MULTILEVEL INVESTIGATIONS OF STUDENT MOTIVATION, ENGAGEMENT, AND ACHIEVEMENT IN SCIENCE IN RELATION TO TEACHER RELATED VARIABLES

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

DEKANT KIRAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF ELEMENTARY EDUCATION

SEPTEMBER 2016

Approval of the Graduate School of Social Sciences

Prof. Dr. Tülin Gençöz
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

Prof. Dr. Ceren Öztekin
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

Assist. Prof. Dr. Sündüs Yerdelen
Co-Supervisor

Prof. Dr. Semra Sungur
Supervisor

Examining Committee Members

Prof. Dr. Jale Çakıroğlu (METU, ELE)

Prof. Dr. Semra Sungur (METU, ELE)

Prof. Dr. Yezdan Boz (METU, SSME)

Assoc. Prof. Dr. Eren Ceylan (Ankara Uni., SSME)

Assist. Prof. Dr. Yasemin Taş (Atatürk Uni., ELE)

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

Name, Last name : Dekant KIRAN

Signature :

ABSTRACT

MULTILEVEL INVESTIGATIONS OF STUDENT MOTIVATION, ENGAGEMENT, AND ACHIEVEMENT IN SCIENCE IN RELATION TO TEACHER RELATED VARIABLES

Kıran, Dekant
Ph.D., Department of Elementary Education
Supervisor: Prof. Dr. Semra Sungur
Co-Supervisor: Assist. Prof. Dr. Sündüs Yerdelen

September 2016, 500 pages

The main purpose of this study was to examine the interrelationships among teacher motivation, job satisfaction, and 7th grade students' motivation, engagement, and achievement in science. Additionally, relationships among school environment variables, teacher motivation, and job satisfaction were also investigated. The participants of the study were 134 science teachers and their 3394 students in Ankara.

A set of Hierarchical Linear Modeling analyses were used to analyze the student and teacher data and a path analysis was used to investigate the interrelationships among only teacher level variables. Student level variables included students' self-efficacy, achievement goals (mastery approach-avoidance, performance approach-avoidance), and engagement (agentic, behavioral, cognitive, and emotional). Teacher level variables included school environment variables which were school context (relations with parents, relations with colleagues, supervisory support, and discipline problems) and school goal structure (school mastery and performance goals) and teacher motivation variables (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management; collective efficacy for group competence and task analysis; mastery and performance goals for instruction), and job satisfaction. It was hypothesized that teacher motivation variables and job satisfaction influenced student outcomes; teacher motivation variables interacted with student level variables; student-level variables influenced students' science achievement; and school environment variables associated with teacher motivation variables. Results indicated that science teachers' mastery approaches to instruction was the only significant predictor of students' science achievement. In the student level, behavioral engagement, self-efficacy and mastery approach goals were the significant predictors of students' science achievement. Moreover, path analysis results indicated that school mastery goal structure significantly associated with science teachers' mastery instructional goals and relations with parents and student discipline problems were the best predictors of science teachers' motivation.

Keywords: Science Achievement, Teacher Motivation, Student Motivation, School Environment, Hierarchical Linear Modelling

ÖZ

ÖĞRENCİ MOTİVASYONU, KATILIMI VE FEN BAŞARISININ
ÖĞRETMEN DEĞİŞKENLERİYLE İLİŞKİSİNİN ÇOK DÜZEYLİ
İNCELENMESİ

Kıran, Dekant
Doktora, İlköğretim Bölümü
Tez Yöneticisi: Prof. Dr. Semra Sungur
Ortak Tez Yöneticisi: Yard. Doç. Dr. Sündüs Yerdelen

Eylül 2016, 500 sayfa

Bu çalışmanın ana amacı öğretmen motivasyonu, iş doyumu ve 7. Sınıf öğrencilerinin motivasyon, katılım ve fen başarısı arasındaki ilişkileri incelemektir. Ayrıca, okul çevresi, öğretmen motivasyonu ve iş doyumu değişkenleri arasındaki ilişkiler de bu çalışma kapsamında incelenmektedir. Çalışmanın katılımcıları Ankara'da ikamet eden 3394 7. Sınıf öğrencisi ve bu öğrencilerin 134 fen bilimleri öğretmenidir.

Öğrenci ve öğretmenlerden toplanan veriler çok düzeyli analiz (HLM) kullanılarak analiz edilmiştir. Öğretmen değişkenlerinin kendi aralarındaki ilişkileri araştırmak için de yol analizi kullanılmıştır. Öğrenci düzeyi değişkenler öğrenci öz-yeterliği, başarı hedefleri (ustalık yaklaşma-kaçınma, performans yaklaşma-kaçınma) ve katılımı (ajanssal, davranışsal, bilişsel ve duyuşsal) içermektedir. Öğretmen düzeyi değişkenler ise, okul ortamı değişkenleri (öğretmen-veli ilişkileri, meslektaşlarla ilişkiler, yönetim desteği, disiplin sorunları) ve okul hedef yönelimi değişkenleri (ustalık ve performans hedefleri), öğretmen motivasyonu değişkenleri (öğrenci katılımı için öğretmen öz-yeterliği, öğretim stratejileri öz-yeterliği, ve sınıf yönetimi öz-yeterliği; grup yeteneği ve görev analizi kolektif yeterliği; ustalık ve performans öğretim hedefleri) ve iş doyumudur. Bu çalışmada öğretmen motivasyonu ve iş doyumu değişkenlerinin öğrenci çıktılarını yordadığı ve öğrenci düzeyi değişkenlere aracılık ettiği; öğrenci düzeyi değişkenlerinin fen başarısını yordadığı ve okul çevresi değişkenlerinin öğretmen motivasyonunu yordadığı hipotezleri kurulmuştur. Analiz sonuçlarına göre fen bilimleri öğretmenlerinin ustalık öğretim yaklaşımları öğrenci fen başarısını yordayan tek öğretmen değişkeni olarak bulunmuştur. Öğrenci düzeyi yordayıcılardan davranışsal katılım, öz-yeterlik ve ustalık yaklaşım hedefleri fen başarısını anlamlı olarak yordamıştır. Ayrıca, yol analizi sonuçlarına göre okul ustalık hedef yapısı fen bilimleri öğretmenlerinin ustalık öğretim hedefleriyle ilişkili bulunurken, öğretmen-veli ilişkileri ve sınıf içi disiplin sorunları öğretmen motivasyonunun en önemli yordayıcıları olarak bulunmuşlardır.

Anahtar Kelimeler: Fen Başarısı, Öğretmen Motivasyonu, Öğrenci Motivasyonu, Okul Çevresi, Çok Düzeyli Analiz

To the memory of my grandfather

İsmail Hakkı Çeviker,

who passed away on August 17^{th}*, 2016*

while I was writing this dissertation.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor Prof. Dr. Semra Sungur for her patience, understanding, encouragement, and academic support throughout my graduate student years. It has been a privilege to have you as a supervisor both in my master's thesis and doctoral dissertation. Your perfect guidance made it easier for me to be able to write these two marvelous manuscripts. Thank you sincerely.

I would also like to thank my co-supervisor and dear friend Assist. Prof. Dr. Sündüs Yerdelen for her valuable feedbacks especially for HLM analysis results. Your encouragement and professional approach taught me a lot in writing my dissertation. Thank you very much. Additionally, I would like to thank to my dissertation committee members, Prof. Dr. Jale Çakıroğlu, Prof. Dr. Yezdan Boz, Assoc. Prof. Dr. Eren Ceylan, and Assist. Prof. Dr. Yasemin Taş. Your valuable comments and feedbacks helped a lot to produce a better dissertation.

I want to spare a paragraph to Assoc. Prof. Dr. Ellen L. Usher, University of Kentucky, College of Education – Department of Educational, School, and Counseling Psychology, and P20 Motivation and Learning Lab. Dr. Ellen Usher, you were my idol scholar in my master's years and in my doctoral years, I had the chance to meet and work with you. Your expertise in the field and recommendations to my studies taught me a lot. I am grateful to you for providing me such and opportunity. I am also thankful to the people of P20 Motivation and Learning Lab and Department of Educational, School, and Counseling Psychology. You made me feel like I was part of the community for long years. Thank you for your friendship and warmth. Dr. Xin Ma, thank you very much for accepting me as a guest student for your multilevel analysis class. You taught me a lot about conducting HLM analysis.

My dear office mates, Mehmet Şen, Sinem Demirci, Gözde Kaplan, Seçil Cengizoğlu, and Nur Alaçam. I will always remember our conversations on science and gossips while having our fruits in the office. Thanks are extended to Dr. Erdinç İşbilir, with whom I worked together while writing our dissertations. Our relaxing chats in the opposite offices during writing our dissertations facilitated this tiring long way. My dear friends Ali Riza Erdoğan and Aylin Civan Erdoğan.You make the best couple ever! Thank you for your friendship and support. You are like a sister and a brother to me.

My special heartfelt thanks go to my dear wife Betül. Life is easier with you! Your presence and never ending support made me stronger in this long and tiring dissertation writing period. I feel very lucky to have you by my side as my wife, lover, friend, and family. Thank you. I love you.

My dear family, words are not enough to describe what you mean to me. Your trust and support never disappeared. Thank you very much. I am thankful to you for being my parents.

I would like to thank TÜBİTAK (The Scientific and Technological Research Council of Turkey) for providing me financial support with the 2214/A Program (Abroad Research Scholarship for Doctoral Students) in the University of Kentucky – United Stated as a visiting scholar. I also would like to thank Faculty Development Program (ÖYP) for creating an opportunity for me to become an academician. Moreover, I am also thankful to Middle East Technical University – Faculty of Education for providing me an excellent research and

learning environment. Lastly, I am thankful to science teachers and seventh grade students who participated in this study. You did a great work!

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LIST OF ABBREVIATIONS

AGQ: Achievement Goal Questionnaire

ANOVA: Analysis of Variance

CFA: Confirmatory Factor Analysis

CFI: Comparative Fit Index

ERIC: Educational Resources Information Center

GFI: Goodness of Fit Index

GPA: Grade Point Average

HLM: Hierarchical Linear Modeling

ICC: Intra-Class Correlation Coefficient

IFI: Incremantal Fit Index

ITEMAN: Item Analysis

LISREL: Linear Structural Relationships

M: Mean

METU: Middle East Technical University

MONE: Ministry of National Education of Turkey

MSLQ: Motivated Strategies for Learning Questionnaire

NFI: Normed Fit Index

PALS: Patterns of Adaptive Learning Survey

PCA: Principal Component Analysis

PISA: Program for International Student Assessment

PSCS: Perceived School Context Scale

RMSEA: Root Mean Square Error of Approximation

SAT: Science Achievement Test

SD: Standard Deviation

SEM: Structural Equation Modeling

SEQ: Students’ Engagement Questionnaire

SES: Socio Economic Status

SGSS: School Goal Structure Scale

SRMR: Standardized Root Mean Square Residual

SSCI: Social Science Citation Index

STEBI-A Science Teachers' Efficacy Belief Instrument version A

TAIS: Teachers' Approach to Instruction Scale

TCES: Teacher Collective Efficacy Scale

TEOG: National High School Placement Examination in Turkey

TIMMS: Trends in International Mathematics and Science Study

TLI: Tucker-Lewis Index

TPPS: Teachers' Professional Perceptions Scale

TSES: Teacher Self-Efficacy Scale

USA: United States of America

ZT_AtISM: Mastery Approaches to Instruction

ZT_AtISP: Performance Approaches to Instruction

ZT_ENGAG: Students' Agentic Engagement

ZT_ENGBH: Students' Behavioral Engagement

ZT_ENGCG: Students' Cognitive Engagement

ZT_ENGEM: Students' Emotional Engagement

ZT_GRCOMP: Teacher Collective Efficacy – Group Competence

ZT_JOBSAT: Job Satisfaction *ZT_SELF*

ZT_MASTAP: Students' Mastery Approach Goals

ZT_MASTAVO: Students' Mastery Avoidance Goals

ZT_PERFAP: Students' Performance Approach Goals

ZT_PERFAVO: Students' Performance Avoidance Goals

ZT_TASKAN: Teacher Collective Efficacy – Task Analysis

ZT_TSECM: Teacher Self-Efficacy – Classroom Management

ZT_TSEIS: Teacher Self-Efficacy – Instructional Strategy

ZT_TSESE: Teacher Self-Efficacy - Student Engagement

ZT_SELF: Students' Self-Efficacy

CHAPTER I

INTRODUCTION

Motivational researchers have recently criticized themselves regarding the little number of studies examining teacher motivation in comparison with the vast number of studies related to student motivation (Butler, 2007; 2012; Mertler; 2016; Retelsdorf, Butler, Streblow, & Schiefele; 2010; Retelsdorf & Günther, 2011). According to Butler (2007) teacher motivation deserves to be investigated in its own right besides its influence on student outcomes. Indeed, Tobin, Tippins, and Gallard (1994) stated that "…teacher beliefs are a critical ingredient in the factors that determine what happens in classrooms" (p. 64). Fortunately however, research on teacher motivation proliferated rapidly with the use of educational theories on motivation (Retelsdorf & Günther, 2011). Motivational theories developed for students' learning were transferred to teacher motivation research (Fives & Buehl, 2016). Up to date teacher motivation has mainly been investigated in the theoretical frameworks of social-cognitive theory (i.e. self-efficacy, collective efficacy) (Klassen, Tze, Betts, & Gordon, 2011; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998; Goddard, 2001), expectancy-value theory (Watt & Richardson, 2007), and goal orientation theory (Butler, 2007; 2012). In the current study, teacher motivation is conceptualized as teachers' personal teaching efficacy beliefs, their collective efficacy as a group, and their instructional goals during their teaching practice. Accordingly, teacher motivation variables examined in this study are teacher self-efficacy (i.e. efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management), teacher collective efficacy (group competence and task analysis) and teachers' instructional goal orientations (mastery and performance).

As Fives and Buehl (2016) has mentioned, similar to students, teachers are influenced by their self-beliefs, particularly self-efficacy beliefs, in terms of their attitude towards teaching profession, behaviors towards students, and student achievement and motivation (Klassen & Chiu 2010). Teacher self-efficacy is defined as the beliefs teachers have about their skills to affect student learning (Caprara, Barbaranelli, Steca & Malone, 2006; Klassen & Chiu 2010). Teachers' self-efficacy may affect student learning and achievement in several ways. Teachers holding high levels of self-efficacy beliefs are more likely to apply innovative teaching acts in the classroom, to use classroom management strategies effectively and utilize appropriate teaching methods fostering students' autonomy (Cousins & Walker, 1995; Guskey, 1988), to undertake responsibility of students with special learning needs (Allinder, 1994; Jordan, Krcaali-Iftar, & Diamond, 1993), to manage classroom discipline problems (Chacon, 2005; Korevaar, 1990), and to keep students concentrated on task than teachers holding relatively low levels of teaching self-efficacy beliefs (Podell & Soodak, 1993). Moreover, teachers possessing high levels of efficacy are more likely to use activity-based learning strategies (Enochs, Scharamann, & Riggs, 1995), student-centered learning strategies (Czerniak & Schriver, 1994), and have a humanistic approach to classroom management (Woolfolk & Hoy, 1990). Teachers' self-efficacy may also contribute to enhance student's sense of efficacy, motivating their engagement in class activities and regulating their efforts in face of low success and challenging tasks (Ross, 1998; Ross, Hogaboam-Gray, & Hannay, 2001). Moreover, literature provided evidence for the contribution of teacher efficacy on students' academic achievement (Caprara et al., 2006; Ross; 1992).

In addition to teacher self-efficacy, other psychosocial factors such as professional aspirations, the satisfaction teachers gain from their profession and collaborative relationships with colleagues and parents are influential in teacher-student relations (Caprara et al., 2006). Bandura (1997) stated that success of a social system which grounds heavily on the cooperative working skills of its workers may be influenced critically by the groups' collective efficacy beliefs. Bandura also contends that people do not work as socially separated, and therefore they form beliefs about the collective capabilities of the people or working group(s) in which they exist. Collective efficacy is defined by Caprara et al., (2003) as the "judgments that people make about a social system (family, team, organization, or community) and about its level of competence and effectiveness in specific domains of action" (p. 821). In educational domain, schools are social systems where teachers work collaboratively. Thus, teachers have collective efficacy beliefs about their working group (colleagues) as they have personal efficacy beliefs. Social cognitive theory acknowledges that teachers' efficacy perceptions of both themselves and their organizations (school collective efficacy) influence their actions. Collective teacher efficacy is different from the personal self-efficacy in that while self-efficacy is individual, collective efficacy is a related to school and it is a property of the school. (Tschannen-Moran & Barr, 2004). Collective efficacy was found to have a positive influence on students' academic achievement (Ross, Hogaboam-Gray, & Gray, 2004; Goddard, 2001). Goddard and Goddard (2001) asserted that collective teacher efficacy may influence student academic achievement indirectly by creating school norms and sanctions that enhance students' tendency to persist on academic tasks. However, little is known about how collective teacher efficacy exert influence on students' motivation and engagement.

As students have goals regarding their academic endeavors, so the teachers have for their instruction as well (Ames, 1992; Anderman & Maehr, 1994). In the literature, teachers' instructional goals shaped by their instructional practices were conceptualized as teachers' mastery instructional approaches and teachers' performance instructional approaches (Ciani, Summers, & Easter, 2008; Deemer, 2004; Ryan, Gheen, & Midgley, 1998). Teachers' mastery approach to instruction stresses valuing learning, understanding the course material, and personal improvement. Moreover, teachers who are mastery oriented in their instruction recognize their students by their willingness to undertake challenging tasks and they place importance on self-improvement for grading (Maehr & Zusho, 2009). On the other hand, teachers' performance approaches to instruction emphasize performance oriented instruction, competition and comparison among students. Students are compared for their abilities and performances in achievement tests. Additionally, students are encouraged to compete with each other and are recognized for their superior performances in normative graded tests (Anderman & Patrick, 2009). According to relevant research, teachers' instructional practices can shape the goal structure in the classroom and in turn influence such student outcomes as motivation, achievement related behaviors including engagement, and actual achievement (Ames, 1992; Maehr & Midgley, 1991; Meece, Anderman, & Anderman, 2006).

In addition to teacher motivation, teacher job satisfaction appears to be an important variable related to student outcomes. Job satisfaction is characterized as a positive or negative sense of fulfillment about one's work (Skaalvik & Skaalvik, 2010). Caprara et al. (2003) stated that job satisfaction a "decisive element" that is influential on teachers' attitudes and performance on teaching. Dissatisfied teachers show decreasing levels of belonging to the profession and are inclined to be motivated towards leaving the profession (Evans, 2001; Ingersoll, 2001). On the other hand, Cockburn and Haydn (2004) assert that teachers gain the sense of job satisfaction from the routine teaching learning and interaction processes such as nature of day-to-day classroom activities, working with children, seeing students' academic progress, working with supportive colleagues, and overall school climate. According to Klusman et al., (2008), teachers with high levels of job satisfaction create more learning-supportive environments for students and try their best for motivating students. Additionally, teachers that have high levels of job satisfaction are more successful in alleviating disturbances in the classroom, better at time management, optimize teaching pace to address the whole class, and are more encouraging for students to gain better insights (Klusmann et al., 2008).

Overall, it appears that teacher motivation is related to various student outcomes. However, most of the propositions regarding these relations are theoretical and empirical studies seemed to be limited both in terms of number and the strategies used to analyze the obtained data. For example, in quantitative studies, due to the nested structure of data, HLM is the appropriate statistical technique to use. Nevertheless, number of studies utilizing this analysis is very few. In general, basic student outcomes, needing further empirical investigations in relation to teacher motivation include student engagement, motivation, and achievement. Additionally, there is a need for examining the relations among these student outcomes in different context and countries due to context specific nature of the related constructs (Pajares, 2006, Klassen et al., 2011). Accordingly, current study aims to examine the relationships among these student level variables as well as the relationships of them with teacher level variables including teacher motivation and job satisfaction conducting a series of HLM analyses. Next sub-section provides details about student outcomes.

Student Outcomes

As one of the important student outcomes, engagement research, recently, received attention with the reconceptualization of four dimensional structure of student engagement, namely agentic, behavioral, cognitive, and emotional engagement. (Reeve & Tseng, 2011). Student engagement research has a relatively short history beginning from the 1980s to present day (Appleton, Christenson, & Furlong, 2008). In time, engagement research has received attention because it produced positive school related outcomes such as achievement and school belonging (Fredricks, Blumenfeld, & Paris, 2004; Heddy & Sinatra, 2013; Tytler & Osborne, 2012). Engagement, as a general construct, was defined simply by Natriello (1984) as taking part in the educational activities organized by schools. Regarding its subcomponents, agentic engagement is expressing personal preferences and commenting on the flow of the course. It necessitates an active participation by stating ideas and personal preferences without hesitation (Reeve, 2013; Reeve & Tseng, 2011). Behavioral engagement refers to one's active participation in own learning and academic tasks in an effortful, persistent and attentive manner both in and out of school activities. Behavioral engagement also includes positive conduct such as obeying pre-defined classroom and school rules and not skipping school (Appleton, et al., 2008; Fredricks, et al., 2004; Reeve, 2013) Cognitive engagement refers to the students' own investment psychologically on learning (mastering) and being self-regulated in terms of using deep level cognitive strategies and setting challenging goals to go beyond the requirements of the learning task (Connell & Wellborn, 1991; Fredricks et al., 2004; Wehlage & Smith, 1992). An example of cognitive engagement could be described as exerting cognitive effort for understanding the learning task, striving for being in advance of the activity steps, and choosing tasks which are challenging such as activities slightly over students' competence (Sinatra, Heddy, & Lombardi, 2015). And lastly, emotional engagement refers to the positive or negative feelings towards school, classes, and teachers etc. (Fredricks, et al., 2004). These positive and negative feelings include interest, value, boredom, happiness, sadness, anxiety (Connell & Wellborn, 1991; Skinner & Belmont, 1993) enjoyment, relief (Sinatra et. al., 2015) and identification as belonging (Voelkl, 1997).

Various dimensions of student engagement have been found to be associated with other student outcomes such as achievement and motivation (Connell & Wellborn, 1991; Connell, Spencer, & Aber, 1994; Greene, Miller, & Crowson, 2004; Marks, 2000; Reeve & Tseng, 2011). For example, Connell et al., (1994) and Marks (2000) reported that emotional and behavioral engagement predicted students' academic achievement. Similar findings were reported for the relationship between cognitive engagement and student achievement and motivation. In an early study, Pintrich and DeGroot (1990) found that self-efficacy and intrinsic value (could be taken as emotional engagement) correlated positively with cognitive engagement (measured as strategy use). For the newly proposed dimension, agentic engagement correlated positively with student motivation and achievement (Reeve & Tseng, 2011). Accordingly, in the current study, it is expected that there are positive relations between each engagement dimension and science achievement.

In student motivation, two main constructs involve students' achievement goals (Pintrich & Schunk, 2002) and students' self-efficacy beliefs (Bandura, 1997; Pajares, 2002; Pintrich & Schunk, 2002). Achievement goals refer to the purposes students' have for completing academic tasks or engaging in achievement situations (Ames, 1992; Elliot, 1999; Pintrich, 2000; Pintrich & Schunk, 2002). Firstly, two types of achievement goals were proposed by achievement goal theorists which were mastery and performance goals (Ames, 1992). While mastery goals refer to mastering the task, learning the material, understanding deeply, and improving oneself intellectually, performance goals refer to surpassing others, getting the highest grades in normative standards in grading, and showing one's performance to others that one is able (Ames, 1992; Meece et al., 2006; Pintrich & Schunk, 2002; Schunk, Meece, & Pintrich, 2012). Afterwards, Elliot (1999) suggested to divide these two approaches into "approach" and "avoidance" approaches. Thus, a two-by-two frame for achievement goals was espoused in the achievement motivation field.

Accordingly, mastery approach goals referred to understanding, mastering and learning the material. Mastery avoidance goals emphasized avoiding not mastering and not learning completely. On the other hand performance approach goals represented getting the highest grade and showing the ability to others and performance avoidance goals represented the desire to avoid looking incompetent and dumb in normative comparisons. This two-by-two conceptualization for achievement goals were investigated by educational psychologist in relation with student outcomes in a number of studies. For example academic achievement, (Chen & Wong, 2014; Taş, 2008; Yerdelen, 2013; Bezci, 2016), academic self-efficacy and self-regulation variables such as metacognitive strategy use and effort regulation (Anderman & Midgley, 1997; Pajares, Britner, & Valiente, 2000; Kahraman, 2011; Kiran & Sungur, 2012), and different aspects of engagement (agentic, behavioral, emotional, and cognitive) (Anderman & Young, 1994; Dweck & Legett, 1988; Midgley & Urdan, 1995; Hıdıroğlu, 2014) were investigated in relation to students' achievement goals. As a general trend, mastery approach goals correlated positively with adaptive outcomes, performance approach goals generated mixed results. For avoidance tendencies, while international literature generally yielded negative or no correlation, national studies found positive relationships with adaptive patterns of behavior and academic achievement (Anderman & Young, 1994; Kahraman, 2011; Kıran, 2010; Midgley & Urdan, 1995). Under these circumstances, it is expected that, in the present study, achievement goals would yield results similar to the studies conducted in Turkey. More specifically, mastery approach-avoidance and performance approach-avoidance goals are expected to have positive associations with students' self-efficacy and engagement dimensions. Mastery approach goals are expected to have positive relationship with students' science achievement but performance approach-avoidance and mastery avoidance goals may have negative or no relationship with students' science achievement.

According to socio-cognitive theory, self-efficacy beliefs are one of the most influential and pervasive agent in human decisions on undergoing certain behaviors. Such a distinctive belief, self-efficacy, is defined by Bandura (1997) as “beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments” (p. 3).” Choices of activities people make, courses of actions they follow, effort expenditure and persistence are the most prominent ones that are influenced by self-efficacy beliefs (Pintrich & Schunk, 2002; Pajares, 2002). Self-efficacy beliefs are influential in motivation, personal attainments and welfare of people. That is the main reason which locates self-efficacy beliefs at the center of social cognitive theory (Pajares, 2002). Self-efficacy beliefs are widely documented in the literature that they are effective and they lead to personal achievement in many contexts such as business administration, education, sport, work, and health (Multon, Brown, & Lent, 1991; Pajares, 1996; Schunk, 1995). Considering educational settings, self-efficacy beliefs are associated with students’ academic achievement, motivation, cognition, and actual performance (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Pajares, 1996; Pintrich & DeGroot, 1990). Students possessing high levels of self-efficacy beliefs are eager to involve in accomplishing a task; those holding low self-efficacy are inclined to avoid it (Pintrich & Schunk, 2002). Additionally, students with high self-efficacy were reported to set goals that are slightly higher than their actual ability, select challenging tasks, persist in the face of difficulties, exert greater effort to overcome obstacles in completing academic tasks, and use various learning strategies (Bandura, 1986; Pajares, 2002; 2006). Thus, it is expected that self-efficacy is positively linked to student engagement and achievement. In addition, self-efficacious students are expected to adopt mastery approach goals more than avoidance goals and performance approach goals.

Student Outcomes in relation to Teacher Motivation and Job satisfaction

According to the related literature, aforementioned student outcomes including engagement, motivation, and achievement, appears to be associated with teacher motivation and job satisfaction (Anderman & Young, 1994; Goddard & Goddard, 2001; Pamuk, 2014; Urdan, 2004; Yerdelen, 2013). Regarding the relationship between teachers' self-efficacy and students' self-efficacy, limited number of studies reported mixed results. While Kurien (2011) reported no relationship, Stuart (2006) found a positive relationship between teacher self-efficacy and students' self-efficacy in science. In addition, national studies investigating the relation between teacher self-efficacy and achievement found mixed results. For example, Yerdelen (2013) and Pamuk (2014) reported that while teachers' self-efficacy for student engagement associated positively with student science achievement, teachers' self-efficacy in instructional strategies and classroom management was not found as significantly related to science achievement. Concerning students' engagement, Uden, Ritzen and Pieters (2014) reported that teacher self-efficacy was positively associated with students' behavioral, cognitive and emotional engagement. Nevertheless, literature lacks studies investigating the relationship between teacher self-efficacy and students' achievement goals. Accordingly, in this study, positive links were expected between teacher self-efficacy and students engagement dimensions and student achievement. Because, self-efficacious students are likely to persist in a task until they succeed and they set challenging goals for themselves, positive relation is expected between self-efficacy and mastery approach goals. However, limited number of studies concerning the link between self-efficacy and achievement goals restrict expectations.

For the relationship between teachers' collective efficacy and student outcomes, literature is limited to student achievement. Ross, Hogaboam-Gray & Gray (2004) stated that collective teacher efficacy, similar to teachers' personal teaching efficacy, influences students' achievement and is a strong predictor of student achievement. Bandura (1997) asserted that collective teacher efficacy was a stronger predictor of student achievement than student socio-economic status. Likewise Goddard (2001) found that collective teacher efficacy accounted for almost 50 % of the between-school variance in mathematics and reading achievement. Literature indicates similar results of collective teacher efficacy on student achievement in different grade levels of students (see Goddard, Hoy, & Hoy, 2000; Goddard, Hoy, & LoGerfo, 2003). It is argued that collective teacher efficacy affects student achievement indirectly by creating school norms and sanctions that enhances intent on persistence about academic tasks (Goddard & Goddard, 2001). Based on the literature findings, a positive relationship is expected for the relationship between teachers' collective efficacy and students' achievement but lack of studies restrict further propositions for student engagement, achievement goals, and students' self-efficacy. Nevertheless, higher levels of collective efficacy may lead to creation of learning environments conducive to student motivation and engagement.

Teachers' approaches to instruction have been investigated in relation with student outcomes such as motivation (Meece et al., 2006, Anderman & Young, 1994; Anderman & Midgley 1997; Urdan, 2004) engagement (Anderman & Patrick, 2009; Wolters, 2004; Midgley & Urdan, 2001; Urdan, 2004) and achievement (Gutman, 2006; Lau & Nie, 2008; Linnenbrink, 2005; Wolters, 2004). For example, Anderman and Young found that teachers' mastery approaches in their science instruction resulted in students' adoption of mastery approach goals. Urdan (2004) found that while students' perception of mastery instructional goals lead them to adopt mastery goals, perception of emphasis on performance goals in the classroom resulted in adoption of performance goals. In this study it is expected that the findings are compatible with the literature. Particularly, teachers' mastery approaches to instruction predict students' mastery goals and teachers' performance approaches to instruction predict students' adoption of performance goals. The relationship between teachers' instructional goals and engagement has resulted in positive engagement patterns for mastery instructional goals and negative for performance instructional goals (Urdan, 2004; Wolters, 2004, Kaplan, Gheen, & Midgley, 2002). In this study, it is expected that teachers' mastery instructional goals associate positively with student engagement, teachers' performance instructional goals associate negatively or have no association with student engagement. The linkages between teachers' instructional goals and student self-efficacy resulted in positive relationships (Gutman, 2006; Urdan, 2004; Wolters, 2004). Both instructional approaches associated positively with students' self-efficacy. Thus, in this study, teachers' instructional goals may be expected to correlate positively with student self-efficacy. Lastly, for student achievement, teachers' mastery instructional goals correlate positively with student achievement (Lau & Nie, 2008; Urdan, 2004, Wolters, 2004). However, performance instructional goals were also found as a predictor of student achievement for high achieving students (Ee, Moore, & Atputhasamy, 2001). Thus, student achievement is expected to correlate positively with teachers' mastery instructional goals. Since this study focused on average student achievement, a positive relationship is not expected between performance instructional goals and students' achievement.

The relationships between teachers' job satisfaction and student outcomes have not been investigated deeply to date (Michaelowa & Wittmann, 2008; Yerdelen, 2013). Research on job satisfaction revealed that job satisfaction associated positively with performance at work (Ololube, 2006), undertaking extra-roles towards students and in school organizations (Somech & Drach-Zahavy, 2000), and life satisfaction (Ho & Au, 2006). Moreover, Demirtas (2010) stated that when teachers have high job satisfaction, they are expected to produce qualified instruction and enhance students' educational outcomes. Although literature lacks studies investigating relationships between teachers' job satisfaction and student outcomes, expecting positive relationships is not surprising based on abovementioned assertions. Therefore, positive associations are expected between job satisfaction and student outcomes in the current study.

Teacher Motivation and Job Satisfaction in relation to School Environment

It is important to note that, school environment plays an important role in teacher motivation and job satisfaction. Research indicated that a positive organizational climate and social support from the colleagues, student parents and school principals are positively related to teacher job satisfaction and motivation (Day et al., 2007; Scheopner, 2010; Skaalvik & Skaalvik, 2009; 2011). Moreover, time pressure which is defined as the limited time for rest due to the excessive workload of preparation for the classes (Skaalvik & Skaalvik, 2011) is an important contributor to the decline in teacher overall job satisfaction (Scott, Stone, & Dinham, 2001). Another important contextual factor for teachers influencing their job satisfaction is autonomy. Skaalvik and Skaalvik (2009) stated that teacher autonomy refers to the free decision making of teachers in determining what and how to implement in teaching and learning processes. Research indicate that job satisfaction is closely related to autonomy for well-educated human service workers (Koustelios, Karabatzaki & Kouisteliou, 2004). Among the school environment variables, teachers' perception of school goal structures were reported to play an important role in teachers' motivation. Similar to classroom goal structures, there are certain goals that are emphasized by the schools. Schools do have mastery and performance goal structures that are perceived by the teachers and communicated to the students. According to Maehr and Midgley (1991), middle schools reflect a school culture that emphasizes certain goals through policies, procedures, and teachers' academic practices. Mastery (task) goals refer to schools emphasizing personal improvement, mastery, understanding, and intellectual development. Ability (performance) goals refer to social comparison, competition and normative evaluations among students. In general terms, perceived task (mastery) goal emphasis in the learning environment is related to positive achievement beliefs and perceived performance (ability) goal stress is related to negative achievement beliefs. The literature investigating the influence of school goal structures on teachers' motivation is limited. Therefore, based on the previous research regarding teachers' instructional goals, while school mastery goals are expected to correlate positively with teachers' mastery goals in instruction, self and collective efficacy beliefs, and performance school goal structures are expected to correlate with performance approaches to instruction. Accordingly, in the current study, autonomy, time pressure, discipline problems in the classroom, supervisory support, relations with colleagues, relations with students' parents, and school goal structures (mastery and performance) were intended to be examined as school environment variables in relation to teacher motivation and job satisfaction. However, because, sub-scale reliabilities were found to be low for autonomy and time-pressure, they were excluded from the analyses. Accordingly, it was expected that all included school context variables (except discipline problems) associate positively with teacher motivation and job satisfaction. Since discipline problems are maladaptive for teacher motivation and job satisfaction, consistent negative relationships are expected.

1.1 Purpose of the Study

The main purpose of this study was to examine the interrelationships among teacher motivation, job satisfaction, and students' motivation, engagement, and achievement. Particularly, this study examined teachers' self-efficacy, collective efficacy, and personal goals in implementing instructional strategies as teachers' motivation. Regarding student motivation, this study investigated students' self-efficacy beliefs and their achievement goals (mastery approach goals, mastery avoidance goals, performance approach goals, and performance avoidance goals) in science. Students' engagement in science classes was investigated in terms of agentic engagement, behavioral engagement, cognitive engagement, and emotional engagement. For the specified purpose, students' science achievement was investigated in relation to teachers' motivation, job satisfaction and student motivation, and student engagement variables. In addition, the relations of teacher variables with student outcomes other than achievement were examined. Moreover, the relationships among student motivation and engagement variables were explored. In order to examine the relationships between teacher level variables and student level variables, a series of two level Hierarchical Linear Modeling (HLM) analyses were conducted. In HLM analysis, the interactions between teacher and student level variables were also examined.

