFI= .97, NNFI= .96, RMSEA= .051 ve SRMR= .03). Ölçeğin iç tutarlılık katsayısı .93'tür.

Yarı-Yapılandırılmış Görüşme Protokolü: Mevcut alan yazın ışığında araştırmacı tarafından hazırlanan görüşme protokolü demografik bilgi ve görüşme soruları olmak üzere iki kısımdan oluşmaktadır. Demografik bilgi kısmında öğretmenlere akademik ve mesleki yaşamları ile ilgili tanıtıcı sorular sorulmaktadır. Görüşme soruları bölümü ise öğrencilerin matematik dersinde deneyimledikleri akademik duyguların sebeplerini öğretim süreci ve öğretmen-öğrenci karşılıklı etkileşimleri çerçevesinde ortaya çıkarmayı amaçlayan daha kapsamlı soruları içermektedir. Görüşme protokolü hazırlanma sürecinde nitel araştırma yöntemleri ve ilgili araştırma konusunda uzman kişilerin görüşlerine başvurulmuştur. Son olarak, iki matematik öğretmeni ile pilot görüşme yapılarak protokole son hali verilmiştir.

Veri Toplama Süreci

Araştırma kapsamında gerekli izinler sırasıyla ODTÜ İnsan Araştırmaları Etik Kurulu Komitesi (İAEK) ve İstanbul İl Milli Eğitim Müdürlüğü'nden alınmıştır. İzinler doğrultusunda ana çalışmada kullanılacak ölçeklerin geçerlik ve güvenirliklerini sağlamak amacıyla pilot çalışma verileri örneklem grubu ile benzer özelliklere sahip öğretmen ve öğrenci gruplarından 2017-2018 Bahar ve 2018-2019 Güz dönemlerinde toplanmıştır. Ana çalışma için, nicel ve nitel veriler 2018-2019 Bahar döneminde toplanmıştır.

Nicel verileri toplama aşamasında, öğretmen ve öğrencilerin çalışmaya gönüllü katılımları sağlanmıştır. Ayrıca öğrencilerin aileleri de çalışma konusunda bilgilendirilmiş ve izinleri alınmıştır. Öğrenci ve öğretmen anketlerini uygulamadan önce araştırmanın amacı anlatılarak katılımcıların bilgilerinin gizli tutulacağının güvencesi verilmiştir. Öğrencilere ders saatleri içerisinde okul idaresi ve öğretmenlerinin izinleri alınarak uygulanan anketler, öğretmenlere öğrenci anketleri uygulanırken ya da ders arasında uygulanmıştır. Katılımcılardan gelen sorulara anında müdahale edebilmek için araştırmacı uygulama esnasında çoğunlukla sınıfta hazır olarak bulunmuştur. Nitel veri toplama süreci, nicel bulgular ışığında seçilen okullardaki öğretmenlerle yüz yüze görüşmeler yoluyla gerçekleştirilmiştir.

Veri Analizi

Araştırma verilerinin analizinde nicel ve nitel veri analiz yöntemleri kullanılmıştır. İlk olarak örneklem grubunun demografik özellikleri hakkında bilgi sağlamak amacıyla frekans, yüzde, ortalama ve standart sapma gibi betimsel istatistik değerlerine bakılmıştır. Ardından, öğretmen ve öğrencilere uygulanan ölçeklerin geçerlik analizleri için IBM SPSS 22 ve M-Plus 8.3 (Muthen ve Muthen, 2017) programları ile sırasıyla Açımlayıcı Faktör Analizi (AFA) ve Doğrulayıcı Faktör Analizi (DFA) yapılmıştır. Uygulanan ölçeklerin iç tutarlılık katsayıları için ise yine IBM SPSS 22 programı ile Cronbach alpha değerlerine bakılmıştır. Araştırma soruları kapsamında önerilen modeller Yapısal ve Çoklu Yapısal Eşitlik Modellemesi (YEM) yoluyla M-Plus 8.3 programı kullanılarak analiz edilmiştir. Önerilen modellerin eldeki verilerle istatistiksel olarak uyumlu olup olmadığını anlamak için ki kare istatistik değeri ve karşılaştırmalı uyum indeksi, normlaştırılmamış uyum indeksi, yaklaşık hataların ortalama karekökü ve standartlaştırılmış hata kareleri ortalamasının karekökü değerlerine bakılmıştır.