This study also examined the relations of teacher motivation and job satisfaction with perceived school environment variables. Perceived school environment variables included discipline problems teachers had in their classrooms, relations with parents of the students, relations with their colleagues in the school, the support they receive from the school administration (supervisory support), school mastery and performance goal structure. In order to examine these relationships, a path analysis was also conducted. Since the scope of this study was on science teachers, teacher related variables was measured for science teachers and abovementioned student characteristics (i.e. student motivation, engagement, and academic achievement) was related to science. Thus, 7^{th} grade students and their science teachers constituted the participants of this study and they were administered related scales in order to collect the data for the study.

1.2 Significance of the Study

The main purpose of this study was to examine the relationships among teacher motivation, job satisfaction and student outcomes including motivation, engagement, and achievement in science. The current study focused on science domain considering the fact that, recently, the foremost goal of science education includes development of scientifically literate individuals who grasp scientific knowledge, ideas, and explanations deeply, engage in science activities behaviorally, cognitively, and emotionally, and have positive motivation in science. Indeed, National Academy of Sciences' Committee on Science Engineering, and Public Policy (2001) reported that such habits of minds should be fostered in K-8 education to support the workforce in science, technology, engineering and mathematics. However, International student assessments results such as PISA (2003, 2006, 2009, 2012) (Program for International Student Assessment) and TIMMS (1999, 2007, 2011) (Trends in International Mathematics and Science Study) indicated that science achievement of Turkish students are below the average of the participating countries' scores. Moreover, results of national high school placement examination (TEOG) (2014, 2015, and 2016) has showed that, average science achievement is around 50 %. Thus, as an important component of scientific literacy, results of international exams suggest that Turkish students do not possess a good understanding of scientific concepts and ideas. Accordingly, there is a need for investigating the factors related to students' achievement in science as well as their motivation and engagement. Although available literature suggest relations among teacher variables including their motivation and job satisfaction and such student outcomes, empirical studies examining these relation are limited in number and scope. For example, White (2009) examined the difference in the effects of teacher self-efficacy on student achievement. The researcher conducted two way ANOVA to test whether there was a statistically significant main effect between teacher self-efficacy and student achievement. Results indicated that teacher self-efficacy had main effects on students' math and reading scores. Although White (2009) investigated teacher self-efficacy and its impact on student achievement, the researcher used an ANOVA design and area of concentration was reading and mathematics scores. In another study, Wolters (2004) examined students' perceptions of classroom goal structure and the relationships between these classroom goal structures and procrastination, use of cognitive and metacognitive strategies, persistence, choice, and mathematics grade. Ciani et al., (2008) approached measuring classroom goal structures from the perspective of students and recommended to measure such constructs from the goal perspectives of teachers. The researcher came across with only two studies (i.e. Yerdelen, 2013; Pamuk; 2014) conducted in Turkey that investigated the relationships between teacher variables and student outcomes in science. In these studies, researchers have used a nested data structure and HLM analysis. More specifically, in Turkey, previous research has examined the relationships between teacher self-efficacy and student outcomes (Pamuk, 2014) and teacher job satisfaction and student outcomes (Yerdelen, 2013) but there were limited studies examining the relationship between student outcomes and teachers' collective efficacy and instructional goal orientations. Indeed, review of the relevant literature indicated that while teachers' collective efficacy were reported to be associated with student achievement, the relationship between teachers' collective efficacy and student motivation and engagement were ignored. In this study, the influence of teacher collective efficacy was examined in relation to students' motivation, engagement and science achievement using HLM analysis. Another gap in the literature was that the influence of teachers' approaches to instruction on student outcomes were generally investigated from the perspective of students' perception of classroom goals that are made salient by the teacher. For instructional goals, while previous studies have assessed teachers' instructional approaches from students' perspective, this study measured this construct from teachers' perspective. Ciani et al (2008) pointed the need to investigate teachers' instructional goal orientations from the teachers' perspective because literature is limited on this topic and there is a confusion about conceptulizin classroom goal structures. Researchers take classroom goal structures, students' perception of their teachers' instructional goals, and teachers' own perceptions of instructional goals as the same structure. Thus, in the current study, how teacher approached to instruction in the classroom and the influence of this approach on student outcomes were investigated without aggregating student level data to produce a class level data. Use of HLM analysis enabled keeping important variance between students and classes. Accordingly, current study adopted a more comprehensive approach and conceptualized teacher motivation in terms of teachers' self-efficacy, collective efficacy, and teachers' instructional goals. In addition, job satisfaction, which emerged as an important variable in student outcomes, was investigated.

In addition, current study aimed to investigate the relationships among the school environment variables and teacher motivation. These relationships were examined through path analysis. Studies of Skaalvik and Skaalvik (2009; 2010; 2011) consistently pointed out the importance of the perceptions of school context variables on teacher motivation. The influence of social environment in schools and teachers' relationships with students' parents were emphasized as prominent predictors of teachers work related motivation. However, the number of empirical studies investigating teacher motivation in relation to school context are limited in scope. Even, the national studies conducted to explain teacher motivation did not include contextual variables. For example, in a study conducted in Turkey, Gürçay, Yılmaz, and Ekici (2009) investigated the factors predicting Turkish teachers' collective efficacy. They included teacher self-efficacy, self-regulation, burnout, gender, and experience as the predictors of teachers' collective efficacy. They did not include school context variables as the predictors of teacher collective efficacy. Additionally, Gürçay et al., (2012) sampled teachers without focusing on a specific domain. Kurt (2012) also investigated Turkish teachers' self-efficacy and collective efficacy. Similar to Gürçay et al. (2009), he did not include school context variables as predictors. Instead, Kurt (2012) examined the relationships among transformational and transactional leadership styles of primary school principals and self-efficacy and collective efficacy of Turkish teachers. In the current study, different from the studies investigating the relationship between teacher motivation variables and school context variables (e.g. Skaalvik & Skaalvik, 2009; 2011), science teacher motivation variables were examined in relationship with important student outcomes such as students' science achievement, engagement and motivation. Thus, current study may be a leading one that shed light into the interrelationships between school environment variables and teacher motivation and in turn prominent student outcomes.

For the purpose of the study, the data were gathered from science teachers and their 7th grade students. In the literature, the studies examining teacher characteristics and student outcomes approach the issue in a holistic manner including teachers from all branches. There are few studies investigating both teacher and student variables together in single models (see Yerdelen, 2013; Pamuk, 2014). This study focuses on science teachers' perception of school context, science teachers' motivation and their students' motivation and engagement in science and their science achievement. Therefore, this study will make a unique contribution to the literature.

In summary, taking abovementioned issues into consideration, this study may make significant contributions to understanding of the role of (1) science teachers' motivation and job satisfaction in student motivation, engagement and achievement (2) student motivation and engagement in student achievement in science (3) school environment in science teachers' motivation and job satisfaction.

Accordingly, current study may have important implications for policy makers, school administrators with regard to structuring school environments conducive to teacher motivation and job satisfaction. In addition, there can be implications for science teacher education programs to improve pre-service science teachers motivation and provide them with opportunities to develop skills to maintain motivation in their profession. The study may have implications also for curriculum developers and textbook writers regarding how instructional programs and textbooks should be shaped to enhance students' motivation, engagement and achievement in science

1.2 Research Questions

In this study, five main research questions were tested. First four of these questions were tested through HLM models and the last one was tested through a path model.

The first research question included 4 sub-questions:

1. a. To what extent do students in different classes (taught by different teachers) vary in engagement dimensions *(*i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)*?

1. b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

1. c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) predict students'

engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

1. d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) and engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

To be able to test the subquestions of first question, an illustrative general model was presented below (see Figure 1.1).

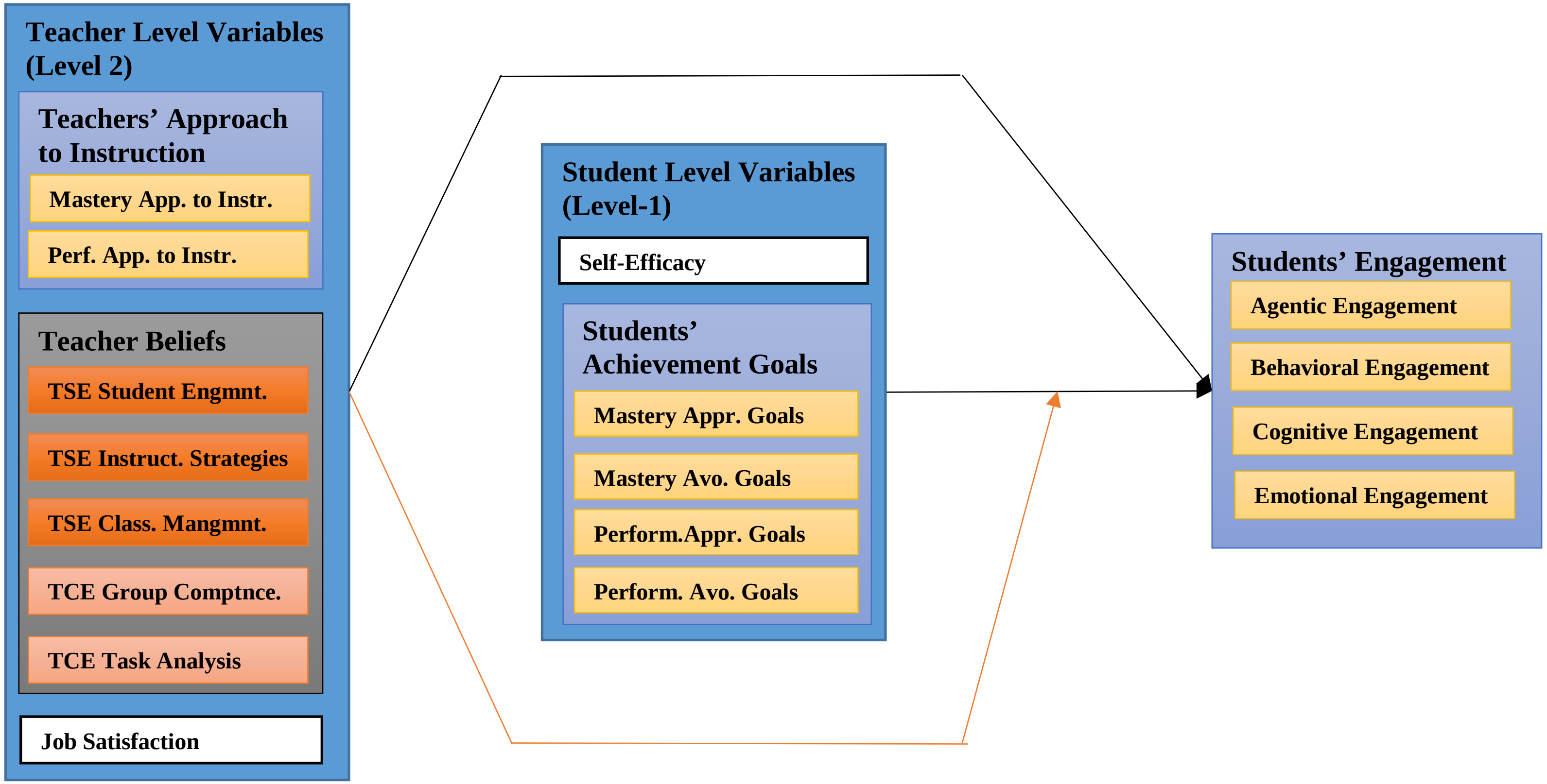

Figure 1.1 The proposed model for predicting engagement variables by self-efficacy, achievement goals (level-1), and teacher variables (level-2)

Note. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables. Orange arrow indicate interaction of level-1 and level-2 variables.

The second research question included 4 sub-questions:

2. a. To what extent do students in different classes (taught by different teachers) vary in achievement goals dimensions *(*i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals)*?

2.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' achievement goals (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

2.c. To what extent do students' self-efficacy beliefs predict students' achievement goals (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

2.d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between students' Self-Efficacy and students' achievement goals *(i.e., Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

To be able to test the subquestions of second question, an illustrative general model was presented below (see Figure 1.2).

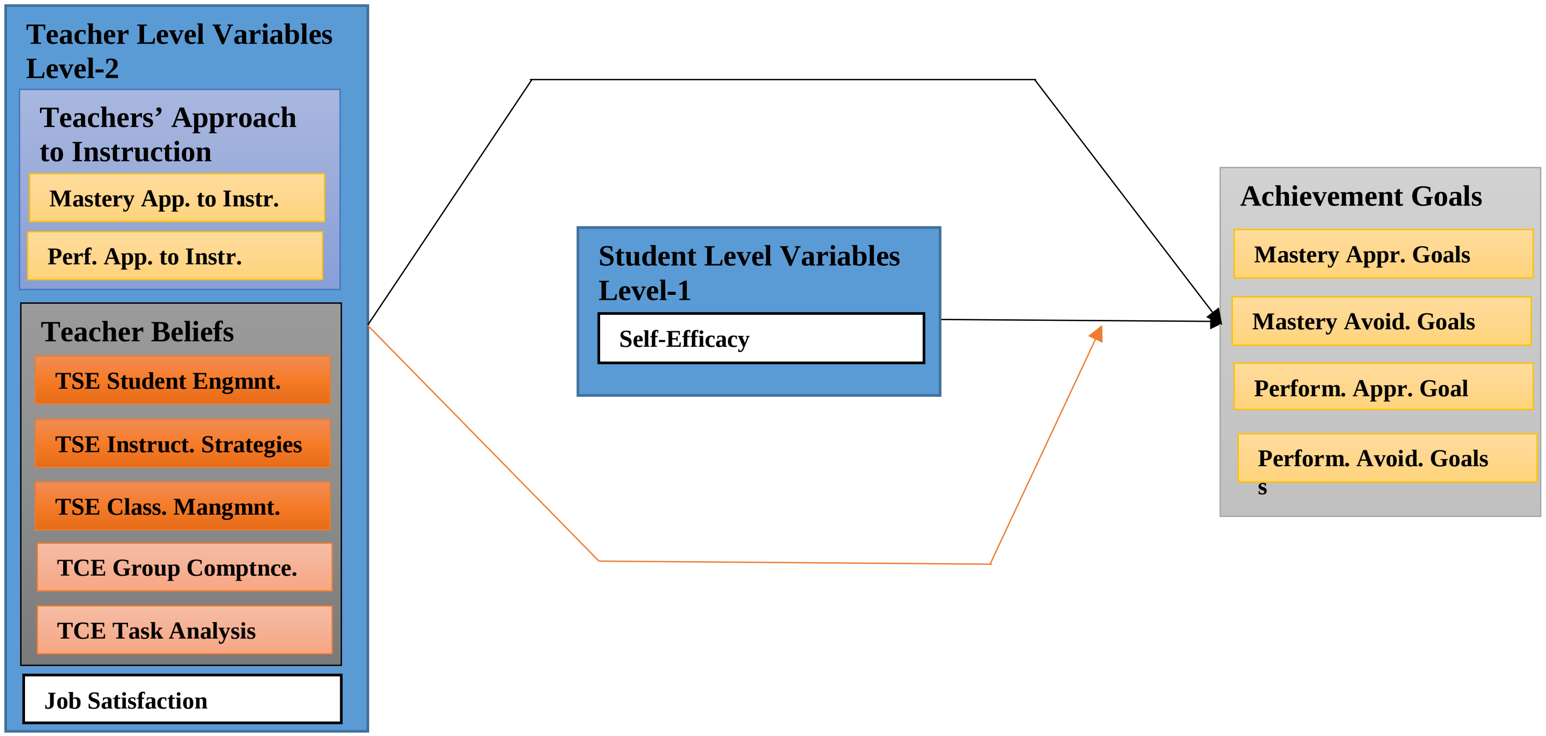

Figure 1.2 The proposed model for predicting achievement goals by self-efficacy (level-1), and teacher level variables (level-2)

Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables. Orange arrow indicates interaction of level-1 and level-2 variables.

The third research questions included 2 sub-questions:

> 3.a. To what extent do students in different classes (taught by different teachers) vary in their self-efficacy beliefs in science classes?
>
> 3.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' self-efficacy beliefs in science classes?

To be able to test the subquestions of third question, an illustrative general model was presented below (see Figure 1.3).

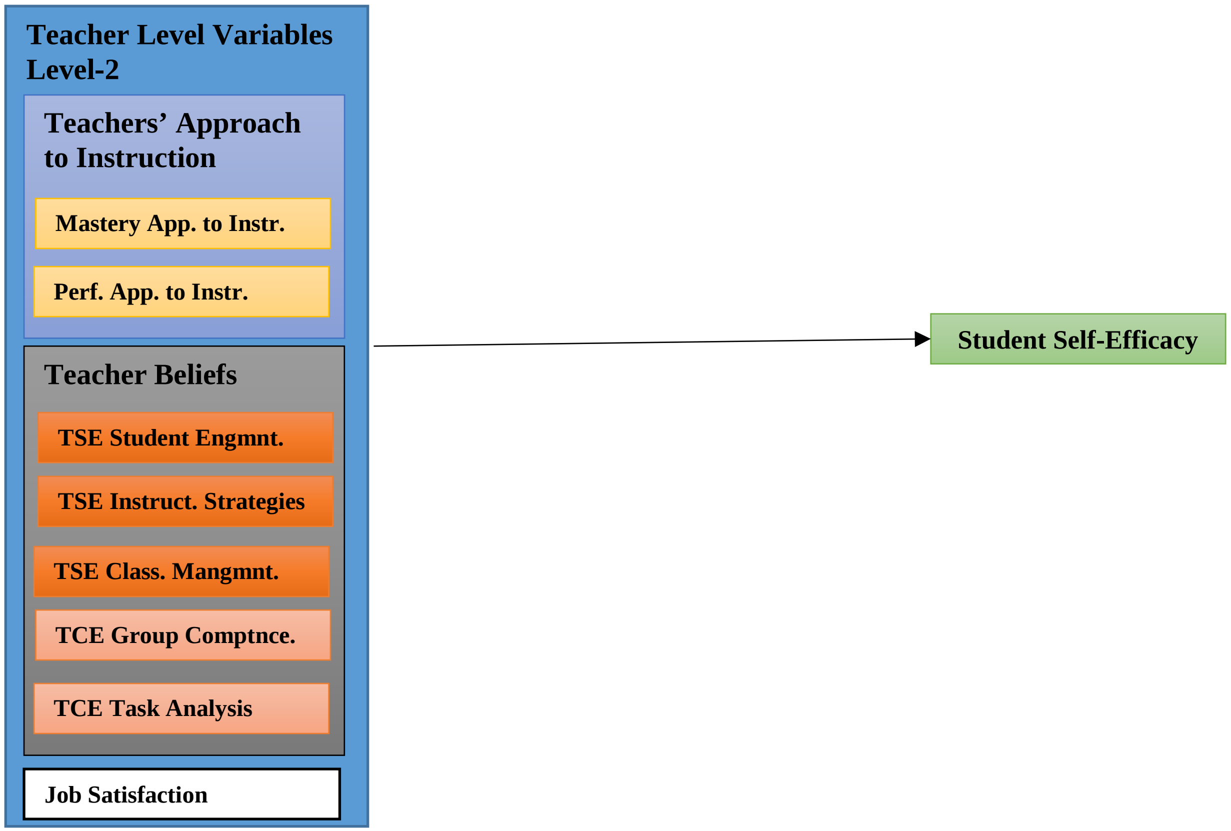

Figure 1.3 The proposed model predicting students' science self-efficacy by teacher variables (level-2)

Note: Arrow do not show causal relationship. Its direction is from predictors to outcomes.

The fourth research question included 4 sub-questions:

4.a. To what extent do students in different classes (taught by different teachers) vary in science achievement?

4.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' science achievement?

4.c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) predict students' science achievement?

4.d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) and students' science achievement?

To be able to test the subquestions of fourth question, an illustrative general model was presented below (see Figure 1.4).

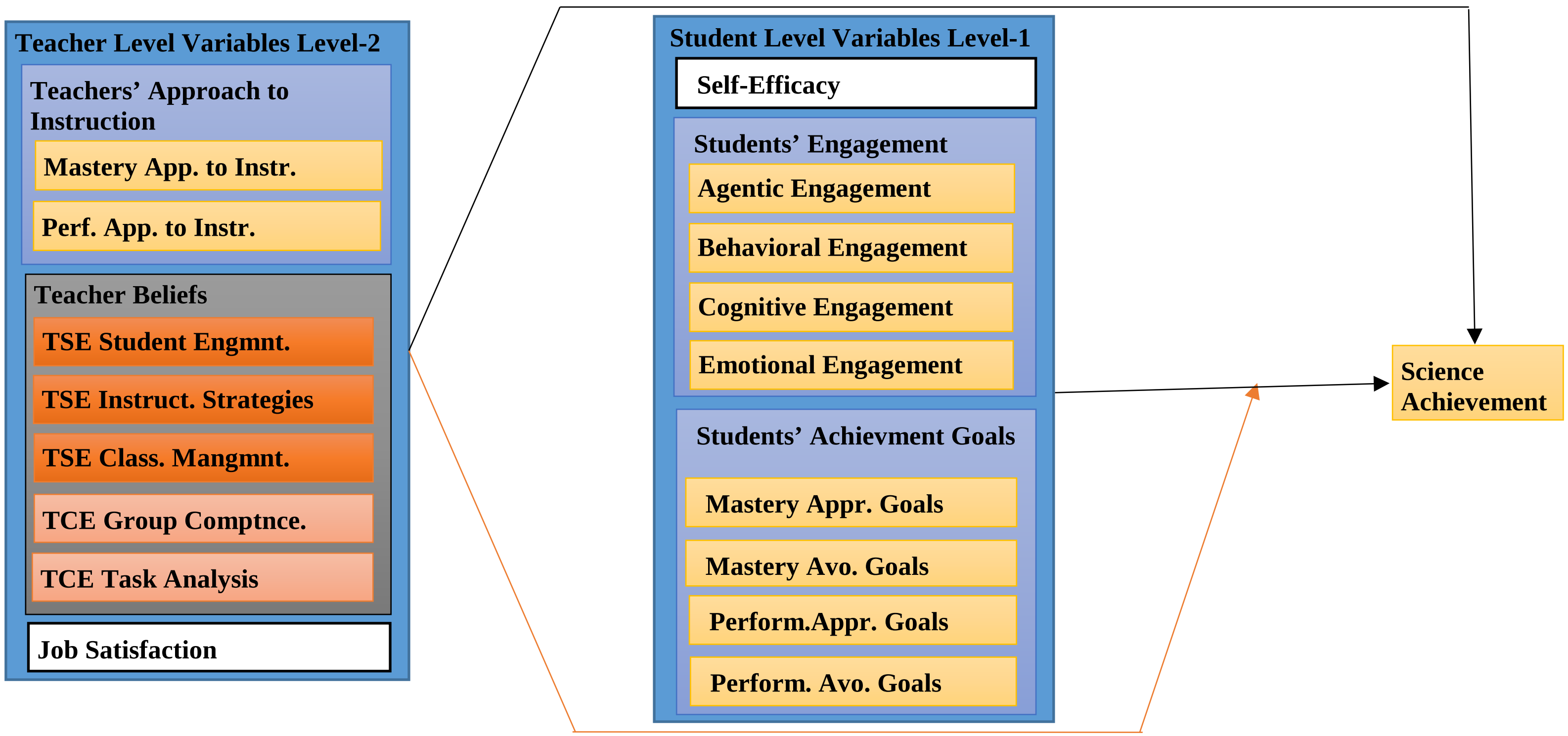

Figure 1.4 Predicting Science Achievement by student self-efficacy, achievement goals, engagement (level-1) and teacher variables (level-2)

Note. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables. Orange arrow indicates interaction of level-1 and level-2 variables.

The fifth and last research question addressed the relationships among school environment variables and teacher motivation variables. This research question was tested through conducting a path analysis.

> 5. What are the relationships among the teachers' perception of school environment variables (i.e., *School Mastery Goals, School Performance Goals, Relations with Parents, Relations with Colleagues, Supervisory Support, and Discipline Problems*) and teachers' motivation (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis),* and job satisfaction?

To be able to test the fifth question, an illustrative general model was presented below (see Figure 1.5).

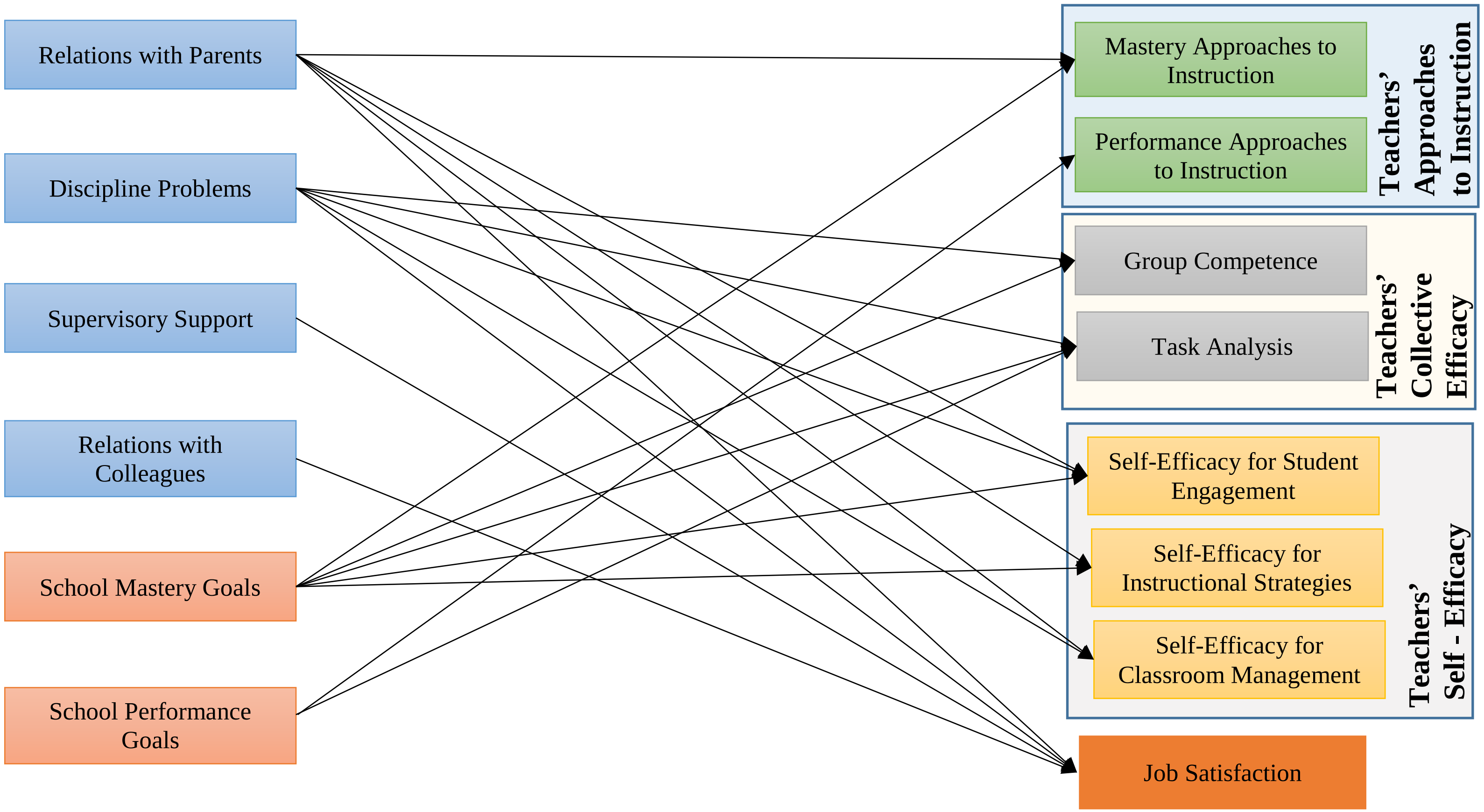

Figure 1.5 The proposed model for the relationships among School Context variables and Teacher Motivation variables

1.4 Definition of Terms

In this section, student and teacher level variables were defined.

1.4.1 Students' Engagement Variables

Agentic Engagement is related to personal agency construct of the social cognitive theory and refers to expressing personal preferences and commenting on the flow of the course (Reeve & Tseng, 2013).

Behavioral Engagement is one's active participation in own learning and academic tasks in an effortful, persistent and attentive manner both in and out of school (Reeve & Tseng, 2013).

Cognitive Engagement refers to using deep level cognitive strategies and setting challenging goals to go beyond the requirements of the learning task (Reeve & Tseng, 2013).

Emotional Engagement refers to the positive or negative feelings towards school, classes, and teachers (Reeve & Tseng, 2013)..

1.4.2 Students' Motivation Variables

Mastery Approach Goals refer to the desire to learn and master the task in addition to developing skills and improving oneself because of the value attributed to intellectual enhancement (Pintrich & Schunk, 2002).

Mastery Avoidance Goals refer to avoiding misunderstanding or avoiding not mastering the schoolwork. Mastery avoidant individuals' are perfectionists that they do not want to fall short of their self-set standards (Pintrich & Schunk, 2002).

Performance Approach Goals emphasize the purpose of competing and surpassing the others to be better than others in the normative standards. Performance approach oriented individuals strive for being the best and getting the highest scores in a group (Pintrich & Schunk, 2002).

Performance Avoidance Goals refer to avoiding looking dumb or avoiding looking incompetent in comparison with the other people in the group. Performance avoidant individuals just try to pass the standard which makes them incompetent and dumb (Pintrich & Schunk, 2002).

Self-efficacy is defined by Bandura (1997) as “beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments” (p. 3).”

1.4.3 Students’ Science Achievement

Science Achievement in this study refers to the students’ scores on a 14-item multiple choice test which includes items related to the first three units of seventh grade curriculum: 1) Body systems, 2) Force and Motion, and 3) Electricity

1.4.4 Teachers’ Motivation Variables

Teacher Self-Efficacy refers to beliefs teachers have about their skills to affect student learning (Caprara et al., 2003).

Collective efficacy is defined by Caprara et al., (2003) as the "judgments that people make about a social system (family, team, organization, or community) and about its level of competence and effectiveness in specific domains of action" (p. 821).

Mastery Approaches to Instruction refers to teachers' instruction which stress valuing learning, understanding the course material, and personal improvement and in turn students are recognized by their willingness to undertake challenging tasks and importance placed on grading for improvement (Midgley et al., 2000).

Performance Approaches to Instruction refers to the kind of instruction that teachers tend to compare students in terms of their abilities and performances. Competition and comparison among students occur frequently (Midgley et al., 2000).

1.4.5 Teachers' Job Satisfaction

Job satisfaction is characterized as a positive or negative sense of fulfillment about one's work (Skaalvik & Skaalvik, 2009).

1.4.6 Teachers' Perception of School Environment Variables

1.4.6.1 Teachers' Perception of School Context Variables

Discipline Problems refer to disruptive student behaviors that students suffer in classrooms during the flow of the course (Skaalvik & Skaalvik, 2011).

Relations with Parents refers to teachers positive or negative relationships with parents of the students (Skaalvik & Skaalvik, 2009).

Relations with Colleagues refers to teachers positive or negative relationships with their workmates in a school environment (Skaalvik & Skaalvik, 2011).

Supervisory Support refers to the support and help that teachers receive form the school principals (Skaalvik & Skaalvik, 2009).

1.4.6.2 Teachers' Perception of School Goal Structures

School Mastery Goal Structure refers to the characteristic of the school emphasizing personal improvement, mastery, understanding and intellectual development (Kaplan & Maehr, 1999).

School Performance Goal Structure refers to emphasis of social comparison, competition and normative evaluations among students made salient by the school (Kaplan & Maehr, 1999).

CHAPTER II

LITERATURE REVIEW

This chapter provides the theoretical framework and empirical studies related to this dissertation. Firstly, social cognitive theory is presented as the main theoretical framework. Following this theoretical part, student and teacher variables are explained and exemplified in relation to the other variables of the study. In student variables part students' self-efficacy, achievement goals, and engagement are examined in relation to science achievement. In teachers' part of this literature review, teachers' self-efficacy and collective efficacy, teachers' instructional goal orientations in the classroom, teachers' perceptions of school goal structures, teachers' perceptions of school context, and teachers' job satisfaction are examined in relation to each teacher variable and student level variables. At the end of each part a brief summary is provided.

2.1 Social Cognitive Theory

Bandura's (1986, 1997, 2001) social cognitive theory emerged mainly from the shortcomings of the two learning theories, behaviorism and social learning, that tried to explain human behavior and learning. The first one was behaviorism which dominated the area of human learning and behavior change till mid 1960's. In brief, behaviorism contends that in human learning consequences of actions in relation to punishment and rewards and reinforcements determine whether something is learned or not. Immediate performance is equated with learning. If something is learned, so it should be performed. On the other hand social learning theory emphasized the role of modeling and observations. People gain knowledge and skills with watching others being reinforced or punished for performing particular actions (Woolfolk Hoy, 2014). Bandura considered the shortcomings of these two theories and formulated his social cognitive theory. For him, behaviorism was too simple to explain the complexity of human learning and behaviors. Social learning theory had better insights but missing in some points. With the publication of *Social Foundations of Thought and Action: A Social Cognitive Theory* in 1986, he explained the social influences on learning and behavior change. The most important contribution that he has made to the social learning theory was including personal factors such as expectations and beliefs. The *social* part in social cognitive theory denotes the importance of learning from observations and models. The *cognitive* part includes thinking, believing, expecting, anticipating, self-regulation and making comparisons and judgments (Woolfolk Hoy, 2014). Besides learning and performance, social cognitive theory also explains motivation and the importance of motivational factors on learning. Human agency, self-efficacy and self-regulation are key elements of motivation dimension of social cognitive theory. Bandura (1986, 2001) asserted that human behaviors occur under the dynamic interaction of three kinds of factors: personal, behavioral and environmental (Figure 2.1). This interaction is known as triadic reciprocality (triadic reciprocal causality) (Schunk, Meece, & Pintrich, 2014; Woolfolk Hoy, 2014; Schunk, 2012).

According to Bandura (1986), human behavior is neither a result of inner factors nor determined or managed by external stimuli. Instead, human behavior is under the influence of three interacting factors namely personal (beliefs, attitudes, expectations, and knowledge), behavioral (individual actions, choices and verbal statements), and physical and social environment (resources, consequences of actions, other people, models and teachers and physical settings) (Woolfolk Hoy, 2014, Schunk, Meece, & Pintrich, 2014). Among

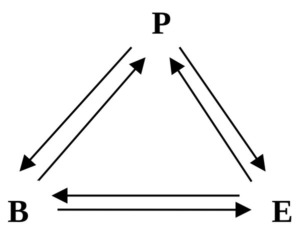

Figure 2.1 Triadic reciprocality model of causation

Note. Adapted from "Self-Efficacy: The Exercise of Control" p. 6 by A. Bandura, 1997 New York: W.H. Freeman.

these three factors, there lies a bidirectional relationship. As personal factors alter behavior, so the behavior may alter personal beliefs and expectations. The same relationship exists between social environment and behavior and between social environment and personal factors.

Schunk (2012) exemplifies this triadic relationship in educational settings by taking self-efficacy as the leading personal factor. Previous research on self-efficacy has indicated that self-efficacy beliefs of students exert influence on their achievement behaviors such as choice of tasks, persistence, effort expenditure and acquisition of skills (personal factors to behavior) (Schunk, 2001; Pajares, & Schunk, 2002). As a result, students' achievement behaviors leads to a change in their self-efficacy beliefs. The progress shown on learning tasks informs students that they are able and improve their self-efficacy for future learning tasks (behavior to personal factors). The interaction of student and teacher behaviors is a good indicator of behavior and environmental factors. In a classical classroom teacher asks students to look at the table (environment to behavior). Students' behavior also influences classroom practices. After finishing the topic students may provide wrong answers to teacher questions and teacher reteaches the topic to the class (behavior to environment). Teacher practices bear importance regarding students' personal factors. Positive teacher feedback to a low achieving student may boost student's self-efficacy (environment to behavior). Research on students with learning disabilities indicated a positive relationship between low achievement and low self-efficacy for performing well (Licht & Kistner, 1986). Reactions of individuals in the social environment of low achieving students (students with low self-efficacy) may be based on what they have demonstrated rather than what they are actually capable of (person to environment).