Nitel verilerin analizinde ise içerik analizi yöntemi uygulanmıştır. Deşifresi yapılan görüşmeler mevcut alan yazın ve eldeki verilerden çıkarılan kavramlara göre kodlanmıştır (Yıldırım ve Şimşek, 2016). Bu bağlamda, oluşturulan kodları belirli tema ve kategorilerin altında sıralamak için tümevarımsal bir yöntem uygulanmıştır (Marshall ve Rosmann, 2006). Kodlayıcılar arası uyumun sağlanması için iki uzmandan rastgele seçilen görüşme metinlerini kodlaması istenmiştir. Uzman ve araştırmacı kodlamaları karşılaştırılarak kodlayıcılar arasındaki güvenirlik sağlanmıştır. Nitel bulguların inandırıcılığı ya da bulgular yoluyla gerçeğin doğru temsilini sağlamak amacıyla derinlik odaklı veri toplama, sürekli etkileşim, kodlayıcılar arası uyum, uzman incelemesi ve pilot çalışma yöntemlerine başvurulmuştur. Aktarılabilirliği sağlamak için bulguların raporlanması kısmında, katılımcılardan alıntılar yapılarak elde edilen tema ve kategorilerin daha ayrıntılı betimlenmesi amaçlanmıştır. Ayrıca, araştırmanın transfer edilebilirliğini artırmak için katılımcılar amaçlı örnekleme yöntemine göre seçilmiştir. Son olarak teyit edilebilirliği ve tutarlığı sağlamak için araştırmanın nitel boyutunun her bir aşaması hakkında çalışmadan bağımsız bir uzmanın görüşlerine başvurulmuştur (Marshall ve Rossman, 2006; Yıldırım ve Şimsek, 2016).

Bulgular

Katılımcı öğretmenlerin matematik öğretiminden aldıkları zevkin ortalaması (*Ort*=3.23, *SS*=0.73) sırasıyla öfke (*Ort* =1.61, *SS*= 0.69) ve kaygı (*Ort* =1.59, *SS*=0.61) duygularından daha yüksektir. Öğretmenlerin sınıf yönetimine dönük özyeterlikleri (*Ort* =7.19, *SS*=1.05) de sırasıyla öğretim stratejileri kullanımına dönük özyeterlik (*Ort* =7.12, *SS*= 0.91) ve öğrenci katılımını sağlamaya dönük özyeterlik (*Ort*= 6.44, *SS*= 0.95) ortalamalarından daha yüksektir. Ayrıca, öğretmen tükenmişliği değişkeni incelendiğinde, katılımcı öğretmenlerin duyarsızlaşma (*Ort* =1.14, *SS*= 1.06) ve duygusal tükenme (*Ort* =2.23, *SS*=1.41) ortalamaları kişisel başarı (*Ort* =4.56, *SS*= 0.83) ortalamasına göre daha düşüktür.

Öğrencilerin, matematik dersinden çoğunlukla zevk aldıkları (*Ort* =3.41, *SS*= 0.82), matematiğe yönelik kaygı (*Ort* =2.66, *SS*= 0.88) ve öfkelerinin (*Ort* =2.15, *SS*=0.97) daha düşük olduğu görülmektedir. Ayrıca, algılanan öğretim niteliği bağlamında öğrenciler, öğretmenlerinin destekleyici sunuş biçimini (*Ort* =3.71, *SS*=1.11), aşırı ders talepleri (*Ort* =2.57, *SS*= 1.07) boyutuna göre daha fazla uyguladıklarını belirtmişlerdir.

Araştırmanın birinci araştırma sorusu kapsamında önerilen yapısal eşitlik modeli sonuçlarına bakmadan önce önerilen ölçme modeli DFA ile test edilmiştir. Dokuz faktörlü yapıya sahip model eldeki verilerle kabul edilebilir bir uyum göstermektedir ($\chi 2(703) = 997.31$, $p<.001$, RMSEA = .043(%90 *CI* = .037-.049), CFI = .93, NNFI = .93, SRMR = .067). YEM ile öğretmen tükenmişliği ve öğretmen özyeterlik inanç boyutları, öğretmen özyeterlik inançları ve öğretmen duyguları arasındaki ilişki test edilmiştir. Önerilen modelin uyum iyiliği indeksi değerleri kabul edilebilir düzeydedir

($\chi 2(712) = 1020.37$, p <.001), RMSEA = .044 (%90 CI = .038-.050), CFI = .93, NNFI = .92, SRMR = .07). YEM analizi sonuçlarına göre ise öğretmenlerin kişisel başarı hisleri boyutu öğretmen özyeterliği boyutlarını pozitif olarak yordamaktadır. Duygusal tükenme boyutu ise öğretmenlerin öğrenci katılımını sağlamaya dönük özyeterlikleri ile negatif bir ilişki içerisindedir. Öğretmenlerin sınıf yönetimine ve öğrenci katılımına dönük özyeterlik inançları öğretimden aldıkları zevk ile pozitif, kaygı ve öfke duyguları ile ise negatif bir ilişki içerisindedir. Öte yandan, öğretmenlerin öğretim stratejileri kullanımına dönük özyeterlik inançları ve öğretimden aldıkları zevk arasında negatif, kaygı ve öfke duyguları arasında ise pozitif bir ilişki bulunmuştur. Ayrıca, öğretmenlerin kişisel başarı hisleri öğretmenlerin kaygı, öfke ve zevk duygularını, sınıf yönetimine yönelik özyeterlik inançları, öğrenci katılımını sağlamaya yönelik özyeterlik inançları ve öğretim stratejileri kullanımına yönelik özyeterlik inançları olmak üzere muhtemel üç yol ile dolaylı olarak yordamaktadır.

Araştırmanın ikinci araştırma sorusu kapsamında öğrencilerin algılanan öğretimin niteliği, algılanan öğretmen yapıcı duygusal desteği, matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlik ve matematik duyguları arasındaki ilişkiyi test etmeden önce ilk olarak yedi faktörlü ölçme modeli test edilmiştir. Önerilen ölçme modelinin uyum iyiliği indeks değerleri kabul edilebilir düzeydedir ($\chi 2(645) = 5208.87$, $p < .001$, RMSEA = .036 (%90CI = .035-.037), CFI = .95, NNFI = .94, SRMR = .034). YEM analizi sonuçlarına göre ise test edilen model eldeki verilerle kabul edilebilir bir uyum göstermektedir ($\chi 2(642) = 4583.85$, p <.05), RMSEA = .033 (%90 CI = .033-.035), CFI = .95, NNFI = .95, SRMR = .034). Bu bağlamda, algılanan destekleyici sunuş biçimi, öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterliği inançlarını ve matematik dersinden aldıkları zevki pozitif olarak yordamaktadır. Öte yanda, algılanan destekleyici sunuş biçimi ile öğrencilerin matematiğe dönük kaygı ve öfke duyguları arasında negatif bir ilişki bulunmaktadır. Ayrıca, algılanan aşırı ders talepleri boyutu öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlik inançları ve matematik dersinden alınan zevki negatif olarak yordamaktadır. Algılanan aşırı ders talepleri boyutu, öğrencilerin matematik dersine yönelik duydukları kaygı ve öfkeyi pozitif olarak yordamaktadır. Algılanan öğretmen yapıcı duygusal desteği ile öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlik inançları arasında pozitif bir ilişki; öğrencilerin matematik dersine dönük öfkeleri arasında ise negatif bir ilişki bulunmaktadır. Son olarak, öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlikleri, öğrencilerin matematik dersinden aldıkları zevkle pozitif, matematiğe dönük kaygı ve öfkeleri ile ise negatif bir ilişki içerisindedir. Algılanan öğretimin niteliği ve algılanan öğretmen duygusal desteğinin dolaylı etkilerine bakıldığında ise öğrencilerin matematik dersinde destekleyici sunuş biçimi ve öğretmen yapıcı duygusal desteğine yönelik algılarının yükselmesi ile öğrenciler matematik dersinden özdüzenleyici öğrenmeye yönelik özyeterlik inançlarının dolaylı etkisi ile daha çok zevk almakta; daha az kaygı ve öfke duymaktadırlar. Öğrencilerin matematik dersinde aşırı ders taleplerine yönelik algıları yükseldikçe, özdüzenleyici öğrenmeye yönelik özyeterlik inançlarının dolaylı etkisi ile öğrenciler matematik dersinden daha az zevk almakta; matematik dersine yönelik kaygı ve öfkeleri artmaktadır.