In triadic reciprocal determinism, the direction of influence among three factors is not always the same. In that bi-directional relationship, one or two factors may pre-dominate. For instance, when students are required to write a term paper and allowed to choose a topic from a list of topics, they will pick the ones that they are interested in or the ones that they enjoy reading about. Here, the environmental component of triadic reciprocality is weak and personal factors (interest, enjoyment) overcome the environmental factor (Schunk 2012; Schunk, Meece, & Pintrich, 2014).

As stated above, one of the most important contribution of Bandura (1986) to social learning theory is integrating cognition and personal factors. Similar to the interaction in triadic reciprocality, personal factors may affect one another (Zimmerman, 2000). For example, accomplishing a learning task successfully may lead students to feel more confident about their learning abilities. In turn, boosted self-efficacy may influence their choice of learning strategy. Such kind of an interaction of personal factors is crucial for self-regulation processes (Schunk, 2012).

According to Bandura (1997), one of the key assumptions of social cognitive theory is that human beings are in need of the development of a sense of agency. Agency stands for the belief that people are capable of controlling and exerting a great deal of influence on important events in their lives. Agency comes forth on actions done on purpose, cognitive and affective processes and self-regulation. Bandura (1997) states that "If people believe they have no power to produce results, they will not attempt to make things happen" (p. 3). People's beliefs of self-efficacy constitute the key element of human agency.

Social cognitive theory asserts that human agency has five fundamental capabilities. These are as symbolizing, forethought, vicarious learning, self-regulation, and being self-reflective. *Symbolizing* refers to vehicles of thought and the experiences are symbolized to regulate the courses of actions. In social environments observations are coded in symbols. When the observed behavior is needed it is recalled and enacted. Symbolizing capability provides the basement for further agency capabilities. *Forethought* capability stands for making plans regarding future events, setting goals and challenges, and regulating courses of actions before stepping in the action. Forethought capability also enables people to produce alternative strategies about the possible consequences of actions before engaging in it and prevent them from unexpected adversities. The social dimension of social cognitive theory addresses *vicarious learning* capability of human agency. Learning does not solely occur by personally experiencing but also observing the actions and behaviors of others'. The data gathered from the environment vicariously is stored in symbols to be used as guidelines for behaviors in the future. Another fundamental human agency capability is *self-regulation* which plays an important role in orchestrating intended actions in an organized way. People use their self-regulation capability to make an overall self-observation and self-monitoring in order to test the accuracy and consistency of their behaviors, choices and their attributions. As a result they make self-directed changes on their actions that complies with their overall self-assessments. The last fundamental capability of human agency is *self-reflection*. According to Bandura (1986), self-reflection is the capability which pertains to the humans the most. Pajares (2002) contended as "Through self-reflection, people make sense of their experiences, explore their own cognitions and self-beliefs, engage in self-evaluation, and alter their thinking and behavior accordingly." Fundamental capabilities of human agency provide individuals to exert influence over the courses of actions and events in their life (Bandura, 1986, 1997).

Overall, social cognitive theory provides an umbrella for the present study. According to social cognitive theory (Bandura, 1986) personal factors, environment, and behavior interact bidirectional and create the human behavior. Indeed, empirical studies suggested findings that verified the assertions of the theory. Related to the current study, previous studies have documented that the characteristics of teachers and teaching and learning environments they created for students influence students' self-efficacy beliefs, achievement goals, engagements, and academic achievement.

In the following sections, students' self-efficacy, goal orientations and engagement are defined. Their relationships with each other and students' achievement are explained in the light of related literature. The scope of this dissertation is limited to middle schools and to the domain of science education. Therefore, the abovementioned variables and their relationships are firstly examined in a general manner including studies from all of educational domains. Then, the scope will be narrowed to middle schools and to science education.

2.2 Student Level Variables

This part of the literature review contains the theoretical information and related empirical studies concerning student engagement, achievement goals, and self-efficacy. Firstly, the student level variables are introduced conceptually in accordance with related theoretical background. Then, their relationship with each other and student achievement are presented in detail. As for the scope of the study, this part is narrowed to science education and students' science achievement at the end of each part.

2.2.1 Student Engagement

Engagement is critical for all students in that it is related to academic achievement, social-emotional well-being and it influences work success in the long run (Christenson, Reschly, & Wylie, 2012). Student engagement research has a relatively short history spanning from the beginning of 1980s to present day (Appleton, Christenson, & Furlong, 2008). Indeed, Mosher and McGowan (1985) explored in their review that the term engagement is used only in two studies. In one of these studies engagement is defined simply as participation in the educational activities organized by schools (Natriello, 1984). In time, examination of engagement has gained attention because it yields positive school related outcomes both in and out of school (Fredricks, Blumenfeld, & Paris, 2004; Heddy & Sinatra, 2013; Tytler & Osborne, 2012). However, a consensus upon the definition and measurement remained inconsistent (Fredricks, et al., 2004; Furlong et al., 2003; Jimerson, Campos, & Greif, 2003; Sinatra, Heddy, & Lombardi, 2015). Although there is still definitional disagreement, engagement is considered as the holy grail of education (Sinatra, et al., 2015). A widely accepted contention is that engagement is a metaconstruct comprising of various sub-components such as behavioral, cognitive, and emotional (Christenson, Reschly, & Wylie, 2012; Fredricks, et al., 2004). Recently, a fourth dimension of engagement was put forward by Reeve and Tseng (2011). The researchers have presented empirical evidence for agentic achievement that it is positively related to behavioral, cognitive, and emotional engagement and predicts student achievement independent of those three (Reeve & Tseng, 2011).

The developmental trend for engagement emerged as it was a two and/or three dimensional construct. The first two were behavioral and emotional engagement. Behavioral engagement was defined as one's active participation in own learning and academic tasks in an effortful, persistent and attentive manner in contexts such as both in and out of school (e.g. social and extra-curricular activities). It also includes positive conduct such as obeying pre-defined classroom and school rules and not to skipping school (Appleton, et al., 2008; Fredricks, et al., 2004; Reeve, 2013). Behavioral engagement manifests itself in the forms of making eye contact, making forward moves in discussions, showing resiliency in the face of difficulties, and trying to reach information without assistance or directions from the authorized others such as parents or families (Buhs & Ladd, 2001). Additionally, behavioral engagement includes positive conduct and it is considered as an important factor in preventing students from dropping out. Emotional engagement refers to the positive or negative feelings of students' towards school, classes, teachers, etc. (Fredricks, et al., 2004). These positive and negative feelings include interest, value, boredom, happiness, sadness, anxiety (Connell & Wellborn, 1991; Skinner & Belmont, 1993) enjoyment, relief (Sinatra et. al., 2015) and identification as belonging (Voelkl, 1997). For example, a student could be defined as emotionally engaged if s/he is showing signs of interest and enjoyment; disengaged if showing boredom and anxiety (Reeve, 2013). Some of the constructs included in emotional engagement such as interest and value are also included as part of motivational theories (Appleton et al., 2008; Fredricks et al., 2004). Moreover, engagement and motivation are used interchangeably (see National Research Council & Institute of Medicine, 2004). While emotional engagement approaches interest and value in a general manner, motivation considers them in detail. For example interest is examined as situational and personal and value is explained in expectancy value theory (Eccles et al., 1983) as comprising of four components (interest, attainment value, utility value, and cost). Cognitive engagement refers to the students' own investment psychologically on learning (mastering) and being self-regulated in terms of using deep level strategies and setting challenging goals to go beyond the requirements of the learning task (Connell & Wellborn, 1991; Fredricks et al., 2004; Wehlage & Smith, 1992). An example of cognitive engagement could be described as exerting cognitive effort for understanding the learning task, striving for being in advance of the activity steps, and choosing tasks which are challenging such as activities slightly over students' competence (Sinatra et al., 2015). Similar to the components of emotional engagement, cognitive engagement overlaps with motivation and/or aspects of self-regulation. Cleary and Zimmerman (2012) stated that self-regulation associated with cognitive engagement that self-regulation can be characterized as exerting metacognitive effort and using learning strategies flexibly.

Recently, agentic engagement was put forth by Reeve and Tseng (2011) as the fourth aspect of engagement. They define agentic engagement as "students' constructive contribution into the flow of the instruction they receive" (p. 258). This new aspect of engagement encompasses students' positive and proactive manipulations with their free will into the ongoing process of instruction (Sinatra et al., 2015). For example, in the classroom students may propose various inputs to class, state their preferences, offer their teacher a different way of instruction, present their needs and ideas, ask questions, ask clarification what they do not understand, and ask for help in modeling, tutoring and feedback during instruction (Reeve & Tseng, 2011). Sinatra et al. (2015) stated that when a teacher reorganizes the flow of the course in accordance with the needs and preferences of the students that are acknowledged during the course, it indicates that agentic engagement has occurred. Agentic engagement was found to correlate modestly to the other three aspects of engagement. Additionally, it was found to correlate positively to student academic achievement and explained unique variance (Reeve, 2013; Reeve & Tseng, 2011). That newly added engagement construct is newly proposed and further research is needed in order to prove its validity in various contexts and cultures (Sinatra et al., 2015).

Engagement has been associated with schooling outcomes such as dropping out, school completion (Christenson et al., 2008; Finn, 2006; Fredricks et al., 2004) and academic achievement (Connel, Spencer, & Aber, 1994; Marks, 2000; Reeve & Tseng, 2011). Engagement may help to reduce dropout rates. Research indicate that behavioral engagement (Alexander, Entwisle, & Dauber, 1993; Archambault, Janosz, Morizot, & Pagani, 2009; Entwisle & Alexander, 1993) and emotional engagement (alienation, estrangement, and social isolation) (Finn, 1989; Newmann, 1981) help reduce dropout rates and increase the rates of school completion.

A number of studies have revealed a positive relationship between various components of engagement and academic achievement (Connell & Wellborn, 1991; Connell, Spencer, & Aber, 1994; Greene et al., 2004; Marks, 2000; Reeve & Tseng, 2011). For example Connell et al. (1994) investigated whether context influences, self-beliefs and engagement predicted African-American adolescents' academic achievement in three different regions of USA. They developed path models for revealing the relationships among these variables for their three samples. Their path analysis results revealed that self-beliefs in terms of perceived competence/efficacy and emotional and behavioral engagement correlated positively positive educational outcomes (academic achievement). In another study, Marks (2000) investigated behavioral and emotional engagement as the outcome variables in a three level HLM (Hierarchical Linear Modeling) analysis. The three level data structure comprised of students in the first level, classrooms in the second and schools in the third, respectively. The sample of the study consisted of more than 3660 students in 5^{th}, 8^{th} and 10^{th} grades, in 149 classrooms and 24 schools. Results indicated that orientation towards school (measured in past achievement in mathematics and social studies) affected engagement positively. In other words, students who are successful in all grade levels (5th, 8th, and 10th) in mathematics and social studies are more engaged. On the other hand unsuccessful students displayed acts of disengagement from the classes. Despite the fact that Marks' (2000) study took engagement as the outcome and previous achievement as a predictor, it is important in that she used HLM as the analysis technique and indicated a positive relationship between previous achievement and engagement for elementary, middle and high school grades.

Research on the relationship between cognitive engagement and academic achievement yielded consistent positive correlation. Since cognitive engagement is described similar and partly overlapping with self-regulated learning, not only cognitive engagement literature, but also motivation literature supports this construct. For example, Pintrich and DeGroot (1990) examined the associations among motivational variables (student self-efficacy, intrinsic value, test anxiety, self-regulation), cognitive engagement (in terms of strategy use) and classroom academic performance. The sample consisted of 173 seventh grade students from English and science classes. They used multiple regression analysis to analyze the data. Their results indicated that self-efficacy and intrinsic value (could be taken as emotional engagement) correlated positively with cognitive engagement (measured as strategy use). Although intrinsic value did not correlate with academic performance, cognitive engagement correlated positively with academic performance. Recently proposed construct of agentic engagement was investigated by Reeve and Tseng (2011) in relation with three other components of engagement (behavioral, cognitive, and emotional) and academic achievement. They collected the data from 365 Taiwanese high school students. Results of structural equation modeling (SEM) indicated that agentic engagement was a distinct construct on its own. It correlated positively with students' constructive motivation, which is characterized as students'' perceived autonomy, perceived relatedness and perceived competence, cognitive behavioral, and emotional aspects of engagement, and academic achievement. Agentic achievement is relatively a new construct. Therefore, engagement literature is limited (see Hıdıroğlu, 2014) in terms of empirical studies investigating agentic engagement and its predictive power on student academic achievement.

To sum up, engagement is a multidimensional construct that influences and influenced by students' school-related outcomes. Although there is a definitional disagreement among researchers, the multidimensional definition of engagement was espoused in this study. Moreover, motivation and engagement was examined as separate constructs based on the idea that motivation is the ignition and engagement is the action itself. The relationship of engagement constructs and achievement suggested a consistent positive correlations in the literature (Reeve & Tseng, 2011, Hıdıroğlu, 2014; Appleton et al., 2004). However, studies examining engagement-academic achievement relationship in science education is very limited. Additionally, in the current study, student engagements were investigated by considering teacher level variables as well. Therefore, in this study it is expected that engagement constructs would correlate positively with science achievement as similar studies in the literature.

2.2.2 Students' Motivation

In this section of the literature review, students' motiavation varaibles, which are achievement goals and self-efficacy, are examined both theoretically and empirically. Additionally, their interrelationships with each other and with engagement and achievement are also examined in the following sections. This parts begins with achievement goals and self-efficacy follows.

2.2.2.1 Achievement Goals

Achievement motivation has been the scope of interest for over a hundred years beginning with the contributions of William James (Elliot, 1999). However, the history of systematic scientific research on achievement motivation only dates back to seventy years ago. Many theoretical considerations such as achievement motive approach, test anxiety approach, the attribution approach have been proposed to explain achievement motivation but widely accepted contemporary approach is achievement goal approach (Elliot, 1999; Schunk et al, 2014). The pioneers of achievement goal approach emerged in the late 1970s and early 1980s. The studies of Dweck (1986), Nicholls (1984), and Ames (1984) are accepted as the foundations of achievement goal approach. Achievement goals refer to the reasons or purposes that students' have for accomplishing academic tasks or engaging in achievement situations (Ames, 1992; Elliot, 1999; Pintrich, 2000; Pintrich & Schunk, 2002). Achievement goal theorists proposed two subtypes of goals in accordance with the definition of competence (Elliot, 1999). For instance, learning and performance goals (Dweck & Legett, 1988), task-involved and ego-involved goals (Nicholls, 1984), task-focused and ability focused goals (Maehr & Midgley, 1991) and mastery and performance goals (Ames, 1992). According to Schunk et al., (2014), these proposed names for achievement goals all overlap on the definitions of Ames (1992) as mastery and performance goals. While mastery goals emphasize mastering the task, learning and understanding the material, and developing skills, performance goals refer to showing one's performance to others. For example, a student having performance goals strive to outperform others on test scores, demonstrate a better normative performance or getting the highest grade in the class (Ames, 1992; Meece et al., 2006; Pintrich & Schunk, 2002, Schunk et al, 2014).

Early research on achievement motivation distinguished two types of goals namely, mastery goals and performance goals (Ames, 1992; Ames & Archer, 1988). More recent research has suggested to take valence into consideration and break mastery and performance goals into approach and avoidance sub dimensions (Elliot, 1999). Therefore, four achievement goals emerged from that break down: mastery approach goals, mastery avoidance goals, performance approach goals, and performance avoidance goals (Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Elliot & McGregor, 2001). Mastery approach goals emphasize learning and deep understanding, while mastery avoidance goals focus on avoiding misunderstanding and avoiding not learning. Concerning performance goals, on the other hand, performance approach goals emphasize showing abilities to others and getting the highest grade, whereas performance avoidance goals focus on avoiding looking stupid and getting the worst grades (Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Elliot & McGregor, 2001; Elliot & Reis, 2003; Pintrich & Schunk, 2002). (See Table Table 2.1).

Achievement goals and their relationships with various motivational constructs have been well-documented in the literature. As a general trend, mastery goals associate with adaptive patterns of behavior such as effort regulation, persistence in challenging tasks, and use of deep level cognitive strategies (Anderman & Young, 1994; Dweck & Legett, 1988; Midgley & Urdan, 1995). Accordingly, while performance approach goals yielded mixed results, performance and mastery avoidance goals appeared to associate with maladaptive behavior types such as using surface level cognitive strategies, giving up a task easily, lack of persistence and perseverance, and failure attributed to lack of ability (Anderman & Young, 1994; Nolen, 1988).

Schunk et al., (2014) stated that mastery avoidance may seem like it refers to a contradictory concept. In some contexts where perfectionists exist, mastery

Table 2.1 Two Goal Orientations and Their Approach and Avoidance Forms

	Approach Focus	**Avoidance Focus**
Mastery Orientation	Focus on mastering task, learning understanding Use of standards of self-improvement, progress, deep understanding of task (learning goal, task goal, task-involved goal)	Focus on avoiding misunderstanding, avoiding not learning or not mastering task. Use of standards of not being wrong, not doing it incorrectly relative to task
Performance Orientation	Focus on being superior, besting others, being the smartest, best at task in comparison to others. Use of normative standards such as getting the best or highest grades, being top or best performer in class (performance goal, ego-involved goal, self-enhancing ego orientation, relative ability goal)	Focus on avoiding inferiority, not looking stupid or dumb in comparison to others. Use of normative standards of not getting the worst grades, being lowest performer in class (performance goal, ego-involved goal, self-defeating ego orientation)

Note. Adapted from "Motivation in education: Theory, research, and applications" p. 191, by D. H. Schunk, P. R. Pintrich, & J. L. Meece, 2014, Columbus, OH: Merrill.

avoidance may take place as self-set high standards. In other words, mastery avoidance may be a personal trait of perfectionists who care much about accomplishing a task flawlessly. Perfectionist avoid doing something superficial. Schunk et al., (2014) explain it in an example:

> One of the authors of this text has a niece who once was in a whole language elementary reading class. The teacher told the children to spell their words any way they wanted because it did not matter if they spelled them correctly. The niece was concerned about not spelling the words wrong, which led her to become upset and frustrated by the teacher's lack of guidance. She was not concerned about others; she

knew there were correct spellings and had a goal of not misspelling the words (p. 192).

After being conceptualized by educational psychologists, achievement goal orientations research has gained an incremental interest up to present time. Achievement goal orientations of students' have been examined in association with many academic and motivational outcomes such as implicit beliefs of intelligence, academic achievement, different aspects of engagement (behavioral, emotional, and cognitive), academic self-efficacy and self-regulation variables such as metacognitive strategies and effort regulation (Anderman & Patrick, 2012).

For example, students' self-efficacy beliefs were found to associate strongly with mastery goals. As stated in self-efficacy literature, students' having high levels of self-efficacy set challenging goals, strive to accomplish a task show persistence in the face of difficulties (Bandura, 1997; Pintrich & Schunk, 2002). Therefore, students having such strong beliefs in their capabilities tend to set mastery goals. A study conducted by Pajares, Britner, and Valiente (2000) investigated the relationship between self-efficacy and achievement goals. Results indicated that self-efficacy correlated positively with mastery approach goals and negatively with performance avoidance goals. Similarly, Anderman and Midgley's (1997) study yielded a positive relationship between mastery goals and self-efficacy. In a theoretical paper, Pajares (2006) stated that "Context is not always everything, but it colors everything" (p. 342). In other words, context and cultural differences may create differences in the motivational beliefs of students. Indeed, a recent study by Kıran and Sungur (2012) examined the relationships between science self-efficacy and achievement goal orientations of Turkish middle grade students. Path analysis results showed that students' science self-efficacy beliefs correlated positively with mastery and performance approach goals. Moreover, performance avoidance goals also correlated positively with science self-efficacy beliefs of middle graders. Therefore, it was concluded that students having high levels of self-efficacy tend to master the material, compete to outperform each other, and also strive not to look incompetent in science class in Turkey. Shortly after, Kahraman and Sungur (2013) published a paper investigating antecedents and consequences of achievement goals in science class. Their participants were 977 seventh grade students. They used task value and self-efficacy as the antecedents of achievement goal orientation. They examined achievement goals in the two by two goal framework which suggested the sub dimensions of achievement goals as mastery approach-avoidance and performance approach-avoidance goals. They used path analysis and their results suggested that students' self-efficacy beliefs only significantly associated with performance approach goals. In another study, Kıngır, Tas, Gok and Sungur-Vural (2013) examined the relationships among constructivist learning environment perception personal relevance, uncertainty, shared control, critical voice, and student negotiation), motivational beliefs (self-efficacy, intrinsic interest, and goal orientations), self-regulation, and science achievement. They studied with eight grade students and collected data were analyzed through a path model. Results revealed that students' self-efficacy beliefs only correlated with their mastery-avoidance and performance-avoidance goals significantly. Although findings of the national and international studies yielded mixed results, in the current study, positive relationships are expected in terms of the relationships between self-efficacy and mastery approach, performance approach and performance avoidance goals. Since the number of studies reporting a positive relationship between self-efficacy and mastery avoidance goals are few in number, a significant relationship is not expected.

One of the most important educational outcomes is student academic achievement. The relevant literature on the relationships between achievement goal orientations and academic achievement suggested inconsistent results. In a comprehensive study, Linnenbrink-Gracia, Tyson, and Patall (2008) conducted a review study concerning the relationships between achievement goals and academic achievement. They included over 90 peer-reviewed journal articles that focus on the associations of mastery and performance approach goal orientations to academic achievement. Firstly, they examined the studies that used self-reported goal orientation measures and analysis techniques of bivariate correlations and beta coefficients from multivariate models. Of the bivariate correlations, 40% of the studies resulted in a positive correlation between mastery goals and achievement but most effect sizes were modest, around .20. There were only two studies that found significant negative relationship and approximately 60% of the studies yielded non-significant results. Similarly, 40% of the studies for performance approach goals and academic achievement relationship resulted in a positive correlation. Again, the effect size was small, ranging from .10 to .30 (Cohen, 1988). The rest of the studies examined reported non-significant results, except 6% reported negative correlations. The authors also examined the results of multivariate analyses. When prior achievement was controlled, the findings indicated inconsistent results. Studies reported both significant and non-significant results in terms of the relationship between mastery goals and achievement. The number of non-significant results were slightly more than significant results. Concerning performance approach achievement relationship, the review provided a similar pattern with mastery goals. When prior achievement was entered as a control variable, the relationship between performance approach goals and achievement was still positive but the number of studies reporting non-significant relationship was higher than those reported a positive relationship. To sum up, the relationship of achievement goal orientations to achievement resulted in inconsistent findings in the literature. The inclusion of prior achievement modified the effect of bivariate zero order correlations. Indeed, Linnenbrink et al., (2008) also included task characteristics (type of achievement task, task difficulty), psychological variables (perceived competence, multiple goals), and individual differences (ability, age, gender, culture) as potential moderators. This literature review pointed out that the abovementioned moderator factors may influence the relationship between achievement goals and achievement. The interpretation of results needs considerable attention while such moderators exist.

Recently in Turkey, a series of studies were conducted in terms of the relationships between students' achievement goals and their achievement in science. First, Tas (2008) examined 1950 7th grade Turkish middle school students' mastery and performance goals and their science achievement. She measured achievement goals with Patterns of Adaptive Learning Scale (Midgley et al., 2000). The results indicated that students' mastery approach goals correlated significantly and positively with science achievement. However, performance approach goals were not reported to correlate with science achievement. In her second study, Tas (2013) tried to find predictors of middle school students' science achievement by using their homework. Hierarchical Linear Modeling (HLM) was used to analyze the data. She found that mastery approach goals predicted science achievement but performance approach did not. In another study by Yerdelen (2013), achievement goals and academic achievement was investigated by controlling student-level and teacher-level variables. The data were collected from a large sample representing the entire country. She conducted HLM analysis and found that mastery approach goals correlated positively and performance avoidance goals correlated negatively with science achievement. Performance approach, and mastery avoidance goals did not correlate with science achievement.

Recently, Chen and Wong (2014) investigated the relationships among achievement goals (mastery, performance approach-avoidance), college GPA (achievement), and average high school scores. Their study sample consisted of 312 college students from Hong Kong. They analyzed the data by using structural equation modeling. They found that achievement goal associate differently with college GPA and high school average scores. Mastery goals and performance approach goals correlate positively with college GPA's but performance avoidance goals correlated negatively. Concerning high school average scores, both performance approach and avoidance goals correlated positively but mastery goals had no association.

In another study Chen (2015) investigated the relations between perceived parenting styles, goal orientations, and academic achievement (GPA) of 339 Chinese college students from Hong-Kong. The author used path analysis to explain the relationships and examine whether achievement goals (mastery goals, performance approach and avoidance goals) mediate the relationship between authoritarian parenting style and academic achievement. Path analysis results revealed that achievement goals mediated the relationship between parenting style and academic achievement. While, mastery goals and performance approach goals correlated positively with academic achievement, performance avoidance goals correlated negatively.

The conceptual and theoretical similarity between motivation and engagement emerged as a challenge for researchers in both fields. Some of the researchers viewed engagement as a prime construct; as cognitive engagement included previous studies on intrinsic motivation (Christenson, et al., 2012). On the other hand, most of the researchers in both fields contended that motivation proceeded engagement. Russell, Ainley, and Frydenberg (2005) stated that motivation is the idea, the ignition for action and engagement is performing the action itself. Indeed, in studies investigating aspects of engagement and motivational constructs together, researchers generally tend to place motivational constructs as predictors of engagement aspects (Anderman & Young, 1994; Pintrich & De Groot, 1990; Wolters, 2004). One of the most important motivational theory in explaining students' achievement motivation, achievement goals were investigated in relation to student engagement in a number of studies. For instance, Nolen (1988) revealed that while task-specific mastery goal orientations associated positively to middle school students' (*N* = 50) use of deep level learning strategies (i.e. cognitive engagement), ego goal orientations (performance goals) associated positively with surface level learning strategies. Recently, Bong (2009) examined South Korean adolescents' mastery approach and avoidance goal orientations in relation with use of cognitive strategies. She revealed that South Korean adolescents' mastery approach and avoidance goal orientations associated positively with use of cognitive strategies such as rehearsal, elaboration, and organizational strategies. She also concluded that mastery avoidance goals associated with cognitive strategy use weaker than mastery approach goals. Other than cognitive engagement, emotional engagement (in terms of affect and motivation) has been investigated in relation to achievement goals and academic achievement in the related literature. For example, research indicated that mastery goals associated positively with positive feelings regarding school. In addition, Roeser, Midgley and Urdan (1996) examined the relationship between 8^{th} grade middle school students' (N = 296) personal achievement goals and feelings of belonging to school. Results indicated that students possessing task goals (mastery) have the feeling of belonging to school (emotional engagement) more than their counterparts who possess low levels of task goals. In another study, Murayama and Elliot (2009) investigated whether performance and mastery goals correlate significantly with intrinsic motivation and academic self-concept (intrinsic motivation and academic self-concept were considered as emotional engagement). They collected data from 1578 Japanese junior and senior high school students. The results of their study showed that while mastery and performance approach goals correlated positively with both intrinsic motivation and academic self-concept, performance avoidance goals correlated negatively with both intrinsic motivation and academic self-concept.

The relationship between behavioral engagement and achievement goals are in the expected direction; mastery goals correlate positively with positive academic behaviors such as exerting effort in classes (Miller, Greene, Montalvo, Ravindran, & Nicholls, 1996), engaging in constructive discussions related to schoolwork with other students around (Patrick, Ryan, & Kaplan, 2007), participating out of school activities (museum visits, field trips, etc.) (Anderman & Johnston, 1998), and adaptive help seeking (Ryan & Pintrich, 1997). Performance orientations generally correlate with maladaptive behaviors such as avoiding help seeking (Ryan & Pintrich, 1997) and showing discipline distracting actions in the classroom (Ryan & Patrick, 2001).

Studies focusing on the relationship between engagement and motivation yielded inconsistent results in terms of achievement goals. Research in different contexts yielded inconsistent results but generally approach orientations (mastery and performance) correlated positively with cognitive and emotional engagement. Mastery approach goals also correlated positively with behavioral engagement. In this study, the relationship between approach achievement goals and engagement is expected to result in a positive association and avoidance achievement goals in a negative correlation because avoidance orientations generally associate with maladaptive behaviors.

Overall, goal orientations have fluctuating relationships with both motivational constructs and student academic achievement. Concerning self-efficacy and goal orientations relationship, research conducted in Turkey and USA generate different results. Studies overlap in terms of the relationship between self-efficacy and mastery approach goals and performance approach goals. However, Turkish students’ self-efficacy beliefs correlate also positively with their performance avoidance goals. The relationship of achievement goals and academic achievement yielded inconsistent results. Literature provides both significant and non-significant relationships. Although such inconsistency exists in the literature, in this study it is expected that mastery approach goals correlate positively with science achievement because studies conducted in Turkey in science domain pointed out such relationship. However, performance approach-avoidance and mastery avoidance goals may have negative or no relationship with students' science achievement.

2.2.2.2 Self-Efficacy

Self-efficacy is the key variable in *personal factors* dimension of triadic reciprocality of social cognitive theory. Bandura (1986) defined self-efficacy as **"**people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). Among self-beliefs**,** self-efficacy is the most prominent one in determining the choice of activities, effort expenditure and persistence (Schunk & Pajares, 2005, 2009). In developing a sense of personal agency, self-efficacy is a key in making people believe that they can influence their lives (Bandura, 1997, 2001). Pajares (2002) stated that self-efficacy beliefs are the pushing forces for motivation, well-being and accomplishments. People possessing low levels of self-efficacy are inclined to refrain from engaging in activities. On the other hand, if people believe that they are able and skilled, then they would be eager to take part (Schunk, Meece, & Pintrich, 2014). If people do not believe that what they do will produce expected consequences, they have little desire to act or their resistance to keep what they do decreases. Bandura (1997) stated that "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2). Thus, the beliefs people have about their skills are better predictors of their behaviors than their actual level of skills. It is obvious when people experience a mismatch with their actual capabilities and the requirements of the task of which they undertake (Pajares, 2002; Pajares, 2006). However, real world and beliefs do not always match.

Self-efficacy beliefs of people are generally better predictors of their accomplishments than their knowledge, skills or previous attainments.

People develop a sense of self-efficacy from four main sources which are enactive mastery experiences, vicarious experiences, verbal persuasions, and physiological and affective states (Bandura, 1997; Usher, 2009; Usher & Pajares, 2009). These four sources are the foundations of people's belief regarding their self-efficacy. As mentioned in the name of social-cognitive theory, cognition plays an important role in forming self-efficacy beliefs. The information conveyed by these four sources are not enough solely to create self-efficacy beliefs. Such information must be processed cognitively to be deemed informative (Bandura, 1997). Enactive mastery experiences are the most predictive source of people's self-efficacy beliefs (Bandura, 1986, 1997; Hoy, 2004). The experience people live are thoroughly personal, or authentic; that makes it completely belong to the performer. Successes gained personally take great part in developing a strong self-efficacy beliefs. On the other hand, failures decrease it. As Bandura (1997) asserted, failures have the potential to diminish beliefs in one's capabilities to accomplish a task successfully, particularly if this happens just before the establishment of a strong sense of self-efficacy. In forming self-efficacy beliefs, modeling processes or observing others performing a task also help to develop a sense of efficacy. This is known as vicarious experience (Usher & Pajares, 2008). The similarity between the observer and the performer also influences the observers' decision about personal self-efficacy (Zeldin & Pajares, 2000). Schunk (2012) asserted that "Observing similar others succeed raises observers' self-efficacy and motivates them to try the task because they believe that if others can succeed, they can as well" (p. 147). The failures of respected others may have devastating effects on observers' self-efficacy. This may be interpreted negatively as such difficult task to accomplish. The third source of self-efficacy beliefs is verbal or social persuasions (Bandura, 1997; Usher & Pajares, 2008; Usher & Pajares, 2009).

Verbal persuasions from the people of close environment help the individual to be persistent on a task and be resistant to unexpected happenings (Zeldin & Pajares, 2000). The credibility of the persuader is important in social or verbal persuasions. The receivers of verbal persuasions should see the persuader as of a high quality to provide constructive feedback. Additionally, verbal persuasions alone are not effective in creating a positive sense of self-efficacy. Rather, verbal persuasions must work together with other sources of self-efficacy (Britner & Pajares, 2006). The fourth source of self-efficacy beliefs is emotional states or physiological arousal (Bandura, 1997; Usher, 2009). Being tired, stress, mood, and tension could be examples of emotional states or physiological arousal. These bodily symptoms may be influential in making judgments of self-efficacy. Usher and Pajares (2008) stated that increasing emotional arousal and decreasing negative feelings (despair, depression, despondency) increase self-efficacy. On the other hand, individuals having a strong sense of efficacy may not be affected from the emotional fluctuations.

Self-efficacy beliefs play a determining role in many domains of human functioning (Bandura, 1997). The choices of tasks, the amount of effort, persistence in sustaining performance and resilience are all affected from people's self-efficacy beliefs (Bandura, 1997; Schunk, 1995, 2012). Moreover, self-efficacy beliefs also mediate the relationship between many personal factors such as skills, previous experience, and mental ability or other self-referent beliefs and academic achievement (Pajares & Schunk, 2002).

Self-efficacy has been the topic of many studies in various domains such as medicine, athletics, media studies, business, social and political change, psychology, psychiatry, and education (Pajares, 2002). In addition to such diverse fields of study, self-efficacy has been shown to have strong relationships with achievement of all sorts (Multon, Brown, & Lent, 1991; Pajares, 1996, 1997; Schunk & Pajares, 2005, 2009; Valentine, Dubois, &

Cooper, 2004). Researchers in the field of education have demonstrated that self-efficacy is positively related to and influence academic achievement (Bandura, 1997; Pajares, 1996, Schunk, 2012). A comparison of students holding high and low self-efficacy indicates that those who are confident in their academic capabilities participate a learning task more readily, work harder, persist longer in the face of difficulties and achieve at a higher level. However, students who have doubts about their capabilities fall short in almost all of such behaviors (Schunk & Pajares, 2002). For example, Bouffard-Bouchard, Parent, & Larivee, (1991) found that students holding high levels of self-efficacy for problem solving showed more performance monitoring and persisted longer than students holding low levels of self-efficacy. A number of studies have found similar results in terms of the positive relationship between self-efficacy and academic achievement in various domains and grades (Britner & Pajares, 2006; Linnenbrink & Pintrich, 2002; Hampton & Mason, 2003; Klassen, 2004; Pajares, 2006; Yildirim, 2012). A meta-analysis concerning the relationship between academic achievement and self-efficacy was conducted by Multon, Brown, and Lent (1991). They examined 36 studies conducted between 1981 and 1988 included 38 samples and 4998 students in total. The great majority of the participating students were from the elementary schools (60.6%) and colleges (28.9%). The researchers have utilized students' three types of performance measures in terms of academic achievement. These are (1) standardized achievement tests (e.g., Iowa Test of Basic Skills), (2) classroom-related measures (e.g., self-rated course performance, course grades, cumulative grade point average), and (3) basic skill tasks (e.g., subtraction problems, reading comprehension problems). The results showed that self-efficacy correlates positively with academic achievement with a moderate effect size ($r = .38$). Self-efficacy beliefs of students explained 14% of the variance in students' academic achievement. Another noteworthy finding of this meta-analysis suggested that as the age of students increase, so does their self-efficacy in academic performance. In other words, students in elementary years presented weaker effects in comparison to their older counterparts.