Öğrenci ve öğretmenlerin matematik öğrenme ve öğretimine dönük zevk, kaygı ve öfke duyguları arasındaki ilişki çok düzeyli YEM analizi ile test edilmiştir. Çok düzeyli YEM analizi öncesi ölçme modeli çok düzeyli DFA ile test edilmiş ve sınıf içi korelasyon değerlerine bakılmıştır. Sınıf içi korelasyon değerleri .047-.096 arasında değişmektedir. Çok düzeyli DFA analizi sonuçlarına göre uyum indeks değerleri ise kabul edilebilir düzeydedir ($\chi 2(148) = 1235.19$, $p<.001$), RMSEA = .04, CFI = .96, NNFI = .95, $SRMR_{within} = .01$, $SRMR_{between} = .05$). Ayrıca, çok düzeyli YEM analizi ile önerilen model eldeki verilerle kabul edilebilir bir uyum göstermektedir ($\chi 2(154) = 1268.65$, $p < .05$, RMSEA = .037, CFI = .96, NNFI = .95, $SRMR_{within} = .013$, $SRMR_{between} = .105$). Değişkenler arasındaki doğrudan etkilere bakıldığında ise öğretmen ve öğrenci duyguları arasında anlamlı bir ilişki bulunamamıştır.

Öğrencilerinin matematik başarı duygularının öğrenme-öğretme süreci ve öğrencilerin matematik öğretmenleri ile karşılıklı etkileşimi kapsamında nasıl şekillendiğini anlamak amacıyla yapılan öğretmen görüşmeleri dört ana temadan oluşmaktadır. Bunlar öğrencilerin matematik öğrenme ve öğretiminde deneyimledikleri duygu çeşitleri, öğrencilerin matematik duygularının sebepleri, öğrencilerin matematik duygularının sonuçları ve öğrencilerin matematik duygularını düzenleme stratejileridir. Bu bağlamda, öğrenciler, matematik öğrenme ve öğretim sürecinde zevk, mutluluk, heyecan, rahatlama, hırs, tatmin, öfke, korku, umutsuzluk, üzüntü, stres ve mutsuzluk hissetmektedirler.

Öğrencilerin hissettikleri bu duygular pozitif ve negatif duyguların sebepleri olmak üzere iki alt temaya ayrılmaktadır. Öğrenciler, öğretmen kaynaklı sebepler ve öğrenci kaynaklı sebeplerden dolayı matematikte pozitif duyguları deneyimlemektedir. Öğretmen kaynaklı sebepler arasında öğretmenlerin öğretim stratejileri (örn., işbirlikli öğrenme, öğretimde kodlama, hikayeleştirme, oyunlar, ödül), öğretmenlerin destekleyici davranışları (örn., öğretmenlerin arkadaşça yaklaşımları, öğrenci problemlerine eğilmeleri, esprili bakış açıları) yer almaktadır. Öğrenci kaynaklı sebepler arasında ise matematik önbilgilerinin olması, matematik konularını kolay algılamaları, matematik konularını anlama becerileri ve duyuşsal sebepler (örn., matematik öğretmenlerini sevmeleri, başarı hissi, yarışma ve karşılaştırma hissi) yer almaktadır. Öte yandan, öğrenciler aile kaynaklı, öğrenci kaynaklı, eğitim programı ve öğretim kaynaklı ve ölçme ve değerlendirme kaynaklı sebeplerden dolayı matematikte negatif duyguları deneyimlemektedir. Aile kaynaklı sebepler arasında ailelerin matematiğe dönük beklentileri, ailelerin çocuklarını diğer çocuklarla kıyaslamaları ve ailelerin matematik notlarına dönük sert tutumları yer almaktadır. Öğrenci kaynaklı sebepler arasında başarısızlık korkusu, düşük özyeterlik ve öz-güven hissi, matematiğin kullanım alanının sorgulanması, matematiğe yönelik ilgisizlik, matematiğe karşı önyargı, çalışma becerilerine dönük problemler, öğrencilerin vazgeçmemeye yönelik isteksizliği, öğrencilerin çalışmaması, öğretmenlerinin öğretim stratejilerine uyum sağlayamamaları ve ergenlik dönemi problemleri yer almaktadır. Eğitim programı ve öğretim kaynaklı sebepler arasında matematik konularının zorluk seviyesinin artması, 7. sınıf matematik programının zorluğu ve klasik anlatma yöntemi yer almaktadır. Son olarak, ölçme ve değerlendirme kaynaklı sebepler arasında ortaöğretime yerleşme sistemi ve LGS sorularının matematik programında yer alan sorularla uyuşmaması gösterilmiştir.

Hissedilen pozitif ve negatif duygular öğrencilerde çeşitli fiziksel semptomlara ve davranışsal etkilere sebep olmaktadır. Pozitif duygular öğrencilerde gülme ve gözlerin parlaması gibi fiziksel semptomlara, duyguları öğretmenle paylaşma ve derse katılımın artması gibi davranışsal etkilere yol açmaktadır. Negatif duygular ise terleme, ağlama, gözlerin büyümesi, titreme ve kızarma gibi fiziksel semptomlara yol açarken, dersi bölme, çalışmayı veya dersi dinlemeyi bırakma, duyguları bastırma/gizleme, ders dışı davranışlar, yardım isteme ve daha fazla çalışma gibi davranışsal etkilere yol açmaktadır.

Son olarak, öğrencilerin deneyimledikleri duyguları düzenlemek için matematik öğretmenleri tarafından öğretimle ilgili ve duyuşsal destek olmak üzere iki ayrı alt tema altında çeşitli stratejiler uygulanmaktadır. Öğretmenler öğretimle ilgili olarak öğrenci merkezli öğretim, akran modelleme ve akran desteği, aktivite ve oyunlar, kolaydan zora anlatım, öğretimi öğrenci seviyesine uyarlama, öğretime ekstra zaman ayırma, yeniden anlatma, farklı ölçme yöntemleri uygulama, sürekli geribildirim verme, yardımcı kaynaklardan yararlanma, sosyal medya platformlarını kullanma, teknolojiyi kullanma, matematiği farklı disiplinlerle ve gerçek hayatla ilişkilendirme gibi stratejileri uyguladıklarını belirtmişlerdir. Ayrıca, öğretmenlerin öğrenci katılımını destekleme, öğrencilerin başarıyı deneyimlemelerini sağlama, fazla sorumluluk verme, sözlü ve beden diline dikkat etme, öğrencileri rahatlatma, öğrencilere ceza vermeme, gerektiğinde öğrencilerle bireysel görüşme gibi duyuşsal stratejileri kullandıkları görülmektedir.