Self-efficacy is a context or situation dependent construct unlike general self-concept and self-esteem (Linnenbrink & Pintrich, 2002). In other words, self-efficacy beliefs are more task or situation-specific in comparison with other motivational expectancy constructs such as goal attainment, outcome expectations, etc. (Schunk, Meece, & Pitrich, 2014). For example, a student may have high self-efficacy for certain topics in a learning area (e.g. solving algebra problems) but may have lower levels of self-efficacy in another topic in the same learning area (e.g. geometry) (Linnenbrink & Pintrich, 2002) Such a difference may result from students' past experiences as successes or failures. Instead of investigating academic self-efficacy as a whole construct, it is more convenient to examine it separately across different subject areas and domains (language, writing, math, science, etc.).

In the area of science education, self-efficacy is investigated in relation to science achievement and other motivational constructs in a number of studies (Bergey, Ketelhut, Liang, Natarajan, & Karakus, 2015; Britner, 2008; Britner & Pajares, 2001; Britner & Pajares, 2006; Chen & Usher, 2013; Pintrich & DeGroot, 1990; Sun, Bradley, & Akers, 2012). As postulated by Bandura (1997) students who believe in their capabilities (holding high levels of self-efficacy) persist in the face of difficulties, exert high effort on task, quit giving up easily and work harder. The results of empirical findings support Bandura's assertions in the area of science education as well. For example, in a recent study Bergey, Ketelhut, Liang, Natarajan and Karakus (2015) investigated whether middle school students' performance on a science assessment would associate with changes in scientific inquiry self-efficacy. Secondly, they examined whether students' computer game self-efficacy associated with their performance on the same assessment. The sample of the study was 407 middle grades students. The researchers measured students' scientific inquiry and computer game self-efficacy before and after their performance on a computer game-like science assessment. The results indicated that prior scientific inquiry self-efficacy predicted achievement on science achievement but computer game self-efficacy did not. Boys had higher self-efficacy for computer games but there was little gender difference in how efficacy beliefs associated with performance.

Sun, Bradley, and Akers (2012) investigated factors impacting science achievement for fifteen year old students in Hong-Kong. The dependent variable of the study was science achievement in PISA 2006 examination. The data supplied by PISA examination have a multilevel structure. Therefore, the researchers used a multilevel data analysis. In the student level of the independent variables, there were student socio-economic status, gender, parental values on the importance of science, motivation, science self-efficacy, science media activities, and peer environment. As school level independent variables to predict students' science achievement, there were school enrolment size, school socioeconomic composition, shortage of science teachers, school science promotion, school educational resources, quantity of instruction, quality of instruction, and school autonomy. The sample of the study was 4675 students of 7^{th} to 11^{th} grades from 146 school all around Hong-Kong. The results showed that, at the student level students from high socio economic status families, students with high self-efficacy, and students whose parents value science are found to be more successful. Also male students were more successful in science than girls. At the school level, the achievement gap between schools could be attributed to school enrollment size, school socio-economic composition, and time allocated for science instruction.

In another study investigating sources of science self-efficacy and the relationship between science self-efficacy and science achievement, Britner and

Pajares (2006) conducted a research with 319 middle school students. The results of the study revealed that all four sources of self-efficacy (mastery experiences, vicarious experiences, verbal persuasions, and emotional arousal) significantly correlated with science self-efficacy for both middle school boys and girls. Among the sources, only mastery experiences predicted science self-efficacy. Girls were found to have stronger science self-efficacy beliefs than boys. Moreover, for both middle school boys and girls science self-efficacy was the strongest predictor for their science grades.

Recently, a similar study was conducted by Chen and Usher (2013) in order to reveal the sources of science self-efficacy of middle and high school students. Additionally the researchers investigated the relationship between science self-efficacy and science achievement. They defined latent profiles as developing from exposure to four sources of self-efficacy and investigated the differences between these latent profiles as a function of implicit theory of science ability, gender, and grade level. They found that mastery experiences were the strongest source of science self-efficacy. Implicit theory of ability and grade level predicted the differences in latent profiles. Students' science self-efficacy predicted their science grades.

A comprehensive study conducted by Yerdelen (2013) in Turkey investigated a number of student and teacher variables by using multilevel modeling techniques. She included 7th grade students' perception of classroom learning environment, self-regulation, and science achievement as the student level variables and their teachers' beliefs about teaching science and satisfaction from their profession as teacher level variables. The sample of the study consisted of 8189 students and 372 science teacher from all over the country. She used HLM analysis in order to analyze the nested data structure with several models. She found that students' science self-efficacy were the strongest predictor of their science achievement. Students who believed in their capabilities in science acquired the highest scores on the science achievement test.

The theoretical assertions about the contribution of self-efficacy to academic achievement are supported by empirical findings in science education research as well. The more students in various grades possess higher levels of science self-efficacy, the more they got higher grades and get higher scores on science assessment tests. As a consequence of both theoretical assertions and empirical support from the literature, in the current study, it is expected that science self-efficacy predicts students' science achievement in this study as well.

Student self-efficacy and engagement has a natural bound as research in educational settings indicate that high levels of self-efficacy positively influences learning, academic success, using self-regulation strategies, motivational constructs such as choice of challenging activities, effort, persistence and interests (Bandura, 1997; Pajares, 1996; Usher & Pajares, 2008). As stated before motivational constructs overlap with engagement constructs. Since motivation is coined as the ignition and engagement as the action, in this review effort and persistence are considered as behavioral engagement; using learning strategies considered as cognitive engagement, and interest as emotional engagement. Theoretical contentions and empirical research support that self-efficacy correlates positively with behavioral, emotional, and cognitive aspects of engagement (Schunk & Mullen, 2012). For example, Caraway, Tucker, Reinke, & Hall (2003) investigated the relationship among self-efficacy, goal orientation, and fear of failure with school engagement for high school students. Participants were 123 high school students. They found that self-efficacy and goal orientations correlated positively but weak with behavioral, cognitive and emotional engagement. The authors also have collected data about academic achievement in terms of GPA.

Self-efficacy associated positively with academic achievement. Additionally, fear of failure had a significant negative association with school engagement.

Social cognitive theory asserts a view of human agency that human beings proactively administer their own career and life paths (Schunk & Pajares, 2005). In other words, human agency plays an important role in deciding human behaviors. As Bandura put it “To be an agent is to influence intentionally one’s functioning and life circumstances” (Bandura, 2006, p. 164). In a similar vein, agentic engagement refers to students’ contribution to the flow of the course in terms of proposing more appropriate teaching methods or presenting their preferences to the teacher (Reeve & Tseng, 2011; Reeve, 2013). Recently in Turkey, Hıdıroğlu (2014) conducted a study investigating relationships among seventh grade students’ engagements (agentic, behavioral, cognitive, and emotional), self-efficacy, classroom goal orientations and science achievement. A total of 744 seventh grade students participated in the study and a path analysis was conducted to reveal the relationships among these constructs. The results suggested that students’ self-efficacy in science class predicted all of the dimensions of students’ engagements in science class. Although the literature is limited related to this relationship, theoretical assertions point out a positive relationship between self-efficacy and agentic engagement. Therefore, in this study, student science self-efficacy is expected that correlate positively with agentic engagement.

In the context of science education research, engagement has been investigated in various grade levels (elementary, middle, high school and college). However, one of the main constraints of engagement research in science education is that the researchers have preferred to study only on cognitive aspect of engagement by taking cognitive strategy use as the indication of cognitive engagement (Greene, 2015). For example, in an early study, Meece, Blumenfeld and Hoyle (1988) investigated the relationships between task mastery goals and cognitive strategy use in six different science activities. Their sample consisted of 275 fifth and sixth grade students. They used structural equation modeling to test the model that they generated to examine the relationships. Their results showed that students possessing high levels of task mastery goals were more cognitively engaged. Moreover, Nolen (2003) examined the relationships among high school students' perceptions of science learning environments, variables of motivation, learning strategies, and achievement. Motivational variables consisted of task orientation, ego orientation, and work avoidance/academic alienation. Strategy-value beliefs were used to measure students' deep processing strategies which are monitoring, elaboration and organization and selection and students' valuing of strategies (i.e. usefulness of various study strategies). The results indicated that both task orientation and ego orientation correlated positively with deep strategy use but the correlation was stronger between deep strategy use and task orientation. On the other hand, work avoidance/academic alienation associated negatively with task orientation and it had no relationship with ego orientation.

In another study, Anderman and Young (1994) examined the relationship between motivation and cognitive strategy use in sixth and seventh grade science classes. Motivation constructs of the study were self-efficacy, ability and learning goal orientations, expectancy-value and self-concept. Deep and shallow strategy use were used to reflect students' cognitive engagement in science class. They found that sixth and seventh graders who are learning oriented use deep learning strategies more. Additionally, having high levels of science self-efficacy, valuing science and having high self-concept of ability correlated positively with being learning focused in science. Lastly, Pugh, Linnenbrink-Garcia, Koskey, Stewart, and Manzey (2010) conducted a study on high school students' transformative experiences. Transformative experiences are a kind of deep engagement and defined as aesthetically understanding of daily life experiences especially out of school with the connection of already learned science concepts (Pugh, 2002; Pugh et al., 2010). In their study Pugh and his colleagues investigated whether transformative experiences were predicted by achievement goals (mastery approach, performance approach, and performance avoidance), science identity, and prior knowledge. They collected data from high school biology students on the topic of evolution and natural selection. They regressed science identity and achievement goal orientations on transformative experiences with entering prior knowledge as control variable. They used hierarchical multiple regression analysis. They found that science identity was a significant predictor of transformative experiences. In initial analysis, bivariate correlations between transformative experiences and performance approach and avoidance orientations indicated relatively weak correlations (r =.10). Mastery approach goals correlated moderately (r =. 31) and included in the regression analysis. Indeed, mastery approach goals are found to be a unique significant predictor of transformative experiences when prior knowledge was controlled. Additionally, the effect of science identity waned when mastery approach orientation was entered in the regression analysis.

Previously conducted studies have indicated that self-efficacy has correlated positively with engagement constructs in the literature consistently. Moreover, self-efficacy was one of the most influential motivational construct in the literature. Therefore, in the current study, it is expected to find a similar pattern as well.

2.3 Teacher Level Variables

This section of the literature review is devoted to the teacher level variables and their interactions within themselves and between student level variables. In this section teacher variables were categorized as teacher motivation, teacher job satisfaction, and teachers' perception of the school environment. Teacher motivation variables included teachers' self-efficacy (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management), collective efficacy beliefs (group competence and task analysis), and instructional goal orientations (mastery approaches to instruction and performance approaches to instruction). Teachers' perception of school environment has two dimensions which are teachers' perception of school context and teachers' perception of school goal structures. Teachers' perception of school context variables included relations with parents, relations with colleagues, supervisory support and discipline problems. Teachers' perception of school goal structures included school mastery goals and school performance goals. The following sections explain teacher variables both theoretically and empirically in accordance with the related literature.

2.3.1 Teacher Motivation and Relations with Student Outcomes

In this section, teacher motivation variables are firstly explained theoretically and then their relationships with student outcomes are presented.

2.3.1.1 Teacher's Instructional Goal Orientations

Teachers' instructional practices can shape the goal structure in the classroom and in turn influence students' motivational beliefs and behaviors (Ames, 1992; Maehr & Midgley, 1991). Achievement goal theorists stated that teachers' instructional practices, behaviors during teaching, and discourse often present their beliefs about the purposes of education to students. Accordingly, teachers in general may influence their students in terms of the goals students' adopt, achievement related behaviors, and cognitions (Ames, 1992; Patrick, Turner, Meyer, & Midgley, 2003). Such teacher effects may occur in the form of classroom or school policies that are emphasized to students as mastery or performance goals. Alternatively, goal emphases may be direct messages by the teachers during teaching (Kaplan, Middleton, Urdan, & Midgley, 2002). Teachers are the vehicles that carry the messages to students as school policies, instructional goals or personal goal orientations and these communications are believed to affect students' motivation, goal orientations and achievement – related outcomes (Maehr & Zusho, 2009).

The kind of instruction teachers emphasize in the classroom in terms of mastery orientation or performance orientation may help to constitute the classroom goal structure (Ames, 1992; Ames & Archer, 1988). Moreover, other methods have been proposed to assess the classroom goal structure such as students' perceptions of teachers' goals in the classroom, independent observations of classrooms, and teachers' self-reports of their approaches to instruction during classroom teaching (Urdan, Midgley, & Anderman, 1998). Since teachers' self-reports of their approaches to instruction is accepted as an integral element of classroom goal structures, studies including classroom goal structure were included in this review.

In a mastery oriented classroom goal structure, teachers' instruction stress valuing learning, understanding the course material, and personal improvement and in turn students are recognized by their willingness to undertake challenging tasks and importance placed on grading for improvement (Maehr & Zusho, 2009). In classrooms where teachers practice mastery oriented instruction, it is more likely that understanding the subject matter is more important than rote memorizing and making mistakes are acceptable as long as learning and progress occurs. Moreover, exerting effort and improvement are appreciated; challenging and creative tasks are picked and assigned and learning is introduced as enjoyable activity (Ames, 1992; Ames & Archer, 1988; Urdan et al., 1998, 1998). A mastery goal emphasized classroom is expected to diminish students' fears about being compared with other students in terms of competence. Instead students are oriented towards understanding and accomplishing the task at hand successfully. (Urdan et al., 1998). On the other hand, in classrooms where teachers emphasize performance oriented instruction, competition and comparison occur frequently. Teachers tend to compare students in terms of their abilities and performances. Students compete with each other and are recognized for their superior performances in normative graded tests. A classroom in which performance goal structure is salient communicates students that learning is a stepping stone for recognition and to be known among other students and such classroom climate emphasizes comparisons of ability among students (Anderman & Patrick, 2009). Additionally, grades and test scores are generally the hot topics of the classroom agenda (Ames, 1992; Ames & Archer, 1988; Urdan et al., 1998). According to Covington (1992), in such a competitive classroom context, students care a lot about how their abilities are seen in the eyes of other students. Additionally, they form a kind of protection mechanism for their self-worth in the classroom community (Ryan & Pintrich, 1997). Therefore, students more likely strive to avoid looking incompetent and appear unable to other students in their classroom.

Teachers are an integral part of the classroom goal structures through communicating the purpose of education and schooling in general and emphasizing a mastery or performance goal structure during their instruction via their teaching strategies (Ames, 1988; Anderman & Patrick, 2009). Theory suggests that when students perceived their learning environment as promoting a mastery orientation, it is expected that students are more likely orient themselves in accordance with perceived mastery goals that emphasize self-improvement, learning and understanding the material. Accordingly, students perceived mastery orientations influence their effort expenditure on academic tasks, use of adaptive learning strategies, and achievement (Ames, 1992; Anderman & Patrick, 2009). Moreover, students' perceptions of a mastery oriented classroom goal structure yields adaptive outcomes such as increased likelihood to help-seeking behavior (Ryan, Gheen, & Midgley, 1998) and decreased likelihood of the use of self-handicapping strategies (Midgley & Urdan, 2001). In contrast to perceptions of a mastery classroom goal structure, a perceived performance goal structure generally yields less adaptive and diminishing effects on learning and achievement (Anderman & Patrick, 2009). Students perceptions of a performance oriented classroom goal structure associated with negative consequences such as decreased rates of help-seeking (Ryan et al., 1998), increased use of self-handicapping strategies (Midgley & Urdan, 2001), competence perceptions in low levels (Stipek & Daniels, 1988).

The literature on the effects of teachers' instructional goal emphasis in the classroom provides an extensive array of studies. In the following sections, teachers' instructional goal emphasis in the classroom is examined in relation with student outcomes such as personal goal adoptions, student engagement, and academic achievement. Since the scope of this dissertation is on science education, studies conducted in science domain are also included. Finally, it should be mentioned that teachers' instructional goal orientations are equaled with classroom goal orientations and studies including student perceptions of classroom goal orientations are taken as reflecting teachers instructional goal orientations in the classroom.

2.3.1.2 Teacher's Instructional Goal Orientations and Student Outcomes

Teachers' Instructional Goal Orientations and Students' Academic Achievement

Teachers' instructional goal orientations, examined in terms of classroom goal structures, have been found to be associated with students' academic achievement in a number of studies (Urdan, 2004; Wolters, 2004; Ee et al., 2003). Mastery and performance classroom goal structures have been examined in relation to achievement in different domains such as mathematics (Gutman, 2006; Lau & Nie, 2008; Linnenbrink, 2005; Wolters, 2004), general achievement at the end of primary school (Ee, Moore, & Atputhasamy, 2001; Ee, Moore, & Atputhasamy, 2003), and English language (Urdan, 2004). The grade levels also differ in these studies: junior high or middle school (Ee et al., 2001; Ee et al., 2003; Linnenbrink, 2005; Wolters, 2004), high school (Gutman, 2006; Urdan, 2004), and elementary school (Lau & Nie, 2008). Students' academic achievement was conceptualized differently in these studies as well. Course grades (Gutman, 2006; Urdan, 2004; Wolters, 2004), multiple choice achievement tests (Ee et al., 2001; Ee et al., 2003; Lau & Nie, 2008), and open ended questions (Linnenbrink, 2005) were all used as a measure of students' academic achievement.

Wolters (2004) found that middle school students' mathematics course grade was predicted by their perceptions of classroom mastery goal structures. However, this effect waned after the researcher entered personal achievement goals. The final model showed that classroom goal structures have no effect when they are included in analysis together with the personal goal orientations. On the other hand, a counter-resulted study was conducted by Ee et al., (2003) in Singapore with sixth grade high achieving students. The researchers investigated the relationship between classroom goal structures and student achievement. Study participants were 566 high-achieving students and their 32 teachers. Data were analyzed by using multilevel analysis techniques. The researchers found that teachers' ego (performance) goal structure associated positively with students' achievement on 6^{th} grades end of year achievement test. The authors stated that this result was in contrast with the literature because studies generally favor mastery classroom goals on the association with student achievement. They explain this inconsistency with the cultural milieu of a meritocratic society structure, working with only the high-achieving students, and a competition-oriented system of education. Another study in Singapore context yielded counter results. Lau and Nie (2008) worked with 3943 5^{th} grade students from 130 classrooms. Although their achievement measure was in mathematics domain, they reported that classroom mastery goal structure associated positively with mathematics achievement of 5th graders.

Urdan (2004) reported similar findings with Wolters (2004) in terms of the positive relationship between mastery oriented classroom goal structures and academic achievement in English at the high school level. Gutman (2006) reported no relation of perceived classroom goal structures to the change in African-American high school students GPA in math during the transition between 8th and 9th grades.

To sum up, classroom goal structures generally effects students' academic achievement. Majority of the studies reported positive associations between mastery classroom goal structure and student achievement. However, a study sampled only high–achieving students reported a counter finding favoring classroom performance goal structures. Another study with African-Americans reported no relationship. In the present study, the sample is not a special group of students. Therefore, it is expected that findings of the present study fit with the mainstream and yield positive associations between mastery classroom goal structure and student science achievement. Since this study focused on average student achievement, a positive relationship is not expected between performance instructional goals and students' achievement.

Teachers' Instructional Goal Orientations and Student Engagement

Classroom goal structures have been measured by various methods such as students' perceptions of classroom goal emphasis, teachers' self-reflections on their instructional practices, and independent classroom observations. Urdan (2004) criticized the vagueness of measuring methods and conceptualizations of classroom goal orientations. Besides student perceptions of classroom goal structure, Urdan (2004) stated that the sources of goal orientation messages in the classroom have not been adequately described yet and teachers' instructional emphasis on mastery and performance goal orientations constituted only one source. Depending on Urdan's (2004) assertions, studies investigating classroom goal structures from the perspective of student perceptions are included in this review as an interchangeable term for teachers' instructional goal orientations. In other words, all methods (teachers' instructional goals, students' perceptions of classroom goal structure, and independent observations) that have been used for conceptualizing classroom goal structures are counted as representing teachers' instructional goal orientations.

As mentioned before classroom goal structures include mastery or performance goals that are salient in the classroom learning context. While classroom mastery goals emphasize personal improvement and effort, performance goal structure emphasizes competition and showing off one's work to outperform others on normative grading standards. Concerning the theoretical associations of classroom goal structures and student engagement, literature documents that mastery classroom goal structure may associate with emotional (e.g. enjoyment, efficacy, belonging), cognitive (strategy use and self-regulation) and behavioral (effort, persistence, help-seeking) engagement (Anderman & Patrick, 2012). In other words, a mastery oriented classroom goal structure provides an adaptive and beneficial climate for students to be engaged in academic tasks. For example, Wolters (2004) investigated the associations among students' perceptions of classroom goal structures (mastery vs. performance), personal goal orientations (mastery, performance approach-avoidance), mathematic achievement, and motivational engagement variables that included choice (taking additional math courses), effort, persistence, procrastination, and cognitive strategy use. The sample consisted of 525 junior high school students. In order to examine the predictive influence of both student and classroom level variables, HLM analysis was used. The results indicated that students perceiving their mathematics class as mastery focused put forth greater effort, did not delay on starting their math works, persisted on aversive situations, more likely to choose additional mathematics classes, and used more cognitive strategies. In contrast, students viewing their mathematics class as performance oriented delayed for mathematics work and less likely show persistence against difficulties.

Students perceiving their classrooms as mastery oriented generally displayed positive emotional engagement patterns. For example, these students showed positive school-related affect (Ames & Archer, 1988; Kaplan & Midgley, 1997), feelings of belonging to school (Anderman & Anderman, 1999), and intrinsic motivation (Wolters, 2004). In addition to cognitive and emotional associations of classroom mastery goal structure, adaptive behavioral engagement patterns are also observed in these classrooms. Students expend effort and persist on academic tasks (Wolters, 2004) and use more adaptive help-seeking strategies in comparison to low-mastery oriented classrooms. Maladaptive patterns of behavioral engagement levels such as procrastinating (Wolters, 2004), not asking for help when needed (Karabenick, 2004), purposefully effort withdrawal (Urdan & Midgley, 2003), and disruptive behaviors (Kaplan, Gheen, & Midgley, 2002) are low in these classrooms.

Students' perceptions of performance oriented classroom goal structure also associate with the emotional, cognitive, and behavioral aspects of engagement (Anderman & Patrick, 2009). Unlike inconsistent findings of personal performance goal orientations, students' perceptions of classroom goal orientations associate with negative beliefs and behaviors that undermine student learning and academic achievement. Firstly, students who are subject to performance emphasis in their classrooms are inclined to endorse personal performance approach and avoidance goals (Wolters, 2004). Students taught in performance oriented classrooms are found to possess more negative feelings about school (Ames & Archer, 1988; Kaplan & Midgley, 1997) and less feelings of belonging (Anderman & Anderman, 1999). Moreover, students find teachers who emphasize performance instructional strategies in their classrooms as being less fair (Murdock, Miller, & Kohlhardt, 2004). Another salient characteristic of performance oriented classrooms is failure attribution to lack of ability more than lack of effort (Ames & Archer, 1988). Concerning behavioral and cognitive engagement in performance oriented classrooms, while performance classroom structure had no correlation with cognitive strategies (Wolters, 2004), it generally associated negatively with behavioral engagement patterns. For example, Wolters (2004) reported a negative association with task persistence and positive association with procrastination. Cheating (Anderman, Griesinger, & Westerfield, 1998), endorsing an entity view of ability (Ames & Archer, 1988), self-handicapping (Midgley & Urdan, 2001; Urdan, 2004), and being disruptive are salient in performance oriented classroom environments.

The literature lacks studies investigating the relations between agentic engagement and classroom goal structures. However, considering the theoretical assertions and previous empirical findings related to other engagement constructs, it is logical to expect a positive relationship with mastery oriented classroom goal structure and agentic engagement because agentic engagement involves expressing the ideas that can alter the flow of the course in accordance with the students' needs and preferences. Indeed, students who perceive a mastery oriented emphasis in the classroom are expected to participate in the flow of the course for the sake of learning and personal improvement.

To sum up, with all aspects of engagement (emotional, cognitive, behavioral, and agentic) may associate positively with mastery classroom goal structure. However, due to the competitive nature of performance classroom goal structure, student engagement occurs in a negative sense. Thus, in this study, it is expected that while teachers' mastery instructional practice goals (mentioned as classroom goal structures) would associate positively with all aspects of engagement, performance instructional practice goals associate negatively or have no association at all with aspects of engagement.

Teachers' Instructional Goal Orientations and Students' Achievement Goals

There exist both theoretical and empirical evidence that students' goal endorsements are influenced from their teachers' instructional practices and procedures in the classroom (Ames, 1992; Ames & Archer, 1988; Anderman & Maehr, 1994; Meece, Blumenfeld & Hoyle, 1988; Meece, 1991). Research has indicated that students' personal achievement goal orientations are predicted by the perceived classroom goal orientations which are emphasized by their teachers in the classroom (Meece et al., 2006). A considerable number of studies (Anderman & Young, 1994; Anderman & Midgley 1997; Urdan, 2004) have found that students adoption of personal goals match with their perceptions of classroom goal emphasis even when student characteristics are controlled. Students tend to endorse mastery oriented goals if they perceive that educational environment (classroom, school, etc.) emphasizes the value of learning, effort and personal improvement. On the other hand, students tend to endorse performance oriented goals if the perceived scope of their educational environment stresses ability comparisons and competition to getting higher marks in comparison to other students in the classroom. In turn, these goal adoptions are thought to influence motivation and achievement behaviors of students.

In an early study, Anderman and Young (1994) examined the associations between teacher instructional practice goals, a number of student motivational and cognitive strategy use variables and academic achievement by collecting data from both middle school science teachers and sixth and seventh grade students. The sample consisted of 678 students and 24 science teachers. The authors have administered all questionnaires of the teachers' section of the Patterns of Adaptive Learning Scale (PALS) to teachers. However, only teachers' ability (performance oriented) focused instructional practices questionnaire was used. Students' were measured on deep and surface strategy use, science self-efficacy, science expectancy, science value, science self-concept of ability, and learning focused (masetery oriented) and ability focused (performance oriented) goals scales. Bivariate correlations among variables suggested noteworthy results. For example, being mastery fcocused (oriented) in science correlated moderately (r = .44) with science self-efficacy and highly with using deep strategies (r = .72). Students using deep-level cognitive strategies in science were found to have ghigh levels of science self-efficacy (r =.39). The two level data structure enable researchers to use HLM analysis in order to reveal class-level effects on student level outcomes. The HLM analysis results indicated that students in classes where teachers emphasize more mastery oriented instruction tend to adopt more mastery goals. Student level predictors indicated that science self-efficacy, science value and science self-concept of ability predicted mastery goals in science. Students whose teachers stress on performance instructional practices (performance oriented classroom goal structure) tend to be less learning focused.

In another study Anderman and Midgley (1997) investigated the change of motivation during transition from elementary to middle school. For this purpose they collected data from 341 students while the students were in fifth grade in the first wave and sixth grade in the second wave. The motivational variables of the study were students' perceptions of classroom goal emphasis in terms of task (mastery) goals and performance goals and personal goal orientations (mastery and performance). To be able to assess the change in motivation across transition, the authors used MANOVA analysis. The results of the study indicated that in the early years of schooling, students' personal goal orientations were more like mastery oriented. The year effect (fifth vs. sixth grade) was a significant predictor of adopting goal orientations. Similarly, students perceived a greater emphasis on task (mastery) goals in the classroom more in fifth grade than in sixth grade in middle school. The year effect was again a significant predictor for students' perception of classroom goal emphasis. The perception of classroom goal emphasis varied according to the domain (English and mathematics classes). While mathematics class was perceived as more task focused than English in fifth grade, that situation reversed in grade six. English class has been perceived as being a more task focused class than mathematics in sixth grade.

Urdan (2004) examined the influence of classroom goals on student motivation and achievement. In order to reflect on different conceptualizations of classroom goal structures, he measured them from both students' perceptions of classroom goals and teachers' self-reported goals of their instructional practices. He collected the data from 880 high school students and 49 teachers. He measured students' perceptions of the mastery and performance goal structure in their classrooms, their personal mastery, performance-approach, and performance-avoidance goals, self-handicapping behavior, self-efficacy, and academic achievement. Concerning teacher scales, he measured teachers' instructional goal emphasis on mastery goals, performance approach and performance avoidance goals. Due to the multilevel structure of the data, he used HLM analysis to show class level effects on student outcomes. The results of HLM analysis indicated that aggregated perceptions of the classroom mastery goal structure were significantly associated positively with personal mastery goals, value, and semester-end grade in English class (achievement). However, perceptions of mastery goals correlated negatively with personal performance-approach goals. Students' personal performance-approach goals and performance-avoidance goals associated with perceptions of the aggregated classroom performance goal structure. Classroom-level class mastery goal structure correlated positively with value, self-efficacy and English grade (achievement) but did not correlate with personal goals. On the other hand, classroom-level class performance structure correlated negatively with students' personal performance avoidance goals. This study indicated that while students' perceptions of classroom goal structure were more influential predictor of their achievement goal orientations than classroom-level (teacher instructional goal) class goal structures. However, predictor effects of classroom level class goal structure were larger for self-efficacy and academic achievement in English.

Overall, empirical studies generally complied with theoretical suggestions concerning the congruence between perceived goal emphasis and personal goal adoptions of students. Mastery oriented classrooms promote students to personal mastery goals and performance oriented classes orient them to personal performance goals. Thus, in light of the consistent findings of abovementioned studies, it is expected that the results of the present study comply with the literature. In particular, teachers' mastery approaches to instruction predict students' mastery goals and teachers' performance approaches to instruction predict students' adoption of performance goals.

Teachers' Instructional Goal Orientations and Student Self-efficacy

Self-efficacy is included as one of the most important motivational variables in a large number of studies (i.e. Anderman & Midgley, 1997; Urdan & Midgley, 2003; Kaplan, Gheen, & Midgley, 2002; Midgley, Anderman, & Hicks, 1995; Friedel, Cortina, Turner, & Midgley, 2007; Wolters, 2004; Urdan, Midgley, & Anderman, 1998; Urdan, 2004; Gutman, 2006) that investigate the influence of classroom goal structures to student related outcomes. In most of these studies self-efficacy is generally used as a predictor of achievement or another motivational variable. The number of studies that predicts self-efficacy with classroom goal structures is limited. In one of these studies, Wolters (2004) investigated the influence of classroom goal structures on self-efficacy and other motivational variables. The sample consisted of 525 high school students and data were collected in math class. The influence of classroom goal structures on students' mathematics self-efficacy was examined by using HLM analysis. The results showed that, unlike the positive association of personal mastery goals, students in classrooms where performance goal structure was emphasized reported a higher level of self-efficacy in mathematics. In contrast, Urdan (2004) examined the predictive effect of classroom goal structures on students' personal goal orientations, self-handicapping, and self-efficacy and English grade. The participants were 880 students in 49 English classrooms from three different high schools. The author aggregated the scores of students' perception of classroom goal structures to generate a classroom level variable representing classroom goal structures. Then, HLM analysis was used to predict the classroom level effect. The results indicated that high school students' self-efficacy in English class associated positively with classroom level mastery goal structure.

Gutman (2006) examined how student and parent goal orientations and classroom goal structures influence the math achievement and self-efficacy of African American students during the high school transition. The sample constituted of 50 adolescents and their families. The researcher used hierarchical regression analysis to analyze the data. The results of the analysis showed that students who perceived more mastery-oriented classroom goals in 9^{th} grade experiences more positive change in their mathematics self-efficacy from 8^{th} to 9^{th} grades. Concerning the changes in math GPA from 8^{th} to 9^{th} grades, perceived classroom goal structures were not found to be related.

In another study, Urdan et al., (1998) examined the influence of classroom goal structures on students self-handicapping strategies. The focus of their study was revealing the relationships between self-handicapping strategies and classroom goal structures but one of their student level predictor was self-efficacy. In descriptive analysis section, the researchers reported zero-order correlations of study variables. They found that self-efficacy (mentioned as perceived academic competence) correlated positively with students' perceptions of mastery oriented classroom goal structure and negatively with performance oriented classroom goal structure.

Overall, the studies summarized above suggested somehow inconsistent findings. Both performance and mastery classroom goal structures have been found to associate with students' self-efficacy in different domains. Mastery goals positively associate with self-efficacy since classrooms where mastery goals are salient, personal improvement is emphasized. Thus, students have the opportunity to monitor their own progress in time and such a monitoring of personal progress may help to increase students' self-efficacy.

Since the literature on classroom goal structures in Turkey is limited in terms of the associations to students' self-efficacy, the findings of the present study will be discussed with caution by taking into consideration the suggestions of the related literature.

2.3.1.3 Teacher Self-Efficacy

Teachers are influenced by their self-beliefs, particularly self-efficacy, in terms of their attitude towards teaching profession, behaviors towards students, student achievement, and motivation (Klassen & Chiu, 2010). Grounded within Bandura's social cognitive theory, teacher self-efficacy can be defined as the beliefs teachers have about their skills to affect student learning (Caprara, Barbaranelli, Steca & Malone, 2006; Klassen & Chiu 2010). Skaalvik and Skaalvik (2007) posited that teachers influence students' self-beliefs, learning, and academic performance. Teachers' self-efficacy may affect student learning and achievement in several ways. Teachers holding high levels of self-efficacy are more likely to apply innovative teaching activities in the classroom, to use classroom management strategies effectively, and utilize appropriate teaching methods that foster students' autonomy (Cousins & Walker, 1995; Guskey, 1988). Additionally, teachers with high levels of self-efficacy are more likely to undertake responsibility of students with special learning needs (Allinder, 1994; Jordan, Krcaali-Iftar, & Diamond, 1993), to manage classroom discipline problems (Chacon, 2005; Korevaar, 1990), and to keep students concentrated on task than teachers holding relatively low levels of teaching self-efficacy (Podell & Soodak, 1993). In general, relevant literature demonstrated that teachers possessing high levels of efficacy are more likely to use activity-based learning (Enochs, Scharamann, & Riggs, 1995), student-centered learning (Czerniak & Schriver, 1994), and have a humanistic approach to classroom management (Woolfolk & Hoy, 1990).

Teachers' self-efficacy may enhance student's sense of efficacy, motivating engagement in class activities, and regulating their efforts in face of low success and challenging tasks (Ross, 1998; Ross, Hogaboam-Gray, & Hannay, 2004). For example, Gibson and Dembo (1984) found that teachers holding high levels of teaching efficacy insist on helping struggling students to solve out questions and find the right answers rather than simply giving answers to students or allowing others to provide the right answers. Furthermore, researches indicate that teacher self-efficacy is in a reciprocal relationship with student achievement (Caprara et al., 2006). In schools where students are successful and well-behaving, teachers' perceived self-efficacy are higher than their counterparts who work in schools with less student achievement and disruptive behaviors (Raudenbush, Rowan, & Cheong, 1992; Ross, 1998). Caprara et al. (2006) suggest that the reciprocal relationship of teacher self-efficacy and student success may develop a strong sense of teacher efficacy with repeated experiences of success with talented students.

Teacher self-efficacy studies first emerged in mid-1970's by the studies of RAND organization. As part of these studies, a two–item teacher self-efficacy scale was created to investigate the contribution of teacher-self efficacy on student achievement. In 1984, Gibson and Dembo extended teacher efficacy scale as a two dimensional scale – one is for *personal teaching efficacy* (teachers competence beliefs in teaching) and the other for *general teaching efficacy* (environmental factors that constraint teachers' teaching effectiveness). In time, general teaching efficacy received criticism because of its inclusion of items that are not directly related to teachers' competence beliefs. That situation also caused critiques on validity and reliability of general teaching efficacy dimension.

Afterwards, Tschannen-Moran and Woolfolk Hoy (2001) developed the Teachers' Self-Efficacy Scale (TSES) in a seminar program with participating teachers' and doctoral students in a three phase study. First draft of the scale consisted of 52 items but at the end of the third validation study, the final version of the scale consisted of 24 items on three factors which were (1) teacher efficacy for student engagement, (2) teacher efficacy for instructional strategies, and (3) teacher efficacy for classroom management. Each of the factors included 8 item. Shortly after, same group of researcher selected four of the items out of each factor and generated the short version of TSES. This version also had the met the validity and reliability criteria. Thus, the researchers concluded that both forms of the TSES were valid and reliable and could be used for further research. In the current study, short form of TSES was used in order to assess participating science teachers' self-efficacy beliefs in teaching science and relationships between dimensions of teacher self-efficacy and student outcomes were examined based on the data obtained by the short form of TSES. The following section provides information related to teachers' self-efficacy and student outcomes.

2.3.1.4 Teacher Self-efficacy and Student Related Outcomes

Teacher Self-Efficacy and Student Achievement

Related research indicated that teacher self-efficacy is in a reciprocal relationship with student achievement (Caprara et al., 2006). In schools where students are successful and well-behaving, teachers' perceived self-efficacy are higher than their counterparts who work in schools with less student achievement and disruptive behaviors (Raudenbush, Rowan, & Cheong, 1992; Ross, 1998). Caprara et al. (2006) suggest that the reciprocal relationship of teacher self-efficacy and student success may develop a strong sense of teacher efficacy with repeated experiences of success with talented students. In their study, they investigated the relationships among teachers' self-efficacy beliefs, job satisfaction, and students' academic achievement. Their participants were 2184 teachers from 75 junior high schools in Italy. They collected longitudinal data that lasted for two years in three time points. In time points one and three, students were measured on their academic achievement and on time point two, teachers' were measured on their self-efficacy and job satisfaction. They constructed a structural model and their findings reveled that there was a low relationship ($\beta = .024$) between teachers' self-efficacy and students' academic achievement. Another finding of their study was that students' prior achievement associated positively with teachers' self-efficacy. They concluded that there might be a reciprocal relationship between students' achievement and teachers' self-efficacy. Lastly, researchers could not find any links between teacher job satisfaction and student academic achievement both in time points one and three.

Ross (1992) investigated personal and general teaching efficacy of 18 history teachers. He used Gibson and Dembo's (1984) 16-item self-report questionnaire. This scale consisted of two subscales and the first one focused on teachers' sense of efficacy to influence student learning and the second one focused on the external factors like home environment and parental influence that affects teacher self-efficacy. He calculated a composite achievement score for students using three measures that are cognitive skills, comparative thinking and knowledge. He conducted regression analysis to predict student achievement and the results indicated that, teachers' personal self-efficacy significantly and positively predicted student achievement. Additionally, correlation analysis revealed that students' achievement was significantly related to total teacher efficacy (personal + general teaching efficacy).

In another study, Benbow (2006) examined students' achievements in English languge arts by comparing their teachers' self-efficacy beliefs. A large number of students, 3402 third grade stududents, and 162 teachers participated in the study. Participating teachers' self-efficacy was measured by Gibson and Dembo's (1984) teacher self-efficacy scale and teachers' were categorized as possessing high and low self-efficacy based on their scores on the scale. Benhow (2006) analyzed the data through t-tests and results revealed that there was not a significant difference between the achievements of the students in English language arts based on their teachers' level of teaching self-efficacy. In other words, their teachers' level of teaching self-efficacy did not elicit a significant difference between students' achievement levels in English language arts.

Recently in Turkey, Yerdelen (20131) examined the relationships among a set of teacher level variables (including teacher self-efficacy), student self-regulation, and science achievement. She worked with a nationwide dataset consisting of 8198 students and 372 science teachers. She used Teacher Self-Efficacy Scale developed Tschannen-Moran and Woolfolk Hoy (2001) which consisted of three distinct dimensions. She included all three dimensions in her analyses and associated to students' science achievement. She analyzed the data by using Hierarchical Linear Modeling techniques. Her findings indicated that while teachers' efficacy for student engagement associated positively with students' science achievement, teachers' efficacy for instructional strategies and teachers' efficacy for classroom management was not found as linked to students' science achievement. Accordingly, in the current study, positive links were expected between teacher self-efficacy in student engagement and students' science achievement in line with the studies conducted in Turkey. Efficacy for instructional strategies and efficacy fot classroom management may not link positively with students' science achievement as was for previously conducted studies.

Teacher Self-Efficacy and Student Engagement

Teachers' self-efficacy may enhance student's sense of efficacy, motivating engagement in class activities, and regulating their efforts in face of low success and challenging tasks (Ross, 1998; Ross, Hogaboam-Gray, & Hannay, 2004). In a general sense, characteristics of highly officious teachers' influence many student outcomes. Accordingly, Pianta, La Paro, Payne, Cox, and Bradley (2002), stated that when students are taught by responsible and efficacious teachers, their academic engagement increases. For example, Gibson and Dembo (1984) found that teachers holding high levels of teaching efficacy insist on helping struggling students to solve out questions and find the right answers rather than simply giving answers to students or allowing others to provide the right answers. Furthermore, Raudenbush, Rowen, and Cheong (1992) found that teachers feel higher efficacy in classes of high achieving students and in academic track classes than nonacademic classes. As measured by the science and mathematics teachers' perception of student engagement with the item "About what percent of the students in this class are actively engaged?", researchers reported that teacher self-efficacy is strongly related to student engagement.

As abovementioned theoretical assertions and indirectly related studies demonstrate, the number of available studies conducted on the relationship between teachers' self-efficacy and student engagement is limited. In a recent study, Uden, Ritzen and Pieters (2013) investigated whether teachers' motives for being a teacher, their ratings of the relative importance of different teacher competences, their self-efficacy for teaching, and ratings of their own interpersonal teacher behavior could predict teacher perceptions of student engagement. The authors also provided a short discussion on the vagueness of the sub dimensions of engagement and they decided to pick behavioral and emotional engagement as the sub dimensions of students' engagement. They collected the data only from teachers and their teacher sample consisted of 195 Dutch teachers from Netherlands. They measured students' behavioral and emotional engagement from the teachers' perspective. They conducted a path analysis in and found that teacher self-efficacy is an important predictor of perceived student engagement. Teachers' self-efficacy contributed significantly to the prediction of students' emotional and behavioral engagement, but the effects of self-efficacy reduced when ratings of interpersonal teacher behavior are added to the regression model. However, teachers' also warn that another finding of their study suggested that teachers' with high self-efficacy are more satisfied from being in the teaching profession. Therefore, their satisfaction from being a teacher may interfere with their perception about students' engagement and their evaluations may be more positive. Therefore, student engagement in reality may not be that high but teacher perceptions may erroneously increase the strength of the relationship.

Next year, the same group of researchers, Uden, Ritzen and Pieters (2014) expanded their focus of research and included both student and teacher data to examine the contribution of perceived interpersonal teacher behavior and teacher beliefs concerning motives for being a teacher, attitudes toward teacher knowledge domains and self-efficacy for teaching to the vocational high school students' self-reported engagement. Different from the previous study, they included student self-reported data concerning behavioral, cognitive, and agentic engagement. Their participants were 200 teachers and 2288 students from vocational high schools. Since their data were collected from both teachers and students and their focus of the research was to investigate the influence of teacher level factors on student level outcomes, they conducted a multilevel analysis (a synonym used for HLM). Their multilevel analysis revealed that students' behavioral, cognitive and emotional engagement scores varied among classes. Thus, it was appropriate to model these relationships for the teacher level. Further analysis for assessing contribution of teacher level measures to student engagement suggested that perceived interpersonal teacher behavior was by far the most important predictor of all types of student engagement. Moreover, there was a negative relationship between higher teacher scores on extrinsic motives and students' emotional engagement directed at the subject teachers teach. Concerning teacher beliefs, researchers reported that teacher self-efficacy and extrinsic motives for being a teacher explained some variance in students' cognitive engagement. However, the relationships between teachers' self-efficacy beliefs and students cognitive and emotional engagements were weak. There was not a relationship between teacher self-efficacy and behavioral engagement. Lastly, for the relationship between cognitive and emotional engagement and teacher self-efficacy, in the existence of interpersonal behavior variables (proximity and influence), the effect of teacher self-efficacy on cognitive and emotional engagement disappeared.

Overall, theoretical claims propose a positive relationship between teacher self-efficacy and student engagement. The positive and responsive characteristics of self-efficacious teachers lead researchers to propose positive relationships between teacher self-efficacy and student engagement. However, the limited number of empirical studies constrict comparisons for the present study. In the present study, teacher self-efficacy has three dimensions (efficacy for student engagement, efficacy for instructional strategies and efficacy for classroom management) and student engagement has four dimensions (agentic engagement behavioral engagement, cognitive engagement, and emotional engagement). Based on the theoretical assertions and limited number of empirical studies, it is reasonable to expect positive relationships between dimensions of student self-efficacy and student engagement but the discussion of the findings should be made with caution.

Teacher Self-Efficacy and Achievement Goals

The relationships between teachers' self-efficacy and students' achievement goals have not been investigated on the international context but in turkey, two recent studies recently conducted studies including these relationships. The earlier one, conducted by Yerdelen (2013) collected data on a nation-wide scale from science teachers and their seventh grade students. She used HLM analysis due to nested data structure and reported no significant relationships between teachers' self-efficacy and students' achievement goals. Similarly, Pamuk (2014) studied with 137 science teachers and their 3281 seventh grade students. He also collected his data on a nested structure basis and found no relationships between teachers' self-efficacy and students' achievement goals.

Teacher Self-Efficacy and Student Self-Efficacy

Theoretical considerations proposed a close relationship between teacher self-efficacy and their corresponding students' self-efficacy (Woolfolk-Hoy & Davis, 2006). In their teacher self-efficacy and possible outcomes model Woolfolk and Davis (2006) define goal orientations and self-efficacy under the student motivational outcomes. The list of outcomes is not limited to self-efficacy and goal orientations. They proposed that student self-regulation and achievement are also included. Moreover, development of persistence and resilience as the long term goals take place when students are taught by teachers who have high efficacy beliefs in their ability to teach. Empirical studies conducted to date could not present consistent results both in the international and national teacher efficacy research area. For example, a study in United States, Kurien (2011) investigated the relationship between science teachers' self-efficacy beliefs in science and their students' efficacy towards science and inquiry-based science. The sample of the study consisted of 26 middle school science teachers and 660 middle school students from the participating teachers' classes. The instrument for measuring science teachers' self-efficacy was Science Teachers' Efficacy Belief Instrument (STEBI-A). The researcher utilized 2 level HLM analysis to investigate the association between science teacher efficacy and students' efficacy beliefs in science. The results of the two level HLM model suggested that science teachers' teaching efficacy for inquiry based science and science teachers' personal teaching efficacy for science were not found as significant predictors of students' self-efficacy for inquiry based science and students' self-efficacy for science in general. On the contrary in another study in United States, Stuart (2006) studied with 397 fourth and fifth grade students. He investigated the relationship between their general academic self-efficacy and their teachers' teaching self-efficacy. He conducted a correlational analysis and reported a positive relationship (r = .17) between students' general academic self-efficacy and their teachers' teaching efficacy.

Recently, in Turkey, two studies investigated the influence of science teachers' self-efficacy in student engagement, instructional strategies and classroom management on seventh grade students' science self-efficacy beliefs. In the first study, Yerdelen (2013) studied with a nationwide sample consisting of 8198 students and 372 teachers. She conducted HLM analysis to capture the influence of a teacher level variable on a student level outcome. Similar to Kurien (2011), she did not find a significant relationship between any type of teacher self-efficacy and students' science self-efficacy. In the second study, Pamuk (2014) studied with a 3281 students and 137 teachers from Ankara and he also used HLM analysis to analyze the data. His study results suggested that there was a negative relationship between teachers' efficacy for classroom management and students' self-efficacy in science.

Overall, literature on the relationships between teacher self-efficacy and student self-efficacy has presented inconsistent results in comparison with the suggestions of Woolfolk and Davis (2006). Although theoretical assertions have proposed positive relationships, mixed results are expected in this study because empirical studies conducted on similar samples did not suggest consistent results for the aforementioned relationship of teacher and student self-efficacy.

2.3.1.5 Teacher Collective Efficacy

Bandura (1997) stated that success of a social system which grounds heavily on the cooperative skills of its workers may be influenced critically by the groups' collective efficacy beliefs. Bandura (1997) also contended that people do not work as socially separated, and therefore they form beliefs about the collective capabilities of the people or working group(s) in which they exist. Collective efficacy is defined by Caprara et al., (2003) as the "judgments that people make about a social system (family, team, organization, or community) and about its level of competence and effectiveness in specific domains of action" (p. 821). In an educational domain, schools are social systems where teachers work collaboratively. Thus, teachers have collective efficacy beliefs about their working group (colleagues) as well as they have personal efficacy beliefs. Social cognitive theory acknowledges that, teachers' efficacy perceptions of both themselves and their organizations (school collective efficacy) influence their actions (Bandura, 1997). Collective teacher efficacy is different than personal self-efficacy in a way that while self-efficacy is individual, collective efficacy is a property of the school. (Tschannen-Moran & Barr, 2004).

Teachers' personal efficacy beliefs rest heavily on individual classroom teaching performance whereas collective teacher efficacy beliefs are social perceptions that rely on the consideration and evaluation of the capability of the entire school faculty (Goddard, Hoy & Hoy, 2000). Although teachers' personal self-efficacy and collective efficacy are documented differently, they have a reciprocal relationship and influence each other (Goddard & Goddard, 2001). Likewise, collaboration among teachers enhances teachers' individual self efficacy (Chester & Beaudin, 1996; Morrison, Walker, Wakefield, & Solberg, 1994; Ross, 1992). Teachers possessing low levels of individual self-efficacy may be influenced by the environment whose faculty has a high sense of efficacy and accord his/her teaching to the whole school staff (Tschannen-Moran & Barr, 2004).

Collective efficacy research has been in an incremental trend after the work of Goddard and Goddard (2001). One important point in Goddard and Goddard's (2001) study was that it examined the association between collective efficacy and student achievement and reported a positive relationship. Collective efficacy research has an international context. Researchers from Norway (Skaalvik & Skaalvik, 2007) and Italy (Caprara et al., 2006) have also studied collective teacher efficacy extensively. Goddard and Goddard's (2001) 21 items measure was the prominent scale for collective efficacy research. In the current study this measure was used as well.

2.3.1.6 Teacher Collective-Efficacy and Student Related Outcomes

Teacher Collective Efficacy and Student Achievement

Considerable research examined the link between collective efficacy and student achievement. For example, a recent study by Moolenaar, Sleegers, and Daly (2012) investigated the relationships among teachers' social networks, their collective efficacy, and school level student achievement in mathematics and language. They included the demographic teacher and student variables in their study such as student gender, socioeconomic status (SES), school size, teacher gender, and years in experience. The participants were 775 educators (teachers and principals) from 53 schools and 1383 sixth-grade students. The results of the study revealed that SES was one of the most influential factors in student achievement in language and mathematics. When socioeconomic status was controlled, collective efficacy did not contribute to achievement in math but language.

Another important study in investigating of collective efficacy on student achievement was conducted by Goddard and Goddard (2001). They examined the associations among teacher self and collective efficacy, school related variables (school size, lunch status, mean socioeconomic status), and student achievement in mathematics. Their participants were 452 teachers from 47 schools. In their study, they used powerful HLM technique for their multilevel data structure. Their multilevel analysis showed that teacher self-efficacy varies among schools; and mean SES, mean prior math achievement and collective efficacy significantly predict the variation among schools. This means that the differences among school in terms of teacher self-efficacy can be predicted by mean socioeconomic status (SES) of students, mean prior math achievement and teacher collective efficacy.

A similar study, which explored the relationships among collective efficacy, student achievement in math, English, and writing and student SES, was conducted by Tschannen-Moran and Barr (2004). They used schools as the unit of analysis and the sample consisted of 66 middle schools. The results of the study indicated that collective efficacy predicted student achievement in mathematics, writing and English but after controlling for SES, collective efficacy made only significant contribution to achievement in writing. They also concluded that SES plays and important role in student achievement.

Overall, abovementioned studies suggested that collective teacher efficacy may predict student achievement in various domains of teaching (math, reading, general academic achievement, etc.). Therefore, in this study, it is reasonable to expect a positive association between collective efficacy and student science achievement. At this point, it is important to keep in mind that Turkish context has a big gap concerning the research related to collective efficacy and achievement relationship. Moreover, international studies to date concentrated on collective teacher efficacy as a school trait more than a trait of a group of teachers. Therefore, lack of studies both in national and international literature constraints the comparability of the present study. After all, this study will make a significant contribution to the national literature for examining the relationship between science teachers' collective efficacy as a group in relation to students' science achievement.

Teacher Collective Efficacy and Other Student Outcomes (Engagement, Achievement Goals and Self-Efficacy)

Researchers to date have commonly examined the contribution of teacher collective efficacy to student achievement in various domains. However, the literature lacks studies concerning the relationship between teachers' collective efficacy and students' psychological and motivational constructs. Although teacher self-efficacy has been associated with both student achievement and other motivational and engagement constructs, the field of collective efficacy is intact. This study will be one of the first studies investigating the link between teachers' collective efficacy and students' motivational and engagement constructs. Moreover, this study includes only science teachers and seventh grade students motivational and engagement constructs towards science class. Accordingly, similar to the expectations in the relationship between teachers' individual self-efficacy and students' outcomes, it is reasonable to expect positive but weak relationships between teachers' collective efficacy and students' outcomes. However, as mentioned before, the literature is limited and comparison of studies will not be possible for these relationships.

2.3.1.7 Teacher's Job Satisfaction

Job satisfaction is defined as a positive or negative sense of fulfillment about one's work (Skaalvik & Skaalvik, 2010). It is a prominent indicator of professional well-being. According to Michaelowa and Wittmann (2007), teacher job satisfaction received the attention of educational researchers' interest because it was assumed to influence the effectiveness of teachers' teaching and students' success, be a predictor of teacher attrition. Additionally, it was expected to predict teachers' professional well-being. Cockburn and Haydn (2004) asserted that teachers gain the sense of job satisfaction from routine teaching, learning, and interaction processes such as; day-to-day classroom activities, working with children, seeing students' academic progress, working with supportive colleagues, and overall school climate. Liu and Ramsey (2008) found that teachers' job satisfaction is negatively affected by poor physical conditions of schools and classrooms, limited time for planning and preparation for classes, and heavy teaching workload. Previous researches on teacher job satisfaction indicated that teachers' job satisfaction associated positively with their work performance (Ololube, 2006), self-regulation (Klusmann, Kunter, Trautwein, Ludtke, & Baumert, 2008), self-efficacy (Caprara et al. 2006; Klassen & Chiu, 2010; Skaalvik & Skaalvik, 2010), and collective efficacy (Klassen et al. 2009).

Teacher Job Satisfaction and Student Outcomes

Studies including job satisfaction, teacher efficacy and student achievement are rare in literature. Caprara, et al., (2006) investigated the links among teacher self-efficacy, job satisfaction and student achievement. They used student overall final grades as student achievement in two time points. 2184 teacher from 75 school participated in their study. Time 1 student achievement did not predict teachers' job satisfaction but exerted a low impact on teacher self-efficacy. Teacher self-efficacy positively predicted teacher job satisfaction. Teacher self-efficacy positively predicted time 2 student achievement, but job satisfaction did not.

Another study examining school context variables and their influence on student achievement growth was conducted by Johnson, Kraft, and Papay (2012). They measured a wide range of school context variables that were colleagues, community support, facilities, principal, professional expertise, resources, school culture, and time. Their outcome variables were teacher job satisfaction, career intentions, and student achievement growth. Their sample consisted of 25,135 teachers teaching in 1,142 schools in Massachusetts K-12 public schools. They revealed that conditions of work are important predictors of teachers' satisfaction, their career intentions, and student achievement growth. Students, who are in schools in which teachers are pleased with their working conditions and satisfied with their jobs, were found to be more successful than their counterparts in schools where are less satisfied.

Michaelowa and Wittmann (2007) investigated the relationship between teacher job satisfaction and student performance. They collected data from 384 teachers and 6664 primary school students in sub-Saharan countries (Burkina Faso, Cameroun, Côte d'Ivoire, Madagascar and Senegal). In their study, they used student achievement as the outcome variable and tried to predict it with student level variables such as prior achievement, age, and having media (radio and/or television) and books at home, etc., and several school level variables such as teacher job satisfaction, teachers' giving private tuition, teachers' non-teaching/school related activities, being volunteer teachers, teachers' being union member, experience etc. They analyzed data by using HLM and the results showed that teacher job satisfaction was a significant and positive predictor of student achievement. According to Klusman et al., (2008), teachers with high levels of job satisfaction create more learning-supportive environments for students and try their best for motivating students. Additionally, teachers that have high levels of job satisfaction are more successful in alleviating disturbances in the classroom, better at time management, optimize teaching pace to address the whole class, and are more encouraging for students to gain better insights (Klusmann et al., 2008). Overall, lack of studies related to teachers' job satisfaction restrict further expectations about student motivation and engagement but based on abovementioned positive classroom environments created by satisfied teachers strengthen the expectations that teacher job satisfaction may associate positively with adaptive student outcomes such as motivation and student engagement.

2.3.2 Teacher Motivation and Job Satisfaction in relation to Perceived School Environment

Aforementioned literature, suggested that teacher motivation and teachers' job satisfaction might be associated with student outcomes. However, these teacher motivation variables (self-efficacy, collective efficacy, and instructional goals) may be influenced by the school environment factors such as school context (relations with parents, relations with colleagues, supervisory support, and discipline problems) and school goal structures (school mastery and performance goal structure). Thus, in the following section, teachers' perception of school environment variables and their influence on teachers' motivation and job satisfaction are explained in the light of related literature.

2.3.2.1 Teachers' Perceptions of School Context Variables

Psychosocial factors such as professional aspirations, the satisfaction teachers' gain from their profession and collaborative relationships with colleagues, and parents as well as student-teacher interactions are influential to teacher self and collective efficacy. (Caprara et al., 2006). Research indicated that a positive organizational climate and social support from the colleagues, student parents and superintendents are positively related to teacher job satisfaction and motivation (Day et al., 2007; Scheopner, 2010; Skaalvik & Skaalvik, 2009; 2011). In the current study, teachers' relations with parents, relations with colleagues, discipline problems teachers have in their classrooms, and supervisory support were considered as the teachers' perceptions of school environment variables. By definition, teachers' relations with the parents of the students refer to teachers positive or negative relationships with the parents of the students; relations with colleagues refer to teachers positive or negative relationships with their workmates in a school environment; discipline problems refer to disruptive student behaviors that teachers suffer in classrooms during the flow of the course; and lastly supervisory support refers to the support and help that teachers receive form the school principals regarding teaching and professional matters (Skaalvik & Skaalvik, 2009; 2010; 2011).

Research on the relationships between school contextual variables or school climate variables and teacher motivational and job related factors date back to the beginning of 1990's with the studies of Hoy and Woolfolk (1993), Taylor and Tashakkori (1995) and Meier (1992). According to Hoy and Woolfolk (1993), teachers' sense of efficacy in relation to school climate was the topic of little research. The study conducted by Hoy and Woolfolk (1993) focused on a healthy school climate. They defined the elements of a healthy school climate as institutional integrity, principal influence, consideration, resource support, morale, and academic emphasis. Accordingly, they asserted that, a healthy school climate possessing these positive qualities would help develop the efficacy beliefs of teachers working in such environments. The findings of their research indicated that institutional integrity ("Teachers who perceive that the school protects them from unreasonable community demands and helps them maintain integrity in their instructional programs" p. 363) and teacher morale ("teachers who perceive a sense of trust and support among their colleagues" p. 363) predicted teachers' general teaching efficacy. In another study, Taylor and Tashakkori (1995) followed the steps of Hoy and Woolfolk (1993) and designed a similar study. Their study revealed that lack of obstacles to teaching and communication among the teachers (relations with colleagues) were found as the strong predictors of teachers' self-efficacy. Recently, Tobin, Muller and Turner (2006) examined the relationships among organizational learning, participation in organizational learning activities and organizational climate as possible predictors of teachers' self-efficacy. They collected the data from 679 teachers and conducted a set of regression analyses placing teacher self-efficacy as their outcome variable. Their results indicated that organizational climate and learning in the organization level were significant predictors of teacher self-efficacy. In this study, organizational climate were measured on two items. One of them refers to positive attitudes towards the work environment and another one refers to the commonly shared values and beliefs among the school personnel. Overall, these items represent a positive school environment and results indicated a positive relationship between the positive school environment and teacher self-efficacy.

Previous research on the relationships among perceptions of teachers' school context variables and various teacher outcomes such as self-efficacy, collective efficacy, and job satisfaction were led by Skaalvik and Skaalvik (2009, 2010, and 2011). In their first study, Skaalvik and Skaalvik (2009) investigated the relationships between teachers' perception of the school context, teacher burnout, and teacher job satisfaction. Teachers' perception of the school context was conceptualized under four aspects, which were supervisory support, time pressure, relations to parents, and autonomy. The participants of the study were 563 Norwegian teachers from elementary and middle schools. The reserarchers analyzed the data through a SEM model. In their first model, where they included only school context variables and their relationships with teachers' job satisfaction, they found that teachers' perception of autonomy in their profession and the support they received from the parents of the students associated positively with their satisfaction from the teaching profession. In this first model, they reported that while autonomy was strongly related to job satisfaction (β = .44), time pressure and relations to parents were moderately related to teachers' satisfaction from their job (β = -.26 and β = .23, respectively). Moreover, supervisory support was indirectly related to teachers' job satisfaction over other school context variables, which were time pressure, relations to parents and autonomy.

In their following study, Skaalvik and Skaalvik (2010) broadened their scope and included teacher self-efficacy and collective efficacy with burnout, job satisfaction and school context variables. Additionally, they added discipline problems to the conceptualization of their school context variables. Different from their previous study, they have developed a Norwegian version of teacher self-efficacy scale for this study and they examined its factor structure in addition to the main purpose of the study, which was to examine the interrelationships among teacher self-efficacy, teacher collective efficacy, job satisfaction, teachers' perception of school context, and teacher burnout. Study participants were 2249 Norwegian teachers from elementary and middle schools in Norway. Similar to the first study, their method of data analysis was structural equation modeling. They constructed several structural models both for testing the factor structure of the newly developed Norwegian teacher self-efficacy scale and for testing the relationships among abovementioned variables. Their results indicated that while teachers' self-efficacy was positively and strongly related to relations with parents (β = .46) and autonomy (β = .13), it had a negative relationship with time pressure (β = -.10). In the next model, five aspects of school context variables were associated with collective efficacy. Results indicated that while time pressure (β = *.06*), autonomy (β = .16), relations with parents (β = .17), and supervisory support (β = .50) were positively related to teachers' collective efficacy, discipline problems were negatively related (β = -.05). Lastly, in the third model including job satisfaction, time pressure and autonomy were positively related to job satisfaction (β = .13 and β = .24, respectively). However, relations with parents, discipline problems and supervisory support were all indirectly related to teachers' job satisfaction over teacher self-efficacy and dimensions of burnout. In short, while discipline problems had a negative total effect on teacher job satisfaction, relations to parents and supervisory support had a positive total effect on teachers' job satisfaction.

Next year, Skaalvik and Skaalvik (2011) tested the relationships among school context variables, teachers' job satisfaction, motivation to leave the teaching profession, feeling of belonging, and emotional exhaustion. Their participants of this study was 2569 Norwegian middle and high school teachers. They measured six aspects of school context variables, which were, relations with parents, relations with colleagues, supervisory support, discipline problems, time pressure, and value consonance. Similar to their previously cited studies, they constructed path models to examine the interrelationships among these variables. Their findings showed that all of the school context variables were related to teachers' satisfaction from being in the teaching profession. In particular, while time pressure (β = .14) and relations to parents (β = .14) were directly and positively related to teacher job satisfaction, relations with colleagues, supervisory support, and value consonance were indirectly positively related to job satisfaction over belonging. Lastly, discipline problems that teachers suffer in their classrooms during their teaching was indirectly negatively related to job satisfaction over emotional exhaustion.

Moreover, in an earlier study, Skaalvik and Skaalvik (2007) examined the relationships among teacher self-efficacy, collective efficacy, external control (which refers to the limitations that can be overcome by educating the learners) starin factors (the antecedents of school context variables), and teacher burnout. The strain factors were identified through conversations with 24 teachers and the researchers extracted four strain factors, which were “students with behavior problems” (discipline problems), “conflicts with parents” (negative relationships with parents), “conflicts among the teachers” (negative relationships among the colleagues), and “having to organize teaching in ways one did not believe were the best” (p. 615) (Skaalvik & Skaalvik, 2007). The participants were 244 Norwegian teachers from elementary and middle schools. A series of regression analyses were conducted to reveal the relationships among the strain factors, teachers self and collective efficacy. The results indicated that while discipline problems and conflict with parents were not significantly related to teacehers’ collective efficacy beliefs, conflict among the teachers were negatively related to teachers’ collective efficacy. Moreover, while students with behavioral problems (discipline) and conflict among the teachers (negative relationships with colleagues) were not found as significantly related to teachers self-efficacy, conflict with parents significantly and negatively associated with teachers’ self-efficacy beliefs.

There are limited number of studies conducted in Turkey investigating the relationships among school context variables and teacher outcomes. In one of these studies, Büyükgöze-Kavas, Duffy, Yerin-Güneri, and Autin (2013) examined how goal progress, self-efficacy, perceived organizational support, and positive affect predicted the job satisfaction of Turkish teachers. The researchers recruited 500 Turkish teachers working in state school in various teaching levels, located in Ankara, Turkey. The data were analyzed through hierarchical multiple regression analyses and the results indicated that perceived organizational support, goal progress, and positive affect predicted teachers' job satisfaction positively. Additionally, their results showed that school type moderated these relationships. For elementary school teachers, perceived organizational support was found as more strongly related to job satisfaction than for secondary school teachers. In another study conducted in Turkey, Çalık, Sezgin, Kavgacı, and Kılınç (2012) examined the relationships among principals' school leadership behavior, teacher self-efficay and collective efficacy. They collected the data from elementary and middle school teachers in Ankara and they analyzed the data through a path analysis. Their model fit the data well and results of the path analysis indicated that principal leadership behaviorpositively predicted both teacher self-and collective efficacy. Moreover, principal leadership behavior had an indirect effect on collective efficacy over teacher self-efficacy. Further analysis of mediation of teacher self-efficacy was also significant in this study.

Overall, both theoretical assertions and empirical studies cited above pointed out that school context or school organizational climate had influence on teacher motivation variables (i.e. self-efficacy, and collective efficacy) and job satisfaction. In the current study, it is expected that school context variables, which were relations with parents, relations with colleagues, supervisory support, and discipline problems associate with Turkish science teachers' self-efficacy, collective efficacy, and job satisfaction. Additionally, as above mentioned studies have indicated, discipline problems are expected to associate negatively with teacher motivation and job satisfaction.

2.3.2.2 Teachers' Perceptions of School Goal Structures

Schools are social environments where early adolescents have the opportunity to increase their cognitive inventories, to gain a sense of competence and belonging, and to interact with teachers who have the potential to support them both mentally and physically **(**Roeser, Midgely, Urdan, 1996). However, research on the effects of middle school environment on the adaptive and maladaptive patterns of academic motivation and academic achievement has become the scope of educational psychology starting from the 1990's (Eccles, et al., 1993; Maehr & Anderman, 1993; Midgley, 1993; Urdan, Wood, & Midgley, 1995). Maehr and Midgley (1991) proposed that middle schools have a school culture that emphasizes certain goals via policies, procedures, and academic practices of teachers. According to achievement goal theory perspective of motivation, the purposes of learning and meaning of achievement that are emphasized by schools both explicitly and implicitly creates a school psychological environment that is perceived by students and teachers (Maehr & Midgley, 1991).

Maehr and Midgley (1991) pointed out the importance of the studies conducted at the classroom level and the qualitative observations in the classrooms that were investigating the effects of school policies and procedures on student learning and motivation. Maehr and Midgley (1991) also asserted that the effects of school policies and procedures on student learning and motivation were stemming from the extrapolations of research on classroom goal structures and independent classroom observations. Classroom is not an isolated place and is an integral part of a broader social system. Therefore, it is inevitable that aspects of school psychological environment influence into the desired development and modifications in the classroom (Maehr & Midgley, 1991). Ames (1992) stated that schoolwide policies and procedures can subsume the efforts at the classroom level.

Research on school culture and school climate indicated that schools define the purpose and meaning of learning through goal emphases and such emphases on goals exert influence over students' self-beliefs and achievement behaviors (Kaplan & Maehr, 1999). Accordingly, school environment can be defined in terms of goal theory like it was defined for classroom goal structures. (Kaplan & Maehr, 1997; Krug, 1989; Maehr, 1991; Maehr & Fyans, 1989; Maehr & Midgley, 1991, 1996) Similar to classroom goal structures, school psychological environment may emphasize mastery (task) and performance (ability) goals (Maehr, 1991). While emphasizing personal improvement, mastery, understanding and intellectual development refer to mastery (task) goals, social comparison, competition and normative evaluations among students refer to ability (performance) goals. In a school where effort, personal progress, learning, understanding and improvement are valuable, then the students perceive the school psychological environment as task (mastery) goals are salient. However, when the salient goals are performance oriented in a school, then normative comparisons, showing off one's work, and a competitive environment occur. Schools emphasizing a strong ability goal are places like a group of successful and recognized students are rewarded and success is depended on surpassing others in terms of academic achievement. Covington (1992) stated that this is such a stressful and unattainable work to accomplish. A few studies conducted to date indicated that goals emphasized in schools are related to students' personal achievement goals, sense of academic efficacy, and use of learning strategies effectively (Roeser et al., 1996). Moreover limited number of studies have shown that not only students, but also teachers are influenced by the salient goal structure communicated by the school. For example, Deemer (2004) investigated the influence of school goal structures (mastery and performance) on teachers' instructional goals (mastery and performance goals) and self-efficacy. The researchers recruited 99 high school science teachers in Daleware, USA, and collected the data. She analyzed the data through a path model. The model fit the data well and results indicated that teachers' perception of a mastery school goal structure positively predicted their teaching self-efficacy. Moreover, teachers' perceiving a mastery oriented school goal structure focused on mastery instructional approach goals. On the other hand, teachers' who perceive their school goal structure as emphasizing performance goals espoused more performance instructional approach goals. Surprisingly, teachers' perception of a mastery school goal structure associated positively with the performance instructional approach goals of the high school science teachers.

In another study, Ciani et al., (2008) investigated the differences between school goal structures and their influences on teachers' classroom instructional goal orientataions. The participants of the study were 156 teacher from four high schools in a Midwestern USA state. They collected the data and conducted a series of MANOVAs to analyze the data. Their results indicated that while in a low-performance oriented school teachers endorsed higher mastery instructional classroom goal structure, in a high-performance oriented school goal structure, teachers endorsed lower mastery instructional classroom goals. Thus, it can be inferred that school performance goal structure influenced teachers' mastery instructional goals that they practice in the classrooms during their teaching.

Recently, Cho and Shim (2013) examined school goals and personal factors associated with teachers' instructional goals. They collected data through an online survey from 211 teachers. They analyzed the data by using hierarchical linear regression. Their analysis results revealed that teachers perceived school mastery goal structures predicted their mastery instructional practices in the classroom and similarly their perceived school performance goal structures predicted their performance instructional goal structures. Moreover, they included teachers' self-efficacy in their analyses and found that teacher self-efficacy moderated the effect of teachers' perceived school goal structures on teachers' instructional goal structures.

Learning environments that are supportive and task (mastery) oriented plays an important role in high academic achievement (Eccles et al., 1993; Maehr & Anderman, 1993; Midgley, 1993; Wang & Holcombe, 2010, Bandura, Caprara, Barbaranelli, Pastorelli, & Regali, 2001). Moreover, the goal stresses in the learning environment is hypothesized to be related to students' and teachers' sense of efficacy. In a learning environment that stresses effort, self-improvement, value of learning, and undertaking challenging tasks, students and teachers are likely to feel efficacious. On the other hand, competition and ability comparison promoting environments would make students and teachers feel less efficacious. Midgley et al., (1995) supported these theoretical assertions. Students and teachers were found to have higher self-efficacy in a school environment where task goals are salient.