Tartışma

Bu araştırmanın nicel boyutu kapsamında önerilen modeller incelendiğinde öğretmenlerin kişisel başarı hisleri ve öğretmen öz-yeterliği boyutları arasında pozitif bir ilişki; öğretmenlerin duygusal tükenme ve öğrenci katılımını sağlamaya dönük özyeterlikleri arasında ise negatif bir ilişki bulunmuştur. Ayrıca, öğretmenlerin sınıf yönetimine ve öğrenci katılımını sağlamaya yönelik özyeterlikleri onların zevk duygusu ile pozitif, öfke ve kaygı duyguları ile ise negatif bir ilişki içerisindedir. Bu bulgular alanyazındaki diğer çalışmalar tarafından da desteklenmekte ve Bandura'nın (1997) sosyal öğrenme kuramında belirttiği karşılıklı etkileşim modeli ve özyeterlik kaynaklarıyla açıklanabilmektedir. Bununla birlikte, araştırmanın kuramsal temelini oluşturan denetim-değer kuramı (Pekrun, 2006) da özyeterlik inançlarının olumlu veya olumsuz duyguların oluşumunda rol oynadığını savunmaktadır. Öte yandan, öğretmenlerin öğretim stratejilerine yönelik özyeterlik inançları ve akademik duyguları arasındaki ilişkinin yönü mevcut alanyazınla kısmen çelişmektedir. Bu durum, katılımcılar, kullanılan ölçeklerin psikometrik özellikleri ve uygulanan araştırma yöntemlerine bağlı değişebilir.

Araştırma kapsamında önerilen diğer modeller incelendiğinde ise öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlik inançları ile algılanan öğretmen yapıcı duygusal desteği ve algılanan destekleyici sunuş biçimine yönelik görüşleri ile pozitif, algılanan aşırı ders taleplerine yönelik görüşleri ile ise negatif bir ilişki bulunmuştur. Algılanan destekleyici sunuş biçimi öğrencilerin matematikten aldıkları zevk ile pozitif, kaygı ve öfke ile ise negatif ilişkilidir. Algılanan aşırı ders talepleri boyutu için ise bu ilişki tam tersi yöndedir. Algılanan öğretmen yapıcı duygusal desteği öğrencilerin matematiğe yönelik öfkelerini negatif olarak yordamaktadır. Son olarak, öğrencilerin matematik dersinde özdüzenleyici öğrenmeye yönelik özyeterlik inançları öğrencilerin matematikten duydukları zevk ile pozitif, kaygı ve öfke ile ise negatif bir ilişki içerisindedir. Bu bulgular alanyazındaki diğer çalışmalar tarafından desteklenmekte olup, denetim-değer kuramı kapsamında önerilen başarı duyguları modelinde yer alan öğretimin motivasyonel ve bilişsel niteliği boyutlarının özyeterliği nasıl etkilediği ve özyeterlik ve başarı duyguları arasındaki ilişkiye yönelik varsayımları desteklemektedir. Öte yandan, öğretmen ve öğrenci duyguları arasında anlamlı bir ilişki bulunamaması sonucu birçok açıdan önemlidir. Bu bulgu, mevcut çalışmaların genellikle tek bir duygu durumu üzerinde durmuş olması, çalışmalarda deneyim örnekleme metodu ve boylamsal araştırma deseninin uygulanmış olması bakımından değerlendirilerek düşünülmelidir.

Araştırmanın nitel boyutu kapsamında öğrencilerin matematik başarı duygularının nasıl şekillendiğini anlamak amacıyla yapılan görüşmeler neticesinde elde edilen tema ve alt-temaların başta denetim-değer kuramının temel varsayımları olmak üzere mevcut alanyazın tarafından desteklendiği görülmektedir. Tüm araştırma bulguları kapsamında geliştirilen öneriler sırasıyla verilmektedir.