To sum up, in a school environment, where students do not worry about being compared to others concerning their academic abilities, it is hypothesized that perceptions in such an environment lead to positive school affect and achievement. On the contrary, negative motivational, behavioral and emotional outcomes are hypothesized to associate with school environments where students are compared to each other in their academic abilities and enforced to compete with each other (Roeser & Eccles, 1998). Similar to students, teachers are influenced from the prevailing school goal structure and it is expected in the current study that mastery oriented school goal structure would associate positively with teaachers mastery instructional goals and school performance goals structures would associate positively with teachers' performance instructional approaches in the classroom.

CHAPTER III

METHODOLOGY

This chapter presents the methodology of the study. Specifically, it documents how the study was conducted in terms of the participants, data collection procedure and instruments, data analysis, assumptions and limitations of the study.

3.1 Design of the Study

This study, primarily, examined the relationships among students' motivation, engagement, and achievement in science, and science teachers' motivation and job satisfaction. More specifically, science teachers' motivation was examined in terms of teacher self and collective efficacy and approach to instruction (mastery and performance). Student motivation, on the other hand was examined in terms of self-efficacy and achievement goals in science (mastery approach goals, mastery avoidance goals, performance approach goals, and performance avoidance goals). Student engagement was explored in four dimensions: agentic, cognitive, behavioral, and emotional engagement in science. In order to reveal the relationships among teacher and students variables, hierarchical models were needed. The nested structure of the data enabled the use of multilevel analysis techniques. A two-level hierarchical linear modeling (HLM) technique was used to analyze the data.

Current study, also, investigated teachers' motivation and job satisfaction in relation to their perceptions of school environment measured in terms of perceived school goal structures (mastery and performance) and perceptions of school context (discipline problems, relations to parents, supervisory support, and relations with colleagues). Path analysis was conducted to explore these relations. Overall, the design of the study could be stated as a cross-sectional correlational study. The data for this study were collected from both teachers and their students through self-report questionnaires. Cross sectional data collection procedure was utilized. Both path and HLM analyses yielded results based on regression coefficients.

3.2 Population and Sample

The target population of this study was the entire 7th grade public elementary school students and their science teachers in Ankara. Fraenkel and Wallen (2006) asserted that there is no clear cut off value for a representative sample size. It depends on the effort and energy of the researcher. For the availability of the financial aid and excessive researcher effort, a potentially representative sample was selected from Ankara. Two districts out of seven districts of the city, Yenimahalle and Sincan, were selected randomly by using a two stage sampling method. In the first stage districts were selected randomly and in the second stage schools were selected randomly as well. There are 341 middle schools in the central districts of Ankara and a total of 88 middle schools (43 in Yenimahalle and 45 in Sincan) in two districts. Teachers and students from 60 out of 88 schools (32 from Yenimahalle and 28 from Sincan) were selected randomly for the current study. Overall, two thirds of schools located in various places of Yenimahalle and Sincan were selected randomly in this study and it was considered as a sufficient number (60 middle schools out of 341 middle schools of central districts of Ankara, around 18 %) to be generalized to seven central districts of Ankara.

The middle schools in Yenimahalle and Sincan mostly had more than one science teachers per school. The teacher sample was selected on the *teaching 7th grade* criteria. Therefore, all science teachers teaching in a middle school were not included. The science teachers teaching only 7th grades were included. As a result, a total of 134 science teachers participated in the study. Of these teachers, 81 were from the middle schools of Yenimahalle and 53 were from the middle schools of Sincan.

The student sample was selected in accordance with the teacher sample. The teachers were told to make a random selection of a 7th grade class that they teach. Every teacher was matched with the class of seventh graders they have selected and in the predefined convenient dates, data were collected. The data for the present study were collected only from 7th graders based on a number of reasons. At this point, it is necessary to provide introductory information about the new education system in Turkey. The Turkish national education system has undergone a revolutionary shift in 2012. The old 8 year compulsory education system (5 years of primary school plus 3 years of middle school) was abandoned and a new 12 years compulsory educational system, which was based on four years of primary education, four years of middle school education and four years of high school education (also known as 4+4+4), was introduced. In this system primary school children graduate from fourth grade and enroll in middle school which begins with fifth grade as continuation of primary education. Similarly, at the end of eight grade, middle schoolers graduate from eight grade and enroll in high school. In this new system, science classes begin in the third grade and continue up to eight grade. In the third and fourth grades science is taught by primary teachers. However, in the middle grades (the second fourth year - 5th to 8th grades) science is taught by science domain teachers. Thus, this study focuses on the students of the second fourth year; the seventh graders. Previous research on student motivation provided evidences that age, and classroom learning environment influenced student motivation and achievement (see Yerdelen, 2013; Pamuk, 2014). In the early grades (correspond to the first fourth years in the new system) schools and teachers place more emphasis on cognitive and moral development. While a steady and non-competitive classroom environment exist in the early grades, this situation begins to wane in the upper grades. The shift of primary teachers with domain teachers, physiological and mental development with puberty, changing student expectations, and emphasized competition for success cause decrease in student motivation towards classes and school. Such similar cases exist in Turkey too. In the second fourth year period domain teachers begin to teach each course. Accordingly the negative impact of transition from fourth to fifth grade on student motivation is likely to exist in the beginning years of second fourth (e.g. 5^{th} and 6^{th} grades). Moreover, placement examination at the end of eight grade (TEOG) triggers competition among students and some of the middle school principals were not supportive of scientific studies with eight graders because of the placement examination. Considering the negative impact of transition, time needed for adaptation to the middle school environment (second fourth year period), and the psychological pressure of placement examination at the end of eight grade (TEOG) pointed out seventh grade students as the most convenient sample for this study. Therefore, due to the abovementioned issues the student sample of the study was decided as the seventh grade students rather than other grade levels of middle schools.

3.2.1 Teacher Sample

A total of 134 science teachers’ from two districts of Ankara (53 teachers from Sincan, 81 teachers from Yenimahalle) contributed to the present study. All teachers are working in the public middle schools. The age distribution of teachers ranges from 24 to 59 (M = 38.13, SD = 10.00) and the teaching experience of teachers ranges from 1 to 40 years (M = 14.38, SD = 9.74). Average number of students in the classes they taught ranged from 20 to 45 (M

= 31.44, SD = 4.87). The participant teachers had weekly 16 to 30 hours of class (M = 23.51, SD = 3.93). A great majority of teachers (74.6 %) are graduates of college of education and only 61.2 % of them are graduated of science education program. Most of the teachers hold bachelor degrees (81.3 %) and relatively few of them had graduate degrees (11.9 %). A great majority of the teachers are married (87.3 %) and roughly one fourth of them does not have children. Detailed information about the teacher sample are provided in the Table 3.1below.

Table 3.1 Demographic characteristic of teacher sample

		Frequency (*f*)	Percentage (%)
Teachers	Yenimahalle	81	60.50
	Sincan	53	39.50
Gender	Female	98	73.10
	Male	34	25.40
	Missing	2	1.50
Age (year-old)	24-35	67	53.20
	36-45	29	23.00
	46-55	21	16.20
	56-59	9	6.60
	Missing	8	6.00
Graduated College	Education	100	74.60
	Arts & Sciences	31	23.10
	Engineering	1	.70
	Other	2	1.50
Graduated Program	Science Education	82	61.20
	Physics Education	12	9.00
	Chemistry Education	16	11.90
	Biology Education	21	15.70
	Missing	3	2.20
Graduate Level	Undergraduate	109	81.30
	Graduate	16	11.90
	PhD	1	.70
	Other	3	2.20
	Missing	5	3.70

Table 3.1 Demographic characteristic of teacher sample (Continued)

Experience (year)	1-10	59	45.5
	11-20	41	31.4
	21-30	13	10.4
	31-34	18	12.7
	Missing	3	2.2
Average number of students in class	20-25	13	9.8
	26-30	69	53.4
	31-35	28	21.0
	36-40	16	9.8
	41-45	4	3.0
	Missing	4	3.0
Weekly Class Hours	15-20	32	23.4
	21-25	59	43.8
	26-30	36	27.7
	Missing	7	5.1
Marital Status	Married	117	86.9
	Single	14	10.9
	Missing	3	2.2
Number of Children	No Children	33	25.5
	1	51	37.2
	2	39	28.5
	3	6	5.1
	Missing	5	3.6

3.2.2 Student Sample

A total of 3394 seventh grade students (55.9% female, 43.8% male) from 60 public middle schools participated in this study. The mean age of the students was 13.31 (SD = 2.60). The mean previous semester science marks was 3.31 (SD = .81) out of 5. Most of the students had two siblings (46.9 %) and three siblings follows (29.7 %). Majority of the students had separate study room (83.7 %) and approximately the same percent of these students possess personal computers (84.9 %). However, 69.6 % ıf them had internet access with these computers. The families of participating students do not have a regular newspaper subscription (16.1 %). Most of the parents sometimes buy newspaper (63.8 %). In regard to books at home, participating students reported that approximately one third of the families (34.2 %) had 26 to 100 books in their houses. Concerning the sociodemographic characteristics of the student sample, a great deal of students' mothers are graduates of primary schools (31.2 %), their fathers also are mostly graduated from high school (32.9 %). In general, father is the one earns money for the family (87.1 %) and mothers are unemployed (74.3 %). More details about the demographic characteristics of the student sample are provided in Table 3.2 below.

Table 3.2 Demographic characteristics of student sample

		Frequency (f)	Percentage (%)
District	Yenimahalle	2070	61.0
	Sincan	1324	39.0
Gender	Male	1751	51.6
	Female	1622	47.8
	Missing	21	.60
Age (year-old)	12	129	3.8
	13	2277	67.1
	14	512	15.1
	15	20	.60
	16	6	.20
	Missing	450	13.2
Science GPA	1	98	2.9
	2	284	8.4
	3	909	26.8
	4	1354	39.9
	5	115	3.4
	Missing	634	18.6
Number of Siblings	1	237	7.7
	2	1592	46.9
	3	1008	29.7
	4	313	9.2
	5 and above	132	3.9
	Missing	88	2.6

Table 3.2 Demographic characteristics of student sample (Continued)

Separate Study Room	Yes	2841		83.7	
	No	492		14.5	
	Missing	61		1.8	
Computer at Home	Yes	2881		84.9	
	No	458		13.5	
	Missing	54		1.6	
Internet Access	Yes	2362		69.6	
	No	1977		28.8	
	Missing	54		1.6	
Daily Newspaper	Never	594		17.5	
	Sometimes	2165		63.8	
	Always	546		16.1	
	Missing	88		2.6	
Books at Home	Any or few (0-10)	217		6.4	
	11-25	896		26.4	
	26-100	1160		34.2	
	101-200	495		14.6	
	Over 200	570		16.8	
	Missing	54		1.6	
		Mother		Father	
		f	%	*f*	%
Parents' Educational Level	Illiterate	91	2.7	16	.50
	Primary School	1059	31.2	593	17.5
	Middle School	814	24.0	750	22.1
	Secondary School	875	25.8	1116	32.9
	Bachelor Degree	380	11.2	631	18.6
	Master	61	1.8	145	4.3
	Doctorate	20	.60	30	.90
	Missing	88	2.6	115	3.4
Parents' Occupation	Employed	719	21.2	2956	87.1
	Not Employed	2521	74.3	71	2.1
	Not a regular job	61	1.8	92	2.7
	Retired	71	2.1	200	5.9
	Missing	20	.60	75	2.2

3.3 Data Collection Instruments

The data for the present study were collected both from science teachers and their 7th grade students. A group of teacher questionnaires were gathered together to form the teacher level data collection instruments. Similarly, a group of student questionnaires were gathered together to form the student level data collection instruments. Additionally, teachers and students both filled out a demographic questionnaire.

3.3.1 Teacher Level Data Collection Instruments

Teacher level data collection instruments consisted of six different instruments in varying number of items namely (1) Teachers' Sense of Efficacy Scale (TSES), (2) Teachers' Approach to Instruction Scale (TAIS), (3) School Goal Structure Scale (SGSS), (4) Teacher Collective Efficacy Scale (TCES), (5) Perceived School Context Scale (PSCS), (6) Teachers' Job Satisfaction Scale (TJSS) (see Table 3.3). Following section provided detailed information about these scales.

Table 3.3 Data Collection Instruments and Variables for Teacher Sample

Instruments	Variables
Demographics Questionnaire	Gender Age Graduated College Type Graduated Department Education Level Experience Weekly Class Hours Class Size Marital Status Number of Children

Table 3.3 Data Collection Instruments and Variables for Teacher Sample (Continued)

Teachers' Sense of Efficacy Scale (TSES) *Developed by Tschannen-Moran & Woolfolk-Hoy (2001)* *Translated to Turkish by Çapa, Çakıroğlu, & Sarıkaya (2005)*	Classroom Management Student Engagement Instructional Strategies
Teachers' Approach to Instruction Scale (TAIS) *Developed by (Midgley et al., 2000)* *Translated to Turkish by the researcher*	Mastery Approaches to Instruction Performance Approaches to Instruction
Teacher Collective Efficacy Scale (TCES) *Developed by Goddard, Hoy, and Woolfolk Hoy (2000)* *Translated to Turkish by the researcher*	Group Competence Task Analysis
Teachers' Professional Perceptions Scale (TPPS) *Developed by Skaalvik and Skaalvik (2011)* *Translated to Turkish by the researcher*	Job Satisfaction
Perceived School Context Scale (PSCS) *Developed by Skaalvik and Skaalvik (2010; 2011)* *Translated to Turkish by the researcher*	Time Pressure Autonomy Discipline Problems Supervisory Support Relations with Parents Relations with Colleagues
School Goal Structure Scale (SGSS) *Developed by (Midgley et al., 2000)* *Translated to Turkish by the researcher*	School Mastery Goals School Performance Goals

3.3.1.1 Teachers' Sense of Efficacy Scale (TSES)

Science teachers' science teaching self-efficacy beliefs were measured by the Teachers' Sense of Efficacy Scale (TSES) (see Appendix C). The instrument was originally developed by Tschannen-Moran and Woolfolk-Hoy (2001) as a 9 point Likert type scale ranging from "1 = nothing" to "9 = a great deal". The developers were mostly inspired by Bandura's self-efficacy scale. The instrument was developed to asses three basic teacher capabilities namely, efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management.

Tschannen-Moran and Woolfolk-Hoy (2001) developed TSES during a seminar on teaching self-efficacy with a group of graduate students and two in-service teachers. A number of items were generated by this research team and finally a 36 item scale was agreed upon. Based on a series of factor analyses, Tschannen-Moran and Woolfolk-Hoy (2001) decided on 24 items that had the highest factor loadings. The final version of the instrument had three factors each having 8 items which were Student Engagement (SE) (e.g. "How much can you do to get students to believe they can do well in school work?"), Instructional Strategies (IS) (e.g. "To what extent can you provide an alternative explanation or example when students are confused?"), and Classroom Management (CM) (e.g. "How much can you do to get children to follow classroom rules?"). The reliability coefficients for each subscale were $\alpha = .87$ for Student Engagement (SE), $\alpha = .91$ for Instructional Strategies, and $\alpha = .90$ for Classroom Management. A short version of TSES was also generated by reducing the number of items from the long form of TSES. Tschannen-Moran and Woolfolk-Hoy identified items that had the highest factor lading under each factor and composed the short form of TSES. Each factor (Student Engagement, Instructional Strategies, and Classroom Management) had 4 items and final version of the short form of TSES included 12 items. Cronbach's alpha reliability coefficients for the factors of the short form of TSES were $\alpha = .81$ for Student Engagement, $\alpha = .86$ for Instructional Strategies, and $\alpha = .86$ for Classroom Management.

Çapa, Cakiroglu, and Sarıkaya (2005) translated and adapted the 24-item version (long form) of TSES into Turkish. They tested the validity of the instrument by administering it to a sample of 628 preservice teachers from six universities which are located in four large cities of Turkey. They conducted confirmatory factor analysis and found that the data yielded a good model fit (TLI = .99, CFI = .99, RMSEA = .07) to a three-factor solution as indicated in the original version of the TSES. The reliability coefficient for the full scale of 24-items was .93 and .82 for student engagement, .86 for instructional strategies, and .84 for classroom management.

In the present study, short form of the TSES (12 items) was used to assess teachers' sense of self-efficacy and in order to validate the three-factor structure of the scale, a CFA was conducted. Results indicated a good model fit to the data (χ^2 (51, N = 134) = 83.46, RMSEA = .07, CFI = .98, NFI = .95, SRMR = .06). Below Table 3.5 indicates the Lambda X estimates of the TSES for the present study.

Table 3.4 Lambda X Estimates for TSES

Subscale	Indicator	Present Study LX Estimates
Student Engagement	TSES_4	0.76
	TSES_6	0.72
	TSES_9	0.80
	TSES_22	0.62
Instructional Strategy	TSES_11	0.62
	TSES_18	0.78
	TSES_20	0.70
	TSES_23	0.79
Classroom Management	TSES_3	0.73
	TSES_13	0.81
	TSES_15	0.86
	TSES_16	0.80

Table 3.5 Descriptions, sample items, and reliability coefficients of TSES subscales

Subscales	Description	Sample Item	Number of Items (Main Study)	Cronbach's Alpha-Short Form (Tschannen-Moran & Hoy, 2001)	Cronbach's Alpha-Long Form (Capa, Cakiroglu, & Sarikaya, 2005)	Cronbach's Alpha-Short Form (Present Study)
Student Engagement	Belief in capabilities for engaging students	"How much can you do to help your students' value learning?"	4	.86	.86	.79
Instructional Strategies	Belief in capabilities to use various teaching strategies	"How well can you implement alternative strategies in your classroom?"	4	.84	.84	.80
Classroom Management	Belief in capabilities to manage classroom effectively	"How well can you establish a classroom management system with each group of students?"	4	.81	.82	.87

The internal consistency of the items were also calculated as Cronbachs's alpha coefficient. Reliability coefficient for the 12-item full scale was .90. The alpha coefficient for the sub scales were found as .79 for student engagement, .80 for instructional strategies, and .87 for classroom management.

3.3.1.2 Teachers' Approach to Instruction Scale (TAIS)

Science teachers' approaches to instruction were measured by the teachers' scales part of the Patterns of Adaptive Learning Survey (PALS) (see Appendix C). PALS was developed and refined by a group of researchers from the University of Michigan (Midgley et al., 2000). PALS was developed based on goal orientation theory and aimed to measure the relationships among students' and teachers' motivation, affect, and behavior and the influence of the environment. Teachers' part of PALS have three subscales including 1) teachers' perceptions of the goal structure in the school, 2) teachers' goal-related approaches to instruction, and 3) personal teaching efficacy. PALS was designed on a five point Likert type scale ranging from 1 = "Strongly disagree" to 3 = "Somewhat agree" to 5 = "Strongly agree" in the teachers' part. PALS have been widely used (e.g. Anderman & Young, 1994; Anderman & Midgley, 1997; Anderman & Anderman, 1999; Kaplan &Maehr, 1999; Midgley, Anderman, & Hicks, 1995; Roeser, Midgley, & Urdan, 1996; Urdan, Midgley, & Anderman, 1998) either with all scales or individually in various domains of teaching (math, reading, etc.). Midgley et al., (2000) stated that widely use and acceptance of the PALS scales have provide enough evidence of validity for its scales.

In this study, teachers' approaches to instruction were measured by using the teachers' sub-dimension of the PALS. Teachers' approaches to instruction refer to the goal-embedded strategies that are used by the teachers' in the classroom. A total of 9 items in two scales represented teachers' instructional approaches.

The PALS included two types of teachers' instructional approaches which are a) mastery approaches to instruction (n = 4 items) and b) performance approaches to instruction (n = 5 items). Mastery approaches refer to the teaching strategies that communicate to students that the purpose of schooling and schoolwork is to competence development. Teachers' mastery instructional approaches scale included four items. On the other hand, performance approaches communicate students that the purpose of schooling and schoolwork is to demonstrate competence to others and compete for success. Teachers' performance instructional approaches scale included five items. In the original form of PALS, the reliability coefficients of mastery and performance instructional approaches were both found $\alpha = .69$.

The teachers' approach to instruction scale was translated and adapted into Turkish by the researcher. Firstly, the items of the scale were examined in terms of appropriateness with the Turkish educational system and cultural values of the society. During this preliminary review, none of the items were discarded from the original instrument. All items were decided to be administered to Turkish science teachers. Throughout the translation procedure, expert opinions were obtained from a professor from the faculty of education, department of elementary science education for content validity. Additionally, the translated items were consulted to an English language instructor from Academic Writing Center of a well-known public university. Science teachers were also consulted to review the translated items for face validity and appropriate wording of items. The instrument was tested for validity and reliability issues through pilot study. The participants of the pilot study were 102 in-service science teachers. All items were considered as appropriate to be administered to the Turkish science teachers. All of the items of the scale were seen appropriate and decided to be maintained in the scale. None of the items were discarded in the preliminary reviews before translation. The items were added the words *science* or *science class* in order to address science teachers and science classes.

Table 3.6 Descriptions, sample items, and reliability coefficients of TAIS subscales

Subscales	Description	Sample Item	Number of Items (Main Study)	Cronbach's Alpha - *Midgley et al., 2000*	Cronbach's Alpha - *Pilot Study*	Cronbach's Alpha – *Main Study*
Mastery Approaches to Instruction	The teaching strategies that communicate to students that the purpose of schooling and schoolwork is to competence development	"During class, I often provide several different activities so that students can choose among them"	3	.69	.54	.71
Performance Approaches to Instruction	The teaching strategies that communicate to students that purpose of schooling and schoolwork is to demonstrate and show competence to others	"I display the work of the highest achieving students as an example"	4	.69	.67	.73

A pilot study was conducted with 102 in-service science teachers to see the factor structure and internal reliability of the translated and adapted items. Confirmatory factor analysis did not suggest an acceptable fit (χ^2 (26, N = 102) = 76.24, RMSEA = .13, CFI = .75, SRMR = .11, and NFI = .67). Examination of suggested paths based on modification indices and items' contribution to total, two items seemed problematic: item 6 ("I help students understand how their performance compares to others") and item 5 ("I consider how much students have improved when I give them report card grades"). More specifically, content overlap appeared to lead to suggested error covariance between item 6 and some other items (e.g. "I encourage students to compete with each other" and "I point out those students who do well as a model for the other students") in performance approaches to instruction subscale. When modification indices and suggested error covariances were considered, deletion of item 6 appeared to better improve the model. Concerning item 5 which belongs to mastery approaches to instruction subscale, deletion of this item led to an increase in the reliability coefficient of its corresponding sub-scale. When all items were included, the reliability coefficients were .67 for performance instructional approach subscale and .54 for mastery instructional approach subscale.

For the main study, these problematic items were reviewed again for wording and content. However, the items needed no modifications and the items were utilized as they were. Thus, these items were included in the main study. The teachers' approaches to instruction scale was tested through a confirmatory factor analysis and reliability analyses. Firstly, all 9 items were included in the analysis. The same items, which were problematic in the pilot study, maintained the same problems in the main study. These items were reviewed again and decided that their deletion was not posing any threat to validity of the total scale. Therefore, these items were removed from the scale. In the second attempt, these items (items 5 and item 6) were deleted and a new confirmatory factor analysis was conducted. The results suggested a reasonable model fit (χ^2 (13, N = 134) = 27.24, RMSEA = .09, CFI = .93, SRMR = .08, and NFI = .90) to the data. Below table indicates the Lambda X estimates for the Teachers' Instructional Approaches Scale.

Table 3.7 Lambda X Estimates for TAIS

Subscale	Indicator	Main Study LX Estimates
Mastery Approaches to Instruction	ATIS_2	.59
	ATIS_4	.58
	ATIS_9	.87
Performance Approaches to Instruction	ATIS_1	.50
	ATIS_3	.64
	ATIS_7	.56
	ATIS_8	.85

The reliability coefficients for the mastery instructional approach and performance instructional approach was .71 and .73, respectively. The fit indices of confirmatory factor analysis obtained for the main study indicated an acceptable fit. The reliability coefficients were sufficiently high.

3.3.1.3 Teachers' Collective Efficacy Scale (TCES)

Teacher Collective Efficacy Scale (TCES) is designed to evaluate teachers' collective efficacy beliefs in a school environment. The TCES was originally developed by Goddard, Hoy, and Woolfolk Hoy (2000) in Likert type ranging from "6 = strongly agree" to "1 = strongly disagree" and consisted of 21 items which represented a single factor structure. However, the original version included two elements which are "analysis of teaching task" and "assessment of teaching competence as a group". Task analysis element has 8 items (4 of them positively worded and 4 of them negatively worded) and group competence has 13 items (7 of them positively worded and 6 of them negatively worded). The originally developed version was pilot tested with 452 teachers from 47 randomly selected schools. The developers tested the factor structure of the scale with exploratory factor analysis. They found that 21 items loaded on one factor explaining 57.89 % of the variance. The existence of the two elements led the developers to test the factor structure on a two factor basis. Although two factor solution suggested larger explained variance, the developers relied on the high correlation ($r = .75$, $p < .001$) between two elements and decided to treat the scale as of a single factor structure. In order to provide more validity evidences, they correlated TCES with a criterion, namely personal teaching efficacy. A moderate and positive relationship was hypothesized between two scales. The results suggested an expected value of correlation, $r = .54$, $p < .01$. Additionally, 21 items had high internal reliability (Cronbach's alpha = .96). Recently, McCoach and Colbert (2010) reexamined the factors underlying TCES. Moreover, their factor examination study suggested that four of the items have poor pattern loading coefficients that indicate these items were prone to be discarded in the future studies. They conducted a multilevel confirmatory factor analysis with the remaining 17 items and provided evidence for a two-factor structure which were group competence and task analysis. The correlation coefficient between these two factors were found $r = .44$.

The TCES was translated and adapted into Turkish by the researcher. Firstly, the items of the scale were examined in terms of appropriateness with the Turkish educational system and cultural values of the society. During this preliminary review, 4 items were decided to be discarded. The item (#16 in the original instrument) "Drugs and alcohol abuse in the community make learning difficult for students here" was discarded because this item was considered to be inappropriate to be asked to middle school science teachers considering the context.

Table 3.8 Descriptions, sample items, and reliability coefficients of TCES subscales

Subscales	Description	Sample Item	Number of Items (Main Study)	Cronbach's Alpha - *Pilot Study*	Cronbach's Alpha – *Main Study*
Group Competence	Teachers' judgments about the capability of the school faculty as a whole in order to conduct a good teaching	Teachers here are well-prepared to teach the subjects they are assigned to teach (positive item) If a child doesn't want to learn teachers here give up. (negative item)	10	.86	.87
Task Analysis	Teachers' assessment about the requirements of education as they engage in teaching	The students here come in with so many advantages they are bound to learn. (positive item) Students here just aren't motivated to learn. (negative item)	4	.75	.80

The ethical review board of the Ministry of National Education in Turkey is sensitive in cases such as alcohol and substance use by the youth. The next item was (#17 in the original instrument) “The opportunities in this community help ensure that these students will learn”. This item directly addressed the students described in the previous item. In other words, these two items were interrelated to each other. Discarding the item 17 warranted omitting the following one. Therefore, this item was also discarded. Also, the items “Learning is more difficult at this school because students are worried about their safety” (#19 in the original instrument) and “Teachers here need more training to know how to deal with these students” (#20 in the original instrument) were discarded because of safety issues in the first item and the interrelatedness forced to discard the following one. The final version of the instrument had 17 items whose 12 items represented group competence and 5 items represented task analysis factors (see Appendix C).

After discarding these items, the remaining 17 items were translated into Turkish by the researcher. Exactly the same translation procedure was followed as was done for section 3.3.1.2. The TCES items were developed to assess the collective efficacy beliefs of teachers from various domains. In other words, TCES does not address a certain domain of teachers. However, all teachers participating in this study were science teachers. Therefore, the items were redesigned in order to target science domain teachers. The items were added the words *science* or *science class* in order to address science teachers and their science classes. After the translation and adaptation process, the TCES was pilot tested with 102 in-service science teachers. Negatively worded items (item 3, item 4, item 8, item 11, and item 16) (See Appendix C) were reverse coded during data entry. The pilot data were analyzed for factor structure in the Turkish context and reliability coefficient was also provided. Statistical analyses were conducted via SPSS 21 (Statistical Package for Social Sciences) software.

Since the studies in the literature produced mixed results concerning the factor structure of the instrument (e.g. McCoach & Colbert, 2010), the Turkish version the TCES was tested firstly through exploratory factor analysis. According to Warner (2012) Principal Axis Factoring in exploratory factor analysis is more appropriate than Principal Component Analysis (PCA) in social sciences research. Moreover, it is advised that oblique rotation methods should be used to analyze dependent factors (see Field, 2009; Thompson, 2004). Accordingly, in this study, principal axis factoring with oblique rotation method (promax; kappa 4) was used considering these suggestions. Below Table 3.9 indicates the pattern matrix of principal axis factoring.

Graham, Guthrie, & Thompson (2003) recommended interpreting both pattern and structure matrix tables because structure matrix provides a double check for pattern matrix. Pattern and structure matrices of principal axis factor analysis with oblique rotation (kappa 4) indicated that the CTES better fitted to a two factor solution in the Turkish science teachers' context (See Table 3.9 and Table 3.10). These 17 items with two factor solution explained 45.48% of the variance. Detailed inspection of these two tables, however, pointed out some items (e.g. TCES10, TCES12, TCES1, and TCES2) (See Appendix C) as problematic in terms of low factor loadings (TCES10 and TCES12) and cross loading on two factors (TCES1 and TCES2). The reliability coefficients of the factors were α = .86 and α =.75 for the group competence and task analysis, respectively. Overall, similar to McCoach and Colbert' (2010) findings, the results of exploratory factor analysis suggested a two factor structure for the TCES.

Table 3.9 Structure Matrix for TCES factor analysis

	Factor 1	Factor 2
TCES9	.79	.33
TCES6	.77	.34
TCES3	.73	
TCES5	.72	.33
TCES7	.70	.32
TCES4	.65	
TCES2	.64	.47
TCES1	.58	.49
TCES11	.52	
TCES8	.51	
TCES17	.42	.34
TCES12	.39	
TCES14		.80
TCES15		.68
TCES13		.67
TCES16		.45
TCES10		.35

Table 3.10 Pattern matrix for TCES factor analysis

	Factor 1	Factor 2
TCES9	.76	
TCES3	.76	
TCES4	.75	-.31
TCES6	.74	
TCES5	.69	
TCES7	.66	
TCES11	.62	
TCES2	.54	
TCES8	.52	
TCES1	.46	.33
TCES12	.41	
TCES17	.34	
TCES14		.86
TCES15		.70
TCES13		.66
TCES16		.43
TCES10		.36

In the main study, 17-item TCES was undergone to a confirmatory factor analysis to provide evidence of validity for a two-factor structure and reliability analyses to assess the internal reliability of subscale items. The first confirmatory factor analysis with the 17 items did not suggest an acceptable fit (χ^2 (118, N = 134) = 335.00, RMSEA = .12, NFI = .85, CFI = .90, SRMR = .10) to the data. The results of exploratory factor analysis of pilot study and modification indices of confirmatory factor analysis were reexamined to make a modification for obtaining a good model fit. The problematic items (item 10 and item 12) (see Appendix C) had both low factor loadings (see Table 3.9 and Table 3.10) and did not contribute to the total reliability score of the scale. Additionally, item 1 had a high cross loading value. Thus, these three items were decided to be deleted based on the suggestions and inferences obtained from the exploratory factor analysis of pilot data. Remaining 14 items were subjected to a new confirmatory factor analysis and this new analysis suggested an acceptable model fit to the data (χ^2 (76, N = 134) = 188.02, RMSEA = .10, NFI = .90, CFI = .94, SRMR = .09). Lambda X estimates for TCES subscales are presented in the Table 3.11 below.

Table 3.11 Lambda X Estimates for TCES

Subscale	Indicator	Main Study LX Estimates
Group competence	TCES_2	.63
	TCES_3	.62
	TCES_4	.60
	TCES_5	.68
	TCES_6	.82
	TCES_7	.86
	TCES_8	.61
	TCES_9	.80
	TCES_11	.50
	TCES_17	.49
Task Analysis	TCES_13	.52
	TCES_14	.80
	TCES_15	.88
	TCES_16	.66

Cronbach's alphas for group competence and task analysis are .87 and .80, respectively (see Table 3.8).

3.3.1.4 Teachers' Job Satisfaciton Scale (TJSS)

Teachers' job satisfaction was measured by a four-item scale, namely Teachers' Professional Perceptions Scale (TPPS) (see Appendix C). Job satisfaction refers to teachers' pleasantness from the job they professed. In other words, teachers' feeling of satisfaction from the teaching profession. The scale weas originally developed by Skaalvik and Skaalvik (2011) on a six point Likert type ranging from "completely disagree" (1) to "completely agree" (6). An example item was "I enjoy working as a teacher". Skaalvik and Skaalvik (2011) tested the scale through a study for its factor validity and reliability. A sample of 2569 Norwegian elementary and middle school teachers participated in the study. A confirmatory factor analysis and reliability analyses was conducted on the obtained data. The confirmatory factor analysis results indicated a good model fit (χ^2 (155, N = 2569) = 1344.010, CFI = .96, IFI = .96, TLI = .94 and RMSEA = .06) to the data. The reliability coefficient was .91 for job satisfaction scale.

The scale was translated and adapted into Turkish by the researcher. The same procedure in the translation and adaptation process of 3.3.1.2 was followed as well. All items were considered as appropriate to be administered to Turkish science teachers. All of the items seemed understandable and all of them were kept in the scale. None of the items were removed from the scale. The items were added the words *science* in order to address science teachers. The instrument was subjected to a pilot study to see the factor structure and provide evidences for validity. A confirmatory factor analysis and reliability analyses were conducted. Confirmatory factor analysis suggested an acceptable fit indices (χ^2 (13, N = 102) = 29.24, RMSEA = .12, CFI = .96, SRMR = .07, and NFI = .93). However, CFA results suggested that second item (I look forward to going to school every day) and fourth item (When I get up in the morning, I look forward to going to work) of job satisfaction scale (see Appendix C) had an overlapping content. Actually, these two items had almost the same meaning with similar wordings. Considering this result and relatively low variance explained, fourth item was decided to be susceptible to deletion in the main study. The reliability coefficient was found .84 for job satisfaction.

For the main study, job satisfaction scale was tested through a confirmatory factor analysis and reliability analyses. This problematic fourth item was reviewed again for wording and content. The item needed no modifications and was utilized as it was. Thus, this item remained in the main study. The first attempt of confirmatory factor analysis including all items of job satisfaction scale did not yield acceptable fit indices. The same item, which was problematic in the pilot study, maintained the same problem in the main study. This item was revised again and it was decided that its deletion was not posing any threat to validity of the total scale. Therefore, this item was removed from the scale. In the second attempt, the fourth item was removed from the scale and a new confirmatory factor analysis was conducted. After deletion of item four, results provided a good model fit (χ^2 (8, N = 134) = 12.30, RMSEA = .06, CFI = .99, SRMR = .04 and NFI = .98). Lambda X estimates for the TPPS is presented in the Table 3.13 below. The reliability coefficients for the job satisfaction was .80.

Table 3.12 Lambda X Estimates for TPPS

Subscale	Indicator	Main Study LX Estimates
	PPS_1	.74
Job Satisfaction	PPS_2	.69
	PPS_3	.89

Table 3.13 Descriptions, sample items, and reliability coefficients of TJSS scale

Subscales	Description	Sample Item	Number of Items (Main Study)	Cronbach's Alpha - *Skaalvik and Skaalvik, (2011)*	Cronbach's Alpha - *Pilot Study*	Cronbach's Alpha – *Main Study*
Job Satisfaction	Teachers' pleasantness from the job they professed	"I enjoy working as a teacher"	3	.91	.84	.80

3.3.1.5 Perceived School Context Scale (PSCS)

In this study, teachers' perceived school context was measured by Perceived School Context Scale (PSCS). This instrument was developed by Skaalvik and Skaalvik (2010; 2011) as a six point Likert type scale ranging from "6 = True" to "1 = False". Skaalvik and Skaalvik (2010) developed Perceived School Context Scale as a five dimensional scale containing (1) discipline problems and inappropriate student behavior (discipline, n= 3 items), (2) teachers' feeling of pressure of time due to a busy schedule (time pressure, n = 3 items), (3) parents' trust and decent relationship with the teachers (parents, n = 3 items), (4) teachers' feeling of freedom in deciding teaching content and decisions about the subject matter to be taught (autonomy, n = 3 items), and (5) support to the teacher provided by the school administration in terms of emotional and cognitive help in educational matters (supervisory support, n = 3 items). Each dimension was measured by three items (see Appendix C).

Skaalvik and Skaalvik (2010) tested the validity of the PSCS through a confirmatory factor analysis. The participants for their validation study were 2249 in-service Norwegian teachers working in elementary and middle schools. They found acceptable fit statistics (χ^2 (80, N = 2249) = 520.17, CFI = .96, IFI = .96, TLI = .94, and RMSEA = .05) for the five factor structure. Reliability coefficients for discipline, time pressure, parents, autonomy, and supervisory support were .80, .71, .81, .73, and .83, respectively.

Later, based on the previous research suggesting that a positive social organization context and social support from the school administration and colleagues had a positive influence on teacher motivation and teachers' satisfaction from their work (Day, et al., 2007; Scheopner, 2010; US Department of Education, 1997), Skaalvik and Skaalvik (2011) developed relations with colleagues questionnaire (3 items) to assess the contribution of communication and mutual support between teachers in the school social context. Relation with colleagues refers to the quality of the relationship between teachers working in the same school. Since the present study included variables such as teachers' collective efficacy and perceptions about their professions, considering available literature, items of relations with colleagues questionnaire was also included in the Perceived School Context Scale in order to examine how relations with colleagues are related to such teacher variables (see Appendix C).

Skaalvik and Skaalvik (2011) tested the validity of relations with colleagues questionnaire via confirmatory factor analysis. The participants were 2569 Norwegian elementary and middle school teachers. The results of the confirmatory factor analysis suggested a good model fit (χ^2 (155, N = 2569) = 1344.010, CFI = .96, IFI = .96, TLI = .94, and RMSEA = .06) to the data. The reliability coefficient for the relations to colleagues subscale was .86.

The 18 item PSCS supposed to include 6 sub-scales (discipline, time pressure, parents, autonomy, supervisory support, and relations with colleagues) was translated into Turkish by the researcher. The same procedure in the translation and adaptation procedure of 3.3.1.2 was followed here as well. A confirmatory factor analysis and reliability analyses were conducted on the pilot study data to provide validity and reliability evidences for the six factor structure. The fit indices of the confirmatory factor analyses were partly acceptable (χ^2 (120, N = 102) = 169.24, RMSEA = .07, CFI = .93, SRMR = .08, and NFI = .81). The reliability coefficients for the pilot study are presented in the Table 3.14.

Table 3.14 Descriptions, sample items, and reliability coefficients of PSCS subscales

Subscales	Description	Sample Item	Number of Items (Main Study)	Cronbach's Alpha-*Skaalvik and Skaalvik, (2010;2011)*	Cronbach's Alpha-*Pilot Study*	Cronbach's Alpha-*Main Study*
Discipline Problems	Problems of uncontrolled behavior in the classroom	"Some students with behavior problems make it difficult to carry out lessons as planned"	3	.80	.83	.81
Time Pressure	Feelings of pressed by the busy school schedule and suffering of fatigue	"Life at school is hectic and there is no time for rest and recovery"	3	.71	.60	.50
Relations with Parents	Communication with parents in terms of trust and cooperation	"The parents trust and accept my decisions"	3	.81	.79	.83
Autonomy	Feeling of freedom in the area restricted by the curriculum	"In the subjects that I teach I feel free to decide what content to focus on"	3	.73	.46	.48
Supervisory Support	Support from the school administration both cognitively and emotionally	"The school leadership is supportive and praise good work"	3	.83	.62	.72
Relations with Colleagues	Relations with colleagues in terms of social and professional support	"In educational matters, I can always get good help from my colleagues"	3	.86	.84	.79

In the main study, PSCS was tested through factor and reliability analyses. A confirmatory factor analysis was conducted to see the factor structure of the instrument. A reliability analysis was conducted to indicate the internal reliability coefficients for the subscales of PSCS. Confirmatory factor analysis results suggested and acceptable model fit (χ^2 (120, N = 134) = 157.04, RMSEA = .05, CFI = .96, SRMR = .08, and NFI = .90) to the data. Lambda X estimates of each subscale is presented in the Table 3.15 below.

Table 3.15 Lambda X Estimates for PSCS

Subscale	Indicator	Main Study LX Estimates
Discipline Problems	PSCS_10	.81
	PSCS_11	.84
	PSCS_12	.73
Time Pressure	PSCS_1	.29
	PSCS_2	.91
	PSCS_3	.33
Relations with Parents	PSCS_7	.79
	PSCS_8	.73
	PSCS_9	.91
Autonomy	PSCS_4	.65
	PSCS_5	.76
	PSCS_6	.31
Supervisory Support	PSCS_13	.41
	PSCS_14	.77
	PSCS_15	.92
Relations with Colleagues	PSCS_16	.47
	PSCS_17	.88
	PSCS_18	.99

Detailed inspection of Table 3.15 showed that time pressure and autonomy dimensions of PSCS had low Cronbach's alpha reliability coefficients in both pilot (.60; .46) and main (.50; .48) studies, respectively. The alpha coefficients of both sub dimensions are lower than the acceptable (α = .70) reliability value.

Therefore, these two sub scales were discarded from the further HLM and path analysis.

3.3.1.6 School Goal Structure Scale (SGSS)

Science teachers' perceptions of the school goal structure was measured by the teachers' scales part of the Patterns of Adaptive Learning Survey (PALS) (Midgley et al., 2000) (see Appendix C). As stated in the explanations part of the Teachers' Approach to Instruction Scale above, PALS is a battery of scales including measures for both teachers and students. Teachers' perceptions of the School Goal Structure Scale is one of the sub scales of PALS teachers' scales. Similar to teachers' Approach to Instruction Scale, teachers' perception of School Goal Structure Scale was developed on a five point Likert type ranging from 1 = "Strongly disagree" to 3 = "Somewhat agree" to 5 = "Strongly agree".

In this study, teachers' perceptions of the School Goal Structure Scale was measured by using the scale of teachers' sub-dimension of the PALS. Teachers' perception of the school goal structures refer to teachers' perception of the goals that are communicated to students by the school culture. These goals are twofold: one of them is mastery school goal structure and the other one is performance school goal structure. Mastery school goal structure is defined as the teachers' perception that school communicates to students that learning is valuable and competence development should be the primary purpose of schoolwork. Mastery school goal structure scale included 7 items. On the other hand, performance school goal structure refers to the teachers' perception that school communicates to students that surpassing the others to be better and demonstrating your competence to others are the purposes of being involved in schoolwork. Performance school goal structure scale included 6 items. In the PALS scales battery pack, the reliability coefficients of the mastery and performance school goal structures were .81 and .70, respectively.

The teachers' perception of the School Goal Structures Scale was translated and adapted into Turkish by the researcher. The same procedure in the translation and adaptation process of 3.3.1.2 was followed for this scale as well. All items of the scale were kept in the preliminary reviews of the instrument before translation. All of the items were considered as appropriate to be administered to the Turkish science teachers.

A pilot study was conducted after the translation and adaptation process. A total of 102 in-service science teachers participated in the pilot study. Confirmatory factor analysis and reliability analyses were conducted on the pilot data. Confirmatory factor analysis results suggested a barely acceptable model fit (χ^2 (64, N = 102) = 112.65, RMSEA = .09, CFI = .83, SRMR = .09, and NFI = .69) to the data. The third item "It's easy to tell which students get the highest grades and which students get the lowest grades" (belongs to teachers' perception of school performance goals subscale) (see Appendix C) had low factor loadings and deletion of this item made a substantial contribution to total scale reliability. Therefore, it was marked as susceptible for deletion in the main study. The reliability coefficients were .70 and .57 for mastery and performance school goal structure, respectively.

For the main study, item 3 was reviewed again for wording and content. However, the item needed no modifications and the item was utilized as it was. Thus, this item was included in the main study and teachers' perception of School Goal Structures Scale was tested through a confirmatory factor analysis and reliability analyses. Results of confirmatory factor analysis did not suggest an acceptable model fit (χ^2 (64, N = 134) = 176.85, RMSEA = .11, CFI = .91, SRMR = .08, and NFI = .87). The item 3, which was problematic in the pilot study, maintained the same problem in the main study. This item was reviewed again and decided that its deletion was not posing any threat to validity of the total scale. Therefore, this item was removed from the scale.

Table 3.16 Descriptions, sample items, and reliability coefficients of SGSS subscales

Subscales	Description	Sample Item	Number of Items (Main study)	Cronbach's Alpha - *Midgley et al., 2000*	Cronbach's Alpha - *Pilot Study*	Cronbach's Alpha – *Main Study*
School Mastery Goal Structure	Teachers' perception of school goals that emphasize learning for the sake of learning and competence development	"In this school the importance of trying hard is really stressed to students"	7	.81	.70	.84
School Performance Goal Structure	Teachers' perception of school goals that emphasize demonstrating competence and surpassing others	"In this school, students hear a lot about the importance of getting high test scores"	5	.70	.57	.74

A second confirmatory factor analysis was conducted without the problematic third item. The results suggested an acceptable model fit (χ^2 (53, N = 134) = 126.14, RMSEA = .10, CFI = .93, SRMR = .07, and NFI = .90) to the data. The fit indices of the main study of teachers' perception of School Goal Structure Scale is reasonable. Table 3.17 indicates Lambda X estimates for SGSS.

Table 3.17 Lambda X Estimates for SGSS

Subscale	Indicator	Main Study LX Estimates
School Mastery Goals	SGSS_1	.51
	SGSS_2	.59
	SGSS_6	.54
	SGSS_8	.78
	SGSS_9	.79
	SGSS_10	.65
	SGSS_12	.80
School Performance Goals	SGSS_4	.55
	SGSS_5	.55
	SGSS_7	.51
	SGSS_11	.69
	SGSS_13	.75

The reliability coefficients for these two subscales are .84 for school mastery goals and .74 for school performance goals. The reliability coefficients for the main study are in the acceptable ranges.

3.3.2 Student Level Data Collection Instruments

Student level data collection instruments include a demographics questionnaire, three self-report questionnaires, and a science achievement test. Self-report questionnaires includes (1) the self-efficacy sub-scale of Motivated Strategies for Learning Questionnaire (MSLQ), (2) Achievement Goal Questionnaire (AGQ), and (3) Students' Engagement Questionnaire (SEQ). Students' science achievement was measured by the (4) Science Achievement Test (SAT) (see Table 3.18). The following sections presents detailed information about the student level questionnaires.

Table 3.18 Data collection instruments for student variables

Instruments	Variables
Demographics Questionnaire	Gender Age Siblings Socioeconomic Status
Student Engagement Questionnaire (SEQ) *Developed by Reeve & Tseng (2011)* *Translated to Turkish by Hıdıroğlu (2014)*	Agentic Engagement Behavioral Engagement Cognitive Engagement Emotional Engagement
Achievement Goal Questionnaire (AGQ) *Developed by Elliot & McGregor (2001)* *Translated to Turkish by Şenler & Sungur (2007)*	Mastery Approach Performance Approach Mastery Avoidance Performance Avoidance
Motivated Strategies for Learning Questionnaire (*MSLQ) Developed by Pintrich, Simith, Garcia, & McKeachie (1991)* *Translated to Turkish by Sungur (2004)*	Self-Efficacy
Science Achievement Test (SAT) *Developed by Yerdelen (2013)*	14 multiple choice science questions

3.3.2.1 Student Engagement Questionnaire (SEQ)

Student engagement questionnaire (SEQ) was used to assess 7th grade students agentic, behavioral, cognitive, and emotional engagement in science class (see Appendix A). The SEQ was developed by Reeve and Tseng (2011) as seven point Likert type scale ranging from "1 = strongly disagree" to "7 = strongly agree" with the anchor "4 = agree and disagree equally". The SEQ includes 22-

items in four subscales. Three of the scales (behavioral, cognitive, and emotional) were obtained from the studies of other researchers and agentic engagement scale (5 items) was generated by Reeve and Tseng (2011). Behavioral engagement scale (5 items) was obtained from Miserandino's (1996) task involvement questionnaire, cognitive engagement (8 items) scale was obtained from Wolter's (2004) learning strategies questionnaire and revised, and emotional engagement scale (4 items) was obtained from Wellborn's (1991) conceptualization of emotional engagement. Newly compiled student engagement scale was pilot tested for its factor structure and internal consistency of items. The subscales of SEQ showed fairly high reliability coefficients; .94 for behavioral engagement, .88 for cognitive engagement, .78 for emotional engagement, and .82 for agentic engagement. See below table for the description of scales, sample items and reliability coefficients of original, pilot and main studies.

The instrument was adapted and translated into Turkish by Hıdıroğlu (2014). All of the items in the original version was kept, none of the items were discarded. Since Hıdıroğlu (2014) conducted her study in middle school science domain, she added the word "science" in items where necessary. For example, a behavioral engagement item "I listen carefully in class" was modified as "I listen carefully in science class". After basic revisions and translation process, the translated version of the scale was administered to 759 7th grade students to provide evidences for validity. A confirmatory factor analysis and reliability analyses were conducted. The fit indices suggested a good model fit (GFI = .93, CFI = .99, RMSEA = .05, SRMR = .04) to the obtained data. Reliability coefficients for the scales were .82 for agentic engagement, .88 for behavioral engagement, .83 for emotional engagement, and .86 for cognitive engagement.

Table 3.19 Subscale descriptions, sample items and reliability coefficients of subscales of SEQ

Subscales	Description	Sample item	n of items	Cronbach alphas (Reeve & Tseng, 2011)	Cronbach alphas (Hıdıroğlu, 2014)	Cronbach alphas (present study)
Agentic Engagement	Students' constructive contribution into the flow of the instruction they receive.	"During science class, I express my preferences and opinions".	5	.82	.82	.78
Behavioral Engagement	Participation in academic, social or out of curriculum activities, and achieving positive academic outcomes.	"I work hard when we start something new in science class".	5	.94	.88	.83
Cognitive Engagement	Consideration and willingness to use the necessary effort for understanding learning, complex ideas and complicated skills.	"When doing schoolwork, I try to relate what I'm learning to what I already know".	8	.88	.86	.82
Emotional Engagement	Students' both positive and negative reactions to their teachers, classmates, tasks, and school.	"When we work on something in science class, I feel interested".	4	.78	.83	.76

In the present study, a confirmatory factor analysis and reliability analyses were conducted to be able to see the factor structure and the internal consistency coefficients (reliability) of each subscale of SEQ. Consistent with Hıdıroğlu (2014), the present study data indicated a good model fit to (χ^2 (203, N = 3294) = 1536.74, RMSEA = .05, SRMR = .04, NFI = .99, and CFI = .99). The reliability coefficients were also in acceptable ranges for the subscales of Student Engagement Questionnaire (see Table 3.19). Below Table 3.20 indicates the Lambda X estimates for SEQ subscales.

Table 3.20 Lambda X estimates for SEQ subscales

Subscale	Indicator	Main Study LX Estimates
Agentic Engagement	SEQ_1	.63
	SEQ_2	.61
	SEQ_3	.69
	SEQ_4	.68
	SEQ_5	.63
Behavioral Engagement	SEQ_6	.71
	SEQ_7	.68
	SEQ_8	.69
	SEQ_9	.69
	SEQ_10	.73
Emotional Engagement	SEQ_11	.68
	SEQ_12	.64
	SEQ_13	.72
	SEQ_14	.62
Cognitive Engagement	SEQ_15	.64
	SEQ_16	.65
	SEQ_17	.65
	SEQ_18	.67
	SEQ_19	.62
	SEQ_20	.59
	SEQ_21	.61
	SEQ_22	.48

3.3.2.2 Achievement Goal Questionnaire (AGQ)

Achievement Goal Questionnaire (AGQ) was used in this study to assess seventh grade students' goal orientations in science classes (see Appendix A). The AGQ was developed by Elliot and McGregor (2001) to examine students' achievement Goals. It is designed as a five point Likert type scale ranging from "1 = strongly disagree" to "5 = strongly agree". The AGQ includes 15 items in 4 subscales that are mastery approach goals (3 items), mastery avoidance goals (3 items), performance approach goals (3 items) and performance avoidance goals (6) items. The AGQ has two main subscales which are mastery goals and performance goals. Mastery goals refer to the desire to learn the material for the sake of learning, or for the value of learning. Performance goals refer to engaging in learning to demonstrate the ability to others or to prove someone that one is able. These two main sub-scales are then divided into their approach and avoidance components. Mastery approach goals represent learning and mastering something because it is worth learning (e.g. "It is important for me to understand the content of this course as thoroughly as possible"). Performance approach goals refer to showing abilities and skills to others (e.g. "It is important for me to do better than other students"). Mastery avoidance goals focus on the idea that learner avoids misunderstanding and not mastering the task (e.g. "I worry that I may not learn all that I possibly could in this class"). Performance avoidance goals refer to trying not to fail in the eyes of others (e.g "My goal for science class is to avoid performing poorly).

The AGQ was validated by Elliot and Gregor (2001) with a sample of 180 undergraduate students. The internal reliability coefficients were also examined. They found $\alpha = .87$ for mastery approach, $\alpha = .92$ for performance approach, $\alpha = .89$ for mastery avoidance, and 83 for performance avoidance goals. In order to provide evidences of validity, a confirmatory factor analysis was conducted on the data. The fit indices suggested an acceptable fit (RMSEA = .06, GFI = .92, CFI = .90, SRMR = .07) for the four factor structure of AGQ.

The instrument was adapted and translated into Turkish by Senler and Sungur (2007). The newly translated version of the instrument was validated through a pilot analysis. A sample of 616 students participated in the study. They conducted exploratory and confirmatory factor analyses and reliability analyses for each subscale. They found evidence from both exploratory and confirmatory factor analyses that four factor structure was supported (RMSEA = .06, GFI = .92, CFI = .90, SRMR = .07). Cronbach' alpha reliability coefficients were found .81 for mastery approach goals, .69 for performance approach goals, .65 for mastery avoidance goals, and .64 for performance avoidance goals.

The AGQ was factor analyzed for this study as well. A confirmatory factor analysis was conducted to validate the factor structure for the sample of the present study. The fit indices indicated a good model fit (χ^2 (84, N = 3294) = 1532.40, RMSEA = .07, SRMR = .06, NFI = .96, and CFI = .96). Also, reliability coefficients were calculated for each subscale. Below table indicated the description, sample items, and reliability coefficients of the original, pilot and main studies. All alpha reliability coefficients of subscales of AGQ were found in acceptable ranges. Below Table 3.22 indicated the Lambda X estimates for AGQ subscales.

Table 3.21 Descriptions, sample items, and reliability coefficients of AGQ subscales

Subscales	Description	Sample item	n of items	Cronbach alphas (Elliot & McGregor, 2001)	Cronbach alphas (Senler & Sungur, 2007)	Cronbach alphas (present study)
Mastery Approach	Valuing learning, mastering the task	“It is important for me to understand the content of this course as thoroughly as possible”	3	.87	.81	.74
Performance Approach	Demonstrating ability to surpass others	“It is important for me to do well compared to others in this class”.	3	.92	.69	.77
Mastery Avoidance	Avoiding failure for the sake of perfection	“I am often concerned that I may not learn all that there is to learn in science class”.	3	.99	.65	.77
Performance Avoidance	Avoiding failure not to seem dumb	“I just want to avoid doing poorly in this class”.	6	.83	.64	.77

Table 3.22 Lambda X estimates for AGQ subscales

Subscale	Indicator	Main Study LX Estimates
Mastery Approach Goals	AGQ_1	.66
	AGQ_4	.67
	AGQ_6	.73
Performance Approach Goals	AGQ_3	.68
	AGQ_7	.73
	AGQ_11	.74
Mastery Avoidance Goals	AGQ_8	.67
	AGQ_10	.74
	AGQ_12	.75
Performance Avoidance Goals	AGQ_2	.53
	AGQ_5	.59
	AGQ_9	.62
	AGQ_13	.55
	AGQ_14	.65
	AGQ_15	.57

3.3.2.3 Motivated Strategies for Learning Questionnaire (MSLQ)

Science self-efficacy of 7th grade students was measured by the self-efficacy for learning and performance sub-scale of Motivated Strategies for Learning Questionnaire (MSLQ) (see Appendix A). MSLQ is a self-report instrument on a seven-point Likert scale, (1 = not at all true of me to 7 = very true of me), and it is developed by Pintrich, Smith, Garcia, and McKeachie (1991). The MSLQ has two main parts: motivation and learning strategies. Motivation part includes 31 items in 6 sub-scales. Learning strategies part has 50 items in 9 sub-scales concerning students' use of various cognitive and metacognitive strategies. Within the scope of the present study, only one of the sub-scales namely, self-efficacy for learning and performance (8 items), was used to collect data concerning students' science self-efficacy.

The validation studies of the original instrument was conducted by Pintrich, Smith, Garcia, and McKeachie (1993) with 380 college students. The alpha reliability coefficients were calculated for each sub-scale of the whole instrument. They obtained fairly high alpha coefficients for motivation section (e.g. it was .93 for self-efficacy for learning and performance sub-scale). For learning strategies section, the alpha coefficients were not as high as motivation section but they also had reasonable alpha coefficients (.57 to .81). A confirmatory factor analysis was conducted to validate the proposed factor structure of MSLQ. The fit indices for the six factor model indicated an acceptable fit (χ^2/df = 3.49, GFI .77, AGFI .73 and RMR of .07.) to the data for motivation section. The fit indices were also in acceptable ranges (χ^2/df = 2.26, GFI = .78, AGFI = .75 and RMR = .08) for the learning strategies section of the MSLQ.

The MSLQ was adapted and translated into Turkish by Sungur (2004). A confirmatory factor analysis was conducted to validate the factor structure in Turkish version. The confirmatory factor analysis yielded similar results with the original instrument (see Sungur, 2004). Below table indicates description, sample item and reliability coefficients of original and main studies.

Table 3.23 Description, sample item and reliability coefficients of Self-Efficacy Scale

Description	Sample item	Cronbach alpha (Original Version)	Cronbach alpha Sungur (2004)	Cronbach alpha (present study)
Belief in capabilities to reach a pre-designed goal	I believe I will receive an excellent grade in science class	.93	.89	.88

For the main study, a confirmatory factor analysis was conducted for the self-efficacy sub-scale of MSLQ. The confirmatory factor analysis suggested an acceptable fit to the data (χ^2 (20, N = 3294) = 341.00, RMSEA = .07, SRMR = .03, NFI = .98, and CFI = .98). The alpha reliability coefficient of the scale is quite high (α = .88). Below Table 3.24 indicated the Lambda-X estimates for self-efficacy scale.

Table 3.24 Lambda X estimates for Self-Efficacy Scale

Scale	Indicator	Main Study LX Estimates
Self-Efficacy	SSEQ_1	.69
	SSEQ_2	.65
	SSEQ_3	.68
	SSEQ_4	.63
	SSEQ_5	.68
	SSEQ_6	.75
	SSEQ_7	.72
	SSEQ_8	.73

3.3.2.4 The Science Achievement Test (SAT)

The student participants of this study, who were 7th grade students in the middle schools of Yenimahalle and Sincan districts of Ankara, Turkey, were administered a science achievement test developed by Yerdelen (2013) (see Appendix A). The Science Achievement Test was developed based on previously administered end of middle school nationwide examinations (e. g. Secondary Education Entrance Examination and Government Complimentary Boarder and Scholar Examination to transition to high schools) which were under control of the Turkish Ministry of National Education (MONE, 2011). These nationwide exams cover all the units taught throughput the middle school years. Therefore, Yerdelen (2013) firstly checked out the curriculum to identify the 7th grade science units and related objectives. After that, class hours per unit and number of instructional objectives were calculated to find out the average number of items per unit. At the end of this process, a total of 14 objectives were specified and test items were selected based on the criterion of 2 items per objective. A total of 27 items were compiled to be administered in the pilot analysis. The last version of the science achievement test was administered to 183 seventh grade students from a middle school in Ankara. The obtained data were analyzed by ITEMAN software. Based on the suggested criteria (Ebel, 1965), ITEMAN analysis results were interpreted and 13 items were decided to be removed from the science achievement test. Finally, a total of 14 items remained. A great majority of these 14 items were found to be at moderate difficulty level. Yerdelen (2013) reported the reliability coefficient of the science achievement test as .78, which indicated a sufficiently high internal consistency. The distribution of the items across the units were as follows: 7 items for body systems, 4 items for force and motion, and 3 items for electricity units. All of the items were developed in the multiple choice format. Student responses were coded dichotomously (0: wrong response, 1: correct response) and total science achievement scores were calculated for each participating student.

In the current study, exactly the same calculation procedure was followed as Yerdelen (2013). Additionally, null responses were considered as wrong and coded as “0” points. Each correct response was coded as “1” and a total science achievement test score was calculated for each student. The reliability coefficient was also calculated for the present study and it was found .83, which indicated a sufficiently high level of reliability.

3.4 Procedure

3.4.1 Data Collection Procedure

In this study, the primary issue was determining the gaps in the teacher and student motivation literature. A wide-range literature review was conducted to determine a theoretical framework and related research questions for the study. Literature review was conducted through examining Educational Resources Information Center (ERIC), Social Science Citation Index (SSCI), Ebscohost, Science Direct, and International Dissertations Abstracts databases. Additionally, books published in motivation in education and educational psychology domains were obtained from the libraries of METU and University of Kentucky. At the end of this wide range research, research questions were generated.

After the literature review, forming of research questions and determining the sample of the study, the procedure continued with the translation and adaptation process of the instruments. During the literature review, usable instruments were obtained from corresponding authors and public sources. Then, the instruments were revised and refined for the pilot study. After obtaining required permissions from the Ministry of Education and METU Ethics Committee, the instruments were pilot tested. The pilot studies of instruments with 7th grade students took place in the 2013-2014 fall semester. After analysis of reliabilities and factor structures, the scales were revised and prepared for the main study. The final form of the scales were administered to the sample in Ankara in 2013-2014 spring semester. All data collection process was managed by the researcher himself. It took forty minutes for students and half an hour for teachers to fill out the questionnaires. All the explanations and directions were provided by the researcher. Teacher support was asked in order to keep the students concentrated on questionnaires. All participants of the study were told that their responses will be kept confidential and they were told to fill out the questionnaires sincerely. It was also stated that this was a voluntarily participating study. Any participant unwilling to participate was not forced to fill out the questionnaires.

3.4.2. Data Analysis Procedure

In this study, preliminary analysis, descriptive statistical analysis and inferential statistical analyses were used. Data cleaning, outlier and normality assumption checking were made as preliminary analysis. Descriptive statistics were run in order to portray the basic characteristics of teacher and student data in terms of means, standard deviations, skewness, kurtosis, etc. Path analysis and Hierarchical Linear Modeling (HLM) technique was used for the inferential statistics. Path analysis was used to portray the causal relationships among science teachers' personal and school related characteristics. Since the data collected is nested in nature (students nested in the schools), researchers should investigate both student and school characteristics (Bryk & Raudenbush, 1992). In this study, a two level hierarchical linear model was developed. The first level was the student level and the second level was the class (teacher) level.

3.4.2.1 Hierarchical Linear Modeling

Hierarchical Linear modeling analyses are a set of techniques that combines multiple linear regression and analysis of variance. This technique enables researchers to model the complex relationships between nested data structures. For example, students nested within classrooms, classrooms nested within schools constitute a three level data structure because in humanities, unlike natural and applied sciences, one of the basic assumptions of independence of observations assumption cannot be thoroughly applied. It is empirically impossible to assume that students in the same classroom or teachers in the same school are independent from each other.

In this study, teacher and student data constitute a two level data structure (students are nested in classes taught by a science teacher). Data were gathered from teachers and their students. Each teacher represents a class of students that he or she teaches. Therefore, a link between a teacher and classroom is established to demonstrate how student level variables vary across classrooms, how teacher and student variables are interrelated, how all together these variables influence students' science achievement. Due to these reasons, HLM analysis was selected for this study as the analysis technique. Hierarchical Linear Modeling generates a different regression model for each and every student group. The structural relations and residual variability enables researchers to observe the interrelatedness between the two data levels. Thus, it becomes possible to examine the relationships among level one variables and how level two variables moderate these relationships.

3.4.2.1.1 Variables and their descriptions

Variables of the present study were grouped as level one and level two variables. Level one variables refer to the variables that belonged to the sampled students. Leve two variable refer to the variables that belonged to the sampled teachers. In this study, a two stage data analysis procedure was conducted. In the first stage, teacher level variables (Level two) were used to conduct a path analysis. No student level variables were included in this path analysis.

In the second stage of the analysis, a two level hierarchical linear modeling was conducted. In a two-level HLM analysis, only level-one variables can become outcome variables, level two variables are the predictors. Level one variable can also be predictor variables. In this study, there are 8 teacher level (level two) variables and 10 student level (level one) variables. In HLM analyses, teacher level variables can only be used as predictors. However, level one variables can be both predictors and outcomes. Below table indicates the variables used in this study in HLM analyses. The abbreviations of the variables were used only in hierarchical linear modeling (HLM) analysis.

Table 3.25 The abbreviations and descriptions of the variables

Name	Description	Type
Student Level Variables (Level 1)		
ZSAT	Science Achievement Indicates students' science achievement scores out of 14 items. Coded dichotomously (1 for correct responses, 0 for wrong responses). The range is 0 to 14. (see Appendix B for science achievement test)	Outcome
ZT_SELF	Student Science Self-Efficacy An 8 item sub-dimension of the Motivated Strategies for Learning Questionnaire. It was constructed by computing average scores of items 1 to 8 (SSEQ_1, SSEQ_2, SSEQ_3, SSEQ_4, SSEQ_5, SSEQ_6, SSEQ_7, and SSEQ_8). It is anchored 1 to 7 (see Appendix A for student science self-efficacy questionnaire).	Outcome, Predictor
ZT_ENGCG	Student Science Engagement - Cognitive The sub dimension of Student Engagement Scale. Consisted of calculating 8 items namely SEQ_15, SEQ_16, SEQ_17, SEQ_18, SEQ_19, SEQ_20, SEQ_21, and SEQ_22. Mean range of it lies between 1 and 5. (see Appendix A for student cognitive engagement sub dimension)	Outcome, Predictor
ZT_ENGEM	Student Science Engagement - Emotional The sub dimension of Student Engagement Scale. Consisted of calculating 4 items namely SEQ_11, SEQ_12, SEQ_13, and SEQ_14. Mean range of it lies between 1 and 5. (see Appendix A for student emotional engagement sub dimension)	Outcome, Predictor

Table 3.25 The abbreviations and descriptions of the variables (Continued)

ZT_ENGAG	Student Science Engagement - Agentic The sub dimension of Student Engagement Scale. Consisted of calculating 5 items namely SEQ_1, SEQ_2, SEQ_3, SEQ_4, and SEQ_5. Mean range of it lies between 1 and 5. (see Appendix A for student agentic engagement sub dimension)	Outcome, Predictor
ZT_ENGBH	Student Science Engagement - Behavioral The sub dimension of Student Engagement Scale. Consisted of calculating 5 items namely SEQ_6, SEQ_7, SEQ_8, SEQ_9, and SEQ_10. Mean range of it lies between 1 and 5. (see Appendix A for student behavioral engagement sub dimension)	Outcome, Predictor
ZT_MASTAP	Student Science Achievement Goals – Mastery Approach The sub dimension of Achievement Goal Questionnaire. Consisted of calculating 3 items namely AGQ_1, AGQ_4, and AGQ_6. Mean range of it lies between 1 and 5. (see Appendix A for mastery approach sub dimension)	Outcome, Predictor
ZT_MASTAVO	Student Science Achievement Goals – Mastery Avoidance The sub dimension of Achievement Goal Questionnaire. Consisted of calculating 3 items namely AGQ_8, AGQ_10, and AGQ_12. Mean range of it lies between 1 and 5. (see Appendix A for mastery avoidance sub dimension)	Outcome, Predictor
ZT_PERFAP	Student Science Achievement Goals – Performance Approach The sub dimension of Achievement Goal Questionnaire. Consisted of calculating 3 items namely AGQ_3, AGQ_7, and AGQ_11. Mean range of it lies between 1 and 5. (see Appendix A for performance approach sub dimension)	Outcome, Predictor

Table 3.25 The abbreviations and descriptions of the variables (Continued)

ZT_PERFAVO	Student Science Achievement Goals – Performance Avoidance The sub dimension of Achievement Goal Questionnaire. Consisted of calculating 3 items namely AGQ_2, AGQ_5, AGQ_9, AGQ_13, AGQ_14, and AGQ_15. Mean range of it lies between 1 and 5. (see Appendix A for performance avoidance sub dimension)	Outcome, Predictor
Teacher Level Variables (Level-2)		
ZT_AtISM	Approach to Instruction - Mastery Approach The Sub dimension of Approach to Instruction Scale. Consisted of calculating the 4 items ATIS_2, ATIS_4, ATIS_5, and ATIS_9. Mean average lies between 1 and 5. (see Appendix C for mastery instructional approach sub dimension)	Predictor
ZT_AtISP	Approach to Instruction - Performance Approach The Sub dimension of Approach to Instruction Scale. Consisted of calculating the 5 items Q1, ATIS_3, ATIS_6, ATIS_7 and ATIS_8. Mean average lies between 1 and 5. (see Appendix C for performance instructional approach sub dimension)	Predictor
ZT_TSECM	Self-Efficacy – Classroom Management The sub dimension of Teachers' Sense of Efficacy Scale. It consisted of computing average score of 4 items TSES_1, TSES_6, TSES_7 and TSES_8. Mean average lies between 1 and 9. (see Appendix C for classroom management sub dimension)	Predictor
ZT_TSESE	Self-Efficacy – Student Engagement The sub dimension of Teachers' Sense of Efficacy Scale. It consisted of computing average score of 4 items TSES_2, TSES_3, TSES_4, and TSES_11. Mean average lies between 1 and 9. (see Appendix C for student engagement sub dimension)	Predictor

Table 3.25 The abbreviations and descriptions of the variables (Continued)

ZT_TSEIS	Self-Efficacy – Instructional Strategies The sub dimension of Teachers' Sense of Efficacy Scale. It consisted of computing average score of 4 items TSES_5, TSES_9, TSES_10, and TSES_12. Mean average lies between 1 and 9. (see Appendix C for instructional strategies sub dimension)	Predictor
ZT_GRCOMP	Collective Efficacy – Group Competence The sub dimension of Teacher Collective Efficacy Scale. Consisting of the average score of 12 items TCES_1, TCES_2, TCES_3, TCES_4, TCES_5, TCES_6, TCES_7, TCES_8, TCES_9, TCES_11, TCES_12, and TCES_17. Mean average lies between 1 and 6. (see Appendix C for group competence sub dimension).	Predictor
ZT_TASKAN	Collective Efficacy – Task Analysis The sub dimension of Teacher Collective Efficacy Scale. Consisting of the average score of 5 items TCES_10, TCES_13, TCES_14, TCES_15, and TCES_16. Mean average lies between 1 and 6. (see Appendix C for task analysis sub dimension).	Predictor
ZT_JOBSAT	Professional Perceptions - Teacher Job Satisfaction. The sub dimension of Teachers' Professional Perceptions Scale. Consisting of computing the average scores of 4 items PPS_1, PPS_2, PPS_3, and PPS_4. Mean average lies between 1 and 6. (see Appendix C for teacher job satisfaction sub dimension).	Predictor

Note. All of the variables were standardized to mean = 0 and SD = 1 before conducting HLM analysis.