Öğretmenlerin, özyeterlik inançları ve öğretmen tükenmişliğine yönelik farkındalığını artırmak için hizmet-içi eğitim kapsamında akademik çalıştaylar, seminer ve konferanslar gibi profesyonel gelişim faaliyetlerinin düzenlenmesi önerilmektedir. Bu bağlamda, sözü geçen faaliyetlerin alanında uzman kişiler tarafından verilmesi ve bu tür akademik faaliyetlerin sürdürülebilirliğinin sağlanması açısından fakülte-okul iş birliği büyük önem kazanmaktadır. Eğitim fakülteleri ve okullar arasında güçlü ve sürdürülebilir bir iş birliğinin olması kuramsal bilgilerin hayata dönüştürülmesine büyük katkı sağlayacaktır. Ayrıca, öğretmen yetiştirme programları incelendiğinde akademik duyguları ve bu duyguları düzenlemeye yönelik stratejileri içeren doğrudan bir ders bulunmamaktadır. Dolayısıyla öğretmenlerin, öğrencilerinin duygularını düzenleme ve onlara bu anlamda yardımcı olmaları kolay olmamaktadır. Bu bağlamda, öğretmen adaylarının mesleğe bu farkındalığı kazanarak başlamaları için öğretim programlarına ilgili seçmeli dersler eklenebilir.

Araştırmanın nicel ve nitel bulguları kapsamında, matematik öğrenme ortamlarının düzenlenmesi, öğretimin niteliği ve uygulanan öğretim stratejileri öğrencilerin matematiğe yönelik özyeterlik inançları ve matematik duyguları açısından büyük önem teşkil etmektedir. Hizmet-içi eğitimler kapsamında matematik öğretmenlerinin pedagojik alan bilgisi ve öğretim teknolojileri kullanım becerilerini geliştirmeye yönelik çalıştay, online eğitimler ve seminerler düzenlenebilir. Denetim-değer kuramında bahsedildiği gibi öğretmenlerin öğretimin bilişsel ve motivasyonel niteliğine özen göstermeleri gerekmektedir (Pekrun, 2006; Pekrun, 2018). Öğrencilerin öğretime dönük ihtiyaçlarını karşılamayan bir öğretim, öğrencilerin matematiğe yönelik özyeterlik inançları ve matematik duygularını olumsuz anlamda etkileyecektir. Bu bağlamda, öğrenci-merkezli öğretim aktiviteleri, öğrencilerin kendi öğrenme hedeflerini belirleyerek öğrenmeye dönük sorumluluk almaları, güçlü ve zayıf yanlarını keşfetmeleri, öğrencilerin özdüzenleyici öğrenmeye dönük deneyimlerini artıracaktır (Pekrun, 2018).

Öğrencilere, öğrendikleri bilgileri gerçek hayatta nerede kullanabileceklerini anlamalarını sağlayan öğrenme deneyimlerinin sunulması öğrencilerin matematik ile gerçek hayat arasında bağlantı kurmalarına yardımcı olacaktır. Ayrıca, öğretmenler öğrencilere açık, doğrudan ve yapıcı geribildirimler vermeli, derslerinin zorluk derecesi optimum düzeyde olmalıdır. (Artino, 2012; Paoloni, 2014; Scweinle, Meyer ve Turner, 2006). Yapıcı olmayan geribildirimler öğrenci öz-yeterliğini olumsuz anlamda etkilerken, derslerin zorluk seviyesinin çok düşük veya çok yüksek olması öğrencilerin bıkkınlık gibi olumsuz duyguları deneyimlemelerine veya dersi dinlemeyi bırakma davranışı göstermelerine neden olabilmektedir. Bu kapsamda, Bandura (1998)'nın sosyal öğrenme kuramında belirttiği gibi dolaylı yaşantılar yoluyla öğrencilerin matematik öğrenimine yönelik özyeterlikleri artırılabilir. Bunun için matematik öğretiminde öğrencilere akran desteğini sağlayan ortamların oluşturulması öğrencilerin matematik dersinde karşılaşabilecekleri zorluk ve problemlerle başa çıkmalarını kolaylaştırırken onların yetkinliklerine ve sınıfa aidiyetlerine katkıda bulunacaktır. Bu durum öğrenci şevkini ve olumlu duygularını artıran bir etkiye sahiptir.