3.4.2.2 Path Analysis

Path analysis is a special form of Structural Equation Modeling (SEM). Structural Equation Modeling is a set of statistical analysis techniques to assess the relationships between one or more independent variable/s with one or more dependent variable/s (Tabachnick & Fidell, 2007). It is a better technique when examining multiple dependent variables and their effects on each other. On the analysis process, SEM has five steps which are model specification, model identification, model estimation, model testing, and model modification (Boomsma as cited in Schumacker & Lomax, 2004). The first step in SEM is model specification. In this step the researcher specifies the hypothesis either by drawing a model diagram or describing series of equations (Kline, 2011). The researcher must be careful about the review of the theory because a true reflection of theory should be depicted in the hypothesis (Kline, 2011; Olobatuyi, 2006). The second step is model identification. In this step, model parameter estimation is conducted by using the sample data and if the model is identified, population covariance matrix is computed with these parameters (Tabachnick & Fidell 2007). In the third step, model estimation is made. SEM uses maximum likelihood as a default model estimation method. There are different model estimation methods exist in statistical software, as well (e.g. unweighted or ordinary least squares, generalized least squares). The fourth step is model testing. Model testing is, as the name implies, test of the fit between data and the theoretically proposed model (Jöreskog & Sörbom, 1993; Schumacker & Lomax, 2004). The fit indices generated by the statistical software are used to provide evidence for model fit. Root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), normed fit index (NFI), comparative fit index (CFI) and goodness of fit index (GFI) are widely used fit indices (Kline, 2011). The GFI received serious criticisms (see Sharma, Mukherjee, Kumar, & Dillon, 2005) though it is a widely used fit index in SEM analysis. Thus, GFI was not used as a fit index in this study. Instead, NFI was reported. The last step is model modification. In this step, recommendations produced by the statistical software are taken into consideration to remedy the faults in the model-data fit. However, caution is advised before any modifications since theoretical support is needed in such actions (Raykov& Marcoulides, 2006).

SEM has basic assumptions similar to multiple regression analysis. These assumptions are adequate sample size, nonexistence of missing data, normality, linearity, outliers, absence of multicollinearity and singularity, and examination of residuals (Schumacker & Lomax, 2004; Tabachnick & Fidell, 2007). These assumptions should be checked before forming the SEM models. Below table indicates the widely-used fit indices and their interpretations.

Table 3.26 The widely used fit indices in SEM

Model fit index	Acceptable Range	Interpretation
Root mean square error of approximation (RMSEA)	0 (perfect fit) to 0.1 (fair fit)	Value below .10 indicates acceptable fit (MacCallum et al., 1996).
Standardized root mean square residual (SRMR)	0 (the best fit) to 1 (no fit)	Value below.08 indicates acceptable fit (Hu & Bentler, 1999).
Normal Fit Index (NFI)	0 (no fit) to 1 (the best fit)	Value close to .90 indicates a good fit.(Bentler & Bonnet, 1980)
Comparative Fit Index (CFI)	0 (no fit) to 1(the best fit)	Value close to .90 indicates a good fit. (Hu & Bentler, 1999).

3.5 Threats to Validity of the study

3.5.1 Threats to Internal Validity of the Study

Validity threats refer to the variables that are unintendedly interfering with the variables of the study and distort the relationships between the target variables (Fraenkel & Wallen, 2006). These variables should be considered comprehensively before the study and controlled, omitted or reduced to a minimum where possible throughout the study.

In correlational studies, which investigate the naturally occurring relationships between variables without manipulating, subject characteristics could be a potential threat to the study. In this study, the sample was selected randomly from two huge districts of Ankara randomly. They are representative of the city in terms of the socio-economic status and sociological structure of the people residing there. Although some demographic variables data were collected by demographic questionnaire, subject characteristics still might be a possible source of threat for this study. Besides, demographic data obtained from both teachers and students were not used in the analysis. These data were collected to provide a thick description regarding the sample studied.

Mortality (loss of subjects) was not a threat for this study because the data were gathered cross-sectionally. In another words, the questionnaires were administered once, not longitudinally or in a repeating fashion in time. Therefore, loss of subjects is not considered as a threat in this study. Data were collected from students and teachers who were present in schools at the time of data collection.

Instrument decay, data collector characteristics and data collector bias were not considered as threats to internal validity of the study. The researcher himself collected the data. So, data collector characteristics were controlled. Additionally, the same explanations were provided to teacher and student samples regarding the data collection instruments. Moreover, the data were collected via self-report questionnaires which are objective instruments in terms of obtaining participant responses. Due to abovementioned reasons, data collector characteristics were not taken as a validity threat. Instrument decay did not occur because questionnaires were used one time. Additionally, scantron (optical forms) were used for data entry that disabled the data collector bias in terms of data distortion in entry process. Maturity was not considered as a threat for the present study as well. Maturity is a more dangerous threat to experimental designs when pre-posttest time lags last for long time .Pre-posttests were not used in the current study. Data collection period lasted about six weeks. Therefore, it is not a huge time for both students and teachers in order for posing a threat to internal validity of the study.

Testing could be a possible threat to internal validity of the present study in such a way that students and teachers were administered all of the scales in a single booklet. This might have created an effect of influence to their responses from previous answers to other scales.

In the present study, data were collected both from students and teachers. Students were administered the questionnaires in their ordinary classrooms where they were familiar with. Similarly, teachers also filled out the questionnaires in the classrooms while their students were filling out the questionnaires. For both groups, the environment was the same as usual. Additionally, the schools included in this study were all public school with similar physical conditions and resources. The neighborhoods were also in similar socioeconomic status. Location could be a threat if the data were collected in unfamiliar places but for this study, location was not considered to be a basic threat to internal validity of the study.

3.5.2 Threats to External Validity of the Study

External validity of the study refers to its generalizability of study results to the target population (Fraenkel & Wallen, 2006). In this study, two large districts were selected considering their social and economic backgrounds in order to reflect the similar characteristics with the whole city. Two stage sampling of 60 schools reflected the characteristics of the population. Thus, the sample of this study is large and similar enough to represent the whole population. Additionally, this study included only public schools in these two districts. Since the characteristics of the public schools are similar across the city of Ankara, it could be stated that these issues did not pose external threats to external validity of the study.

3.6 Assumptions of the Study

1. During the instruments' administration, all conditions were standard.
2. Students filled out the questionnaires sincerely.
3. Students did not interact with each other during the instruments' administration
4. The characteristics of sample of the pilot study and the actual sample of the study were assumed to be the similar and representative of the population.

3.7 Limitations

This study provides valuable insights into the relationships between certain characteristics of the teachers, student beliefs and achievement in science, a few limitations need to be addressed for future studies. This study is a correlational study in nature and the data were collected cross-sectionally. Since the motivation levels and personal characteristics are subject to change in time, future studies may use longitudinal data to reveal the change, growth or development of these variables throughout time.

The scope of this study is limited to science teacher characteristics and students' motivation and achievement in science. Future work may focus on other domains such as social studies, mathematics or language education to reveal the relationships in a nested data structure. Also, in future studies, researchers may examine these variables in high school and college level settings. Lastly, this study used quantitative methods for the purpose of the present study. Future researchers may use qualitative data collection techniques such as interviews and observations to obtain a deep understanding in perceived teacher motivation, school context variables, and student related outcomes (perceived motivation, perceived engagement, etc.) and science achievement in science education.

CHAPTER IV

RESULTS

This chapter presents the results of a series of analysis conducted for the related research questions. The results are categorized in three main sections: (1) Preliminary analyses (missing values and outliers, basic descriptive statistics for teacher and student variables), (2) Hierarchical Linear Modeling (HLM) analysis conducted with both teacher and student variables and, (3) Path Analysis of teacher variables,

4.1 Preliminary Analyses

Preliminary analyses of the data includes the treatment of missing values and outliers, basic descriptive statistics (means, standard deviations, skewness and kurtosis, etc.) and bivariate correlations of teacher and student level variables.

4.1.1 Treatment of Missing Values

Missing data is one of the most challenging problem that a researcher has to deal with during data analysis. Missing data should be handled before starting especially for multivariate analysis. Indeed, HLM analysis requires complete cases for parameter estimates. Tabachnick and Fidell (2013) stated that the pattern of missing data (random or nonrandom) is more important than the amount of the missing data. The percentage of missing data should also be computed and a procedure should be selected appropriate to the percentage of the missing data. In the present study, the pattern of missing data were examined by the SPSS 21 statistical package program. Missing data suggested any significant pattern in both student and teacher variables. The percentage of missing values for each teacher and student variables were not more than 4.8 % and 4.5 %, respectively.

Tabachnick and Fidell (2013) suggested that the percentage of missing values below 5 % may be treated with any method since such a low percentage of missing values do not make any substantial impact on the data. The missing values of the self-report questionnaires of the present study did not exceed the critical 5 % cut off criterion. Thus, missing values of the self-report questionnaires of the teacher and student variables were replaced with modes of the variables. Additionally, the missing values of the science achievement test (SAT) were considered as wrong and replaced with zero based on the rationale that if student had known the answer s/he should have attempted to answer it. The missing values of the demographic questionnaires for both teacher and student variables were both kept as they were and presented in the demographic characteristics table in the method chapter.

4.1.2 Outliers

Outliers are influential data points that distort accuracy of the parameter estimates of the study. Outliers should be checked and handled before conducting any multivariate analysis. Outliers may influence the results in two ways namely univariate and multivariate and should be handled in both ways. For univariate outlier check, both teacher and student level variables were examined in z scores. Tabachnick and Fidell (2013) stated that standardized scores that are above the critical value of 3.29 are potential outliers. In large samples a few outliers are inevitable and should be handled in order for parameter estimates to be more accurate. In the current study, teacher and student datasets were examined for univariate outliers on the criteria of 3.29 critical standardized score value. Results suggested that one teacher and 71 students had standardized scores greater that critical 3.29 value and they were discarded from the analysis. In order to determine the multivariate outliers, Mahalanobis distances were calculated for both teacher and student variables. Mahalanobis distance refers to the distance of a case from the center of intersection of all the means of the remaining cases (Tabachnick & Fidell, 2013). One teacher and 32 students were removed from the dataset based on the Mahalanobis distance criteria for being multivariate outliers.

A total of 135 teachers and their 3394 students remained after treatment of missing values and outliers. Hox (2010) asserted that increasing sample size makes a positive contribution to the accuracy of the parameter estimations and suggested a 100/10 rule for two-level HLM models. In other words, if the sample includes 100 groups, then each group is suggested to have at least 10 cases. Missing and outlier examinations decreased the number of students. One teacher who had less than 10 students was removed from the teacher dataset. Finally, 134 teachers and 3394 students remained and the data provided by these participants were utilized for further analysis. Assumptions of HLM analyses were also checked and provided in the Appendix D.

4.1.3 Normality

Skewness and Kurtosis values are used as indicators of normality for a distribution. Values between -2 and +2 are plausible for a normal distribution (George & Mallery, 2003). All student and teacher skewness and Kurtosis values were between the critical points of +2 and -2 (see Table 4.1 and Table 4.2). Therefore, the distributions of student and teacher level variables could be accepted as normal distributions.

Table 4.1 Descriptive statistics for student variables

Student Variables (Level 1)	M	SD	Skewness	Kurtosis	Min	Max
ZSAT (Science Achievement Score)	8.19	3.39	-.21	-.89	0	14
ZSSE (Self – Efficacy)	5.46	1.29	-.78	.10	1	7
ZENGA (Agentic Engagement)	2.90	.64	-.20	-.44	1	4
ZENGB (Behavioral Engagement)	3.37	.52	-.72	.14	1	4
ZENGC (Cognitive Engagement)	3.16	.53	-.40	-.21	1	4
ZENGE (Emotional Engagement)	3.34	.57	-.81	.26	1	4
ZAGMAP (Mastery Approach Goals)	4.50	.58	-1.44	1.88	1	5
ZAGMAV (Mastery Avoidance Goals)	3.51	1.08	-.48	-.56	1	5
ZAGPAP (Performance Approach Goals)	4.30	.81	-1.36	1.55	1	5
ZAGPAV (Performance Avoidance Goals)	3.83	.87	-.74	.06	1	5

Table 4.2 Descriptive statistics for teacher variables

Teacher Variables (Level 2)			M	SD	Variance	Skewness	Kurtosis	Min	Max
School Environment	School Context	ZTIME (Time Pressure)	3.70	1.14	1.30	-.09	-.63	1	6
		ZAUTO (Autonomy)	4.53	1.06	1.12	-.34	-.86	1	6
		ZDISCP (Discipline Problems)	3.67	1.35	1.83	-.07	-.76	1	6
		ZSUSUP(Supervisory Support)	4.01	1.16	1.35.	-.44	-.19	1	6
		ZRELP (Relations with Parents)	4.36	1.05	1.10	-.63	.29	1	6
		ZRELC (Relations with Colleagues)	4.55	1.04	1.07	-.50	-.29	1	6
	School Goals	ZSGM (School Mastery Goals)	3.74	.72	.52	-.30	-.41	1.86	5
		ZSGP (School Performance Goals)	3.56	.70	.49	.00	-.00	1.60	5
Teacher Motivation	Job satisfaction	ZJOBS (Job Satisfaction)	4.81	1.05	1.10	-.81	-.14	1	6
	Goals	ZATISM (Mastery Approaches to Instruction)	3.97	.67	.45	-.31	-.33	2	5
		ZATISM (Performance Approaches to Instruction)	3.87	.79	.63	-.56	-.36	1.75	5
	Self-Efficacy	ZTSEENG (Teacher Self-Efficacy - Student Engagement)	6.69	1.11	1.22	-.11	-.32	4.25	9
		ZTSEIS (Teacher Self-Efficacy – Instructional Strategy)	7.34	.99	.98	-.24	-.60	5	9
		ZTSECM (Teacher Self-Efficacy – Classroom Management)	7.06	1.12	1.26	-.37	-.33	4.25	9
	Collective Efficacy	ZTCESGC (Teacher Collective Efficacy – Group Competence)	4.74	.80	.64	-.48	-.37	2.60	6
		ZTCESTA (Teacher Collective Efficacy – Task Analysis)	2.63	1.11	1.24	.79	.20	1	6

4.1.4 Descriptive Statistics

Detailed basic descriptive statistics were provided in the section below for the teacher and student level variables. Descriptive statistic included means, standard deviations, variances, skewness and kurtosis values, and minimum and maximum scores.

4.1.4.1 Descriptive Statistics for Teacher Motivation Variables

Teacher motivation was measured in terms of teacher self and collective efficacy and approach to instruction (mastery and performance) through administration of Teacher Sense of Efficacy Scale (TSES) (Efficacy for Student Engagement (SE), Efficacy for Instructional Strategies (IS), and Efficacy for Classroom Management (CM), Teachers' Approach to Instruction Scale (TAIS) (Mastery Approaches to Instruction and Performance Approaches to Instruction), and Teacher Collective Efficacy Scale (TCES) (Group Competence and Task Analysis) respectively. Descriptive statistics (means, standard deviations and item percentages) of the items of the teacher motivation variables are presented in this part.

4.1.4.1.1 Descriptive Statistics for Teacher Sense of Efficacy

Science teaching self-efficacy beliefs of participating science teachers were measured by the Teachers' Sense of Efficacy Scale (TSES), which was developed by Tschannen-Moran and Woolfolk-Hoy (2001) as a 9 point Likert type scale ranging from "9 = a great deal" to "1 = nothing". TSES consisted of three subscale namely Efficacy for Student Engagement (SE), Efficacy for Instructional Strategies (IS), and Efficacy for Classroom Management (CM). Each subscale included 4 items. Efficacy for instructional strategy had the largest subscale mean (M = 7.34, SD = .99) among the TSES subscales and

Efficacy for Student Engagement (M = 6.69, SD = 1.11) had the smallest subscale mean. These findings imply that science teachers belief in their .ability to implement instructional strategies is quite high (M = 7.34 out of 9). On the other hand, although their belief in their abilities to engage students to science class is fairly high (M = 6.69 out of 9), it is the lowest among other subscales of efficacy beliefs. Moreover, participating science teachers belief in their ability for managing their classroom is fairly high (M = 7.06 out of 9). Basic descriptive statistics for each subscale are presented in the Table 4.3 below.

Table 4.3 Basic descriptive statistics for TSES

TSES Subscales	M	SD
Efficacy for Student Engagement	6.69	1.11
Efficacy for Instructional Strategy	7.34	.99
Efficacy for Classroom Management	7.06	1.12

Item level analysis of *Efficacy for Student Engagement* (ES) (see Table 4.4) subscale indicated that the largest item mean belongs to the item 3, which is “How much can you do to get students to believe they can do well in school work?” (M = 7.16, SD = 1.25). Science teachers believe in their ability more in getting students to believe that they can do well in school work more than other engagement items. Interestingly, first three anchors got zero frequency for item 3. The responses of the teachers gathered mostly around 7 (35 %). On the other hand, the smallest item mean in the efficacy for student engagement subscale belongs to the item 11, which is “How much can you assist families in helping their children do well in school?” (M = 6.29, SD = 1.75). Similar to other items, responses gather on the anchor 7 with the highest frequency but the spread of responses is larger in item 11. Thus, the standard deviation is also largest (SD = 1.75) of the subscale.

For *Efficacy for Instructional Strategy* (IS) subscale (see Table 4.4), item level analysis of descriptive statistics suggested that highest item mean belongs to item 10, which is “To what extent can you provide an alternative explanation or example, when students are confused?” (M = 7.67, SD = 1.10). The 5th item, which is “To what extent can you craft good questions for your students?” also had the second highest item mean (M = 7.64, SD = 1.04). These results suggest that science teachers have subtle belief in their ability to provide an alternative explanation or example when students are confused and to craft original questions. Indeed, these two items had the highest mean scores of the whole TSES. For these two items, the largest rating frequency lied on 7 (34 % and 35 %, respectively) and the high end of the scale had a considerable frequency (54 % and 52 % respectively). Moreover, the first three anchors had zero frequency in both items. The smallest item mean belonged to the item 9, which is “How much can you use a variety of assessment strategies?” (M = 6.95, SD = 1.43). This finding implied that although item 9 had the smallest mean among other items, it is quite high (the midpoint of the scale is 4.5). In comparison with other items of the efficacy for instructional strategies subscale, science teachers had the lowest level of efficacy belief in their ability to use various assessment strategies. Similar to other items of the subscale, the highest frequency is on anchor 7 (34 %) but the low end of the scale also had a considerable number of respondents (31 %).

Table 4.4 Descriptive statistics of the items of the TSES

				Percentage (%)								
				Nothing		→					A Great Deal	
Subscale	Items	*M*	*SD*	1	2	3	4	5	6	7	8	9
Student Engagement	2. How much can you do to motivate students who show low interest in school work?	6.45	1.39	0.00	0.00	3.00	4.50	16.40	24.60	31.30	12.70	7.50
	3. How much can you do to get students to believe they can do well in school work?	7.16	1.25	0.00	0.00	0.00	0.70	11.20	14.90	35.10	20.10	17.90
	4. How much can you do to help your students value learning?	6.85	1.20	0.00	0.00	0.70	0.70	13.40	19.40	37.30	20.10	8.20
	11. How much can you assist families in helping their children do well in school?	6.29	1.75	0.00	0.70	9.70	5.20	14.90	17.20	29.10	11.90	11.20

Table 4.4 Descriptive statistics of the items of the TSES (continued)

				Percentage (%)								
				Nothing →							A Great Deal	
Subscale	Items	*M*	*SD*	1	2	3	4	5	6	7	8	9
Instructional Strategies	5. To what extent can you craft good questions for your students?	7.64	1.04	0.00	0.00	0.00	0.00	3.00	8.20	35.80	27.60	25.40
	9. How much can you use a variety of assessment strategies?	6.95	1.43	0.00	0.00	3.00	2.20	9.70	16.40	34.30	19.40	14.90
	10. To what extent can you provide an alternative explanation or example, when students are confused?	7.67	1.10	0.00	0.00	0.00	0.00	4.50	6.70	34.30	26.10	28.40
	12. How well can you implement alternative strategies in your classroom?	7.10	1.37	0.00	0.70	9.70	5.20	14.90	17.20	29.10	11.90	11.20

Table 4.4 Descriptive statistics of the items of the TSES (continued)

				Percentage (%)								
				Nothing →								A Great Deal
Subscale	Items	*M*	*SD*	1	2	3	4	5	6	7	8	9
Classroom Management	1. How much can you do to control disruptive behavior in the classroom?	7.15	1.25	0.00	0.00	0.70	0.70	9.70	13.40	38.80	20.10	16.40
	6. How much can you do to get children to follow classroom rules?	7.18	1.17	0.00	0.00	0.00	2.20	6.00	15.70	37.30	25.40	13.40
	7. How much can you do to calm a student who is disruptive or noisy?	7.16	1.37	0.00	0.70	0.00	1.50	11.90	11.90	32.80	22.40	18.70
	8. How well can you establish a classroom management system with each group of students?	6.75	1.48	0.00	0.00	4.50	2.20	10.40	22.40	29.10	19.40	11.90

In the Efficacy for Classroom Management (CM) subscale, the item 6, which is "How much can you do to get children to follow classroom rules?" had the largest mean (M = 7.18, SD = 1.17). In this subscale, 1^{st} and 7^{th} items also had high item means close to the largest one (M = 7.15 and M = 7.16, respectively). On the other hand, the smallest item mean belongs to the item 8, which is "How well can you establish a classroom management system with each group of students?" (M = 6.75, SD = 1.48). Taken together, all item means are quite high in comparison with the scale midpoint of 4.5. It might be inferred from these findings that while teachers believe in their ability to manage their classrooms for individual or whole class disruptions, teachers' belief decrease relatively when it comes to manage the classroom for separate groups of students. As for the other subscales of TSES, the highest frequency of responses are on the anchor 7 (38 %, 37 %, 32 %, and 29 % for items 1, 6, 7, and 8, respectively). However, the spread of scores is largest (SD = 1.48) for item 8, which had the smallest item mean.

4.1.4.1.2 Descriptive Statistics for Teachers' Approach to Instruction

Science teachers approach to instruction was assessed by the teachers' scales part of the Patterns of Adaptive Learning Survey (PALS). PALS was developed and refined by a group of researchers from the University of Michigan (Midgley et al., 2000). PALS was designed on a five point Likert type scale ranging from 1 = "Strongly disagree" to 3 = "Somewhat agree" to 5 = "Strongly agree". Teachers' Approach to Instruction Scale (TAIS) consisted of two subscales namely *Teachers' Mastery Approaches to Instruction* (3 items) and *Teachers' Performance Approaches to Instruction* (4 items). In the present study, subscale means were M = 3.97 (SD = .67) and M = 3.87 (SD = .79) for *Teachers' Mastery Approaches to Instruction* and *Teachers' Performance Approaches to Instruction*, respectively. It might be concluded from the subscale mean scores that participating science teachers use both of the instructional approaches because both approaches has means close to each other (M = 3.87 and M = 3.97) and they are both quite above the subscale mean of 2.5. The basic descriptive statistics are presented in the Table 4.5 below.

Table 4.5 Basic descriptive statistics for TAIS

Subscales of TAIS	M	SD
Mastery Approaches to Instruction	3.97	.67
Performance Approaches to Instruction	3.87	.79

Considering the item level analysis of Teachers' Mastery Approaches to Instruction (see Table 4.6), the largest item mean (M = 4.02, SD = .85) belonged to the item 9, which is "I give a wide range of assignments, matched to students' needs and skill level". A very close item mean (M = 4.00, SD = .85) belonged to the item 2, which is "I make a special effort to recognize students' individual progress, even if they are below grade level". On the other hand the smallest item mean (M = 3.88, SD = .83) belongs to the item 4, which is "During class, I often provide several different activities so that students can choose among them." The mean scores of these three items are very close to each. Therefore, it is hard to make bipolar comments on these item mean scores. The participating teachers rated these items on a similar fashion that the highest frequency for these three items is 3 (43 %, 39 %, and 45 % for items 2,4, and 9, respectively).

The item analysis for the Teachers' Performance Approaches to Instruction (see Table 4.6), suggested that the largest item mean (M = 4.22, SD = 1.05) belonged to the item 3, which is "I display the work of the highest achieving students as an example". Indeed, this item had the largest item mean of all the items of ATIS. A great majority (55 %) of the participating science teachers "strongly agreed" that they display the work of the highest achieving student as an example to other students. On the other hand, the smallest item mean (M = 3.50, SD = 1.16) belongs to the item 1, which is "I give special privileges to students who do the best work". Although this item was above the scale midpoint of 3, it has the smallest item mean among the other items. The highest frequency for this item was 3 (27 %). Moreover, the item means ranged from M = 3.50 to M = 4.22 for Teachers' Performance Approaches to Instruction subscale, which is larger than the Teachers' Mastery Approaches to Instruction subscale.

Table 4.6 Descriptive statistics of the items of the TAIS

Subscale	Items	*M*	*SD*	Percentage (%) Strongly Disagree 1	2	Somewhat Agree 3	4	Strongly Agree 5
Mastery Approach to Instruction	2. I make a special effort to recognize students' individual progress, even if they are below grade level.	4.00	.85	.70	3.00	22.40	43.30	30.60
	4. During class, I often provide several different activities so that students can choose among them.	3.88	.83	0.00	3.00	32.10	38.80	26.10
	9. I give a wide range of assignments, matched to students' needs and skill level.	4.02	.85	0.00	5.20	18.70	44.80	31.30
Performance Approach to Instruction	1. I give special privileges to students who do the best work.	3.50	1.16	6.00	11.90	32.10	26.90	22.40
	3. I display the work of the highest achieving students as an example.	4.22	1.05	2.20	6.00	14.90	21.60	55.20
	7. I encourage students to compete with each other.	3.92	.99	2.20	6.70	19.40	40.30	31.30
	8. I point out those students who do well as a model for the other students.	3.84	1.13	4.50	8.20	21.60	30.60	35.10

4.1.4.1.3 Descriptive Statistics for Teacher Collective Efficacy

Teacher Collective Efficacy Scale (TCES) was used to evaluate participating science teachers' collective efficacy beliefs. The TCES was originally developed by Goddard, Hoy, and Woolfolk Hoy (2000) in Likert type format ranging from "6 = strongly agree" to "1 = strongly disagree". The TCES had two subscales which are "Group Competence" and "Task Analysis". Group competence subscale had 10 items and task analysis subscale had 4 items. The mean scores of subscales are M = 4.74 (SD = .80) and M = 2.63 (SD = 1.11) for group competence and task analysis, respectively. These mean scores imply that while science teachers had a subtle belief in their group capability (M = 4.74, SD = .80), their task analysis score is below the scale midpoint of 3 (M = 2.63, SD = 1.11). Basic descriptive statistics for each subscale are presented in the Table 4.7 below.

Table 4.7 Basic descriptive statistics for TCES

TCES Subscales	M	SD
Group Competence	4.74	.80
Task Analysis	2.63	1.11

Item level analysis for *Group Competence* subscale suggested that the largest item mean (M = 5.18, SD = .93) (see Table 4.8) belongs to the item 7, which is "Teachers here are well-prepared to teach the subjects they are assigned to teach". Approximately 80 % of the participating science teachers agree on the item that their colleagues are well prepared for what they are going to teach. Additionally, their collective belief in their preparations for their classes is fairly high (M = 5.18 out of 6). On the other hand, the smallest item mean (M = 4.26, SD = 1.36) belonged to the item 8, which is "Teachers here fail to reach some students because of poor teaching methods”. Although this is a reverse scored item, still it has the smallest mean. The mean score is quite above the scale midpoint of 3 but it is the smallest mean of the other items of the group competence subscale. The largest reversed rating score is 5 with 32 % frequency.

The item analysis for Task Analysis subscale (see Table 4.8) suggested that the largest item mean (M = 3.23, SD = 1.46) belonged to the item 13, which is “The quality of school facilities here really facilitates the teaching and le arning process”. It is slightly over the scale midpoint of three. It implies that participating science teachers partly agree that the quality of their schools in terms of facilitating science teaching and learning is good. The anchor frequencies are widely dispersed and the largest frequency (29 %) belongs to anchor 3. The smallest item mean (M = 2.07, SD = 1.35) belongs to item 14, which is “The students here come in with so many advantages they are bound to learn”. The mean score of this item is below the scale midpoint of 3 and implied that participating science teachers are pessimistic about the advantages students have of their families and social environment. Approximately half (49 %) of the teacher sample responded 1 to this item that caused such a low item mean.

Table 4.8 Descriptive statistics of the items of the TCES

				Percentage (%)					
				Strongly Disagree ➡					Strongly Agree
Subscale	Items	*M*	*SD*	1	2	3	4	5	6
Group Competence	2. Teachers here are confident they will be able to motivate their students.	4.45	1.09	1.50	0.70	17.90	29.10	32.80	17.90
	3. If a child doesn't want to learn teachers here give up.*	4.49	1.30	1.50	9.00	12.70	14.90	39.60	22.40
	4. Teachers here don't have the skills needed to produce meaningful student learning.*	5.09	1.46	3.00	9.00	4.50	5.20	16.40	61.90
	5. If a child doesn't learn something the first time teachers will try another way.	4.67	1.10	0.00	4.50	10.40	23.90	35.80	25.40
	6. Teachers in this school are skilled in various methods of teaching.	5.04	1.03	0.00	2.20	7.50	14.90	34.30	41.00
	7. Teachers here are well prepared to teach the subjects they are assigned to teach.	5.18	.93	0.00	.70	6.00	13.40	34.30	45.50
	8. Teachers here fail to reach some students because of poor teaching methods.*	4.26	1.36	3.00	9.00	17.90	18.70	32.10	19.40
	9.Teachers in this school have what it takes to get the children to learn.	4.93	1.04	.70	.70	10.40	14.20	40.30	33.60
	11. Teachers in this school do not have the skills to deal with student disciplinary problems.*	4.87	1.28	.70	6.00	10.40	14.20	26.10	42.50
	17. Teachers in this school truly believe every child can learn.	4.42	1.31	3.70	5.20	12.70	24.60	31.30	22.40

***** Reverse scored items

Table 4.8 Descriptive statistics of the items of the TCES (Continued)

				Percentage (%)					
				Strongly Disagree		→			Strongly Agree
Subscale	Items	*M*	*SD*	1	2	3	4	5	6
Task Analysis	13. The quality of school facilities here really facilitates the teaching and learning process.	3.23	1.46	14.20	17.20	29.10	18.70	12.70	8.20
	14. The students here come in with so many advantages they are bound to learn.	2.07	1.35	48.50	22.40	11.90	9.00	6.70	1.50
	15. These students come to school ready to learn.	2.23	1.25	35.10	29.10	22.40	6.70	4.50	2.20
	16. Students here just aren't motivated to learn.*	2.99	1.54	17.90	28.40	19.40	11.90	15.70	6.70

***** Reverse scored items

4.1.4.2 Descriptive Statistics for Teachers’ Job Satisfaction

Teachers’ job satisfaction was assessed by a three-item scale, namely Teachers’ Job Satisfaction Scale (TJSS). The TJSS was developed by Skaalvik and Skaalvik (2011) on a six point Likert type ranging from “completely disagree” (1) to “completely agree” (6). Job satisfaction scale included 3 items. The subscale mean score was M = 4.81 (SD = 1.05). This finding implied that participating science teachers mostly agreed that they were pleasant from being in the teaching profession. Descriptive statistics are presented in the Table 4.9 below.

The item level analysis of Teachers’ Job Satisfaction Scale (see Table 4.9) suggested that the largest item mean (M = 5.32, SD = 1.07) belongs to the item 1, which is “I enjoy working as a teacher”. Such a high item mean score indicated that a great majority of the teachers are pleased from being teacher. Accordingly, the highest frequency (62 %) lies on the high end (6) of the scale. On the other hand, the smallest item mean (M = 4.53, SD = 1.34) belongs to the item 2, which is “I look forward to going to school every day”. Participating science teachers are also willing to go to work every day quite above the scale midpoint but their desire to go to work is less than their passion for their profession. The highest frequency (37 %) for the item 2 was on the anchor 5.

Table 4.9 Descriptive statistics of the items of the Teacher Job Satisfaction Scale (TJSS)

				Percentage (%)					
				Strongly Disagree					Strongly Agree
Subscale	Items	*M*	*SD*	1	2	3	4	5	6
Job Satisfaction	1. I enjoy working as a teacher.	5.32	1.07	1.5	.70	4.50	12.70	18.70	61.90
	2. I look forward to going to school every day.	4.53	1.34	3.70	6.00	11.20	17.20	36.60	25.40
	3. Working as a teacher is extremely rewarding.	4.59	1.37	3.00	4.50	15.70	17.90	25.40	33.60

4.1.4.3 Descriptive Statistics for School Environment Variables

In this part of the results chapter, descriptive statistics (means, standard deviations and item percentages) for teachers' perception of school environment variables (i.e., school context, and school goal structures) measured through the subscales of teachers' Perception of School Context Scale (i.e. discipline problems, relations with parents, relations with colleagues, and supervisory support) and subscales of School Goal Structures Scale (i.e. mastery and performance school goal structure), respectively, were presented.

4.1.4.3.1 Descriptive Statistics for Teachers' Perception of School Context

Teachers' perception of school context was measured by the teachers' Perception of School Context Scale (PSCS), which consisted of six sub scales (autonomy, time pressure, discipline problems, relations with parents, relations with colleagues, and supervisory support). PSCS was developed by Skaalvik and Skaalvik (2009; 2011) on a six point Likert type scale. As stated before, autonomy and time pressure subscales were not included in descriptive statistical analyses, HLM analyses and path analysis because of their low reliability values. The mean scores of the PSCS sub scales ranged from 3.67 (*SD* = 1.35) from 4.55 (*SD* = 1.04) (see Table 4.10).

For participating Turkish science teachers, perception of the school context variables had varying mean scores (see Table 4.10). Participating science teachers had the highest average score on relations with colleagues (M = 4.55, SD = 1.04) dimension of perceptions of school context variables. The lowest scores were for time pressure (M = 3.70, SD = 1.14) and discipline problems (M = 3.67, SD = 1.35). According to these findings, science teachers appeared to help each other and ask for advice and feel that they act freely in their classes at high levels. On the other hand, science teachers were found to feel time pressure and have discipline problems at a moderate level. Additionally, they had a good relationship with their principals slightly above average (M = 4.01, SD = 1.16) and they appeared to have good relationship with the parents of the students (M = 4.36, SD = 1.05) (see Table 4.10).

With regard to relations with parents subscale, item 7 (I feel that the parents have trust in my teaching) had the largest mean item score (M = 4.96, SD = 1.03) and item 8 (The parents are easy to work with) had the lowest mean score (M = 3.46, SD = 1.45). While about three-quarter of science teachers (73.1 %) selected 5 or 6 for the 7th item, more than a quarter of them (27.60 %) selected 4 on the 8th item. These findings suggested that participating science teachers appeared to have the perception that parents had trust in their teaching and decisions at higher levels. However, they were found to be less likely to have the perception that it is easy to work with the parents.

In the discipline problems subscale, the highest item mean score was on the 12th item, “Controlling students' behavior takes a lot of time and effort.”, which had a mean of M = 3.94 (SD = 1.59). Most of the participating teachers (44 %) selected 5 or 6 on the Likert scale for this item implying that teacher partly agree that controlling disruptive