Araştırmanın nitel bulguları, ailelerin öğrenci duyguları üzerinde kritik bir rol oynadığını ortaya koymaktadır. Aileler ve öğretmenler arasında kurulacak işbirliğinin matematikte olumlu duyguların daha fazla deneyimlenmesine katkıda bulunacağı düşünülmektedir Bu bağlamda, okul rehberlik servisleri bu işbirliğin ve öğretmen, öğrenci ve aile etkileşiminin sağlanmasında bir adım öne çıkmaktadır. Bu kapsamda, rehberlik ve psikolojik danışmanlık alanında uzmanlar tarafından öğrencilerin matematik dersinde deneyimleyebilecekleri muhtemel olumlu ve olumsuz duygular ve onları düzenlemelerine yönelik bu gruplara yönelik çeşitli seminer serileri düzenlenebilir.

Ortaöğretime geçişte uygulamaya konulan sınav sisteminin (LGS) öğrencilerin negatif duygu durumunu tetiklediği görülmektedir. Matematik öğretim programında kullanılan ders kitaplarında yer alan sorular ve sınavda sorulan sorular arasındaki uyum problemi bu duyguların sebepleri arasında gösterilmektedir. Dolayısıyla, yeni sınav sistemine dönük çalışmaların öğrencilerin duygusal olarak karşılaştıkları zorlukların azalmasına katkıda bulunacağı düşünülmektedir.

Araştırmanın sınırlılıkları düşünüldüğünde ilk olarak nicel boyut kapsamında öğretmen ve öğrenci duygularının farklı değişkenlerle ilişkisini incelemek amacıyla kesitsel ve ilişkisel araştırma deseni uygulandığı için bu değişkenler arasında neden-sonuç ilişkisinden bahsetmek mümkün değildir. Bu bağlamda gelecek çalışmalarda deneysel araştırma yöntemleri kullanılabilir. Ayrıca, boylamsal çalışmaların yapılması değişkenler arasındaki ilişkilerin daha kapsamlı yorumlanmasına olanak sağlayacaktır. İkinci olarak, bu araştırmada öğretmen ve öğrenci grupları için zevk, kaygı ve öfke olmak üzere üç temel duygu durumu üzerinde durulmuştur. Bireylerin bu duygular dışında da farklı duygular deneyimleyebileceği gerçeği göz önünde bulundurulduğunda araştırmacıların bu duygu durumlarını içeren çalışmalar yapması önerilmektedir. Üçüncü olarak, bu araştırma kapsamında veriler anket ve yüz-yüze görüşmeler yoluyla toplanmıştır. Veri toplamada uygulanan bu yöntemler öğretmen ve öğrencilerin geçmişe dönük düşüncelerine bağlı kalmaktadır. Dolayısıyla, öğretmen ve öğrencilerin anlık ifadelerine ulaşmak mümkün olmamaktadır. Bu kapsamda, gelecek çalışmalarda öğretmen ve öğrenci duygularını ölçmek için deneyim örnekleme metodu, sınıf gözlemleri, öğrenci ve ailelerle görüşme ve fizyolojik ölçümler gibi farklı yöntemler kullanılabilir.

Bu araştırmanın katılımcı grubu İstanbul devlet okullarında öğrenim görmekte olan yedinci ve sekizinci sınıf öğrencileri ve onların matematik öğretmenleri olarak belirlenmiştir. Araştırmanın genellenebilirliği açısından gelecek çalışmaların Türkiye'nin farklı şehirlerinden farklı eğitim kademelerini de içermesi önerilmektedir. Ayrıca çalışmaların farklı disiplinleri içermesi duyguların konu alanına bağlı olarak değiştiği savını test etmek açısından da önemlidir. Son olarak, gelecek çalışmalarda başarı hedefleri, duygu düzenleme stratejileri, öğrenme stratejileri, öz-düzenlemeli öğrenme ve başarı gibi duyuşsal ve bilişsel farklı değişkenleri de içeren modelleme çalışmalarının yapılması öğretmen ve öğrenci duygularına daha geniş ve bütüncül bir perspektif kazandırabilir.

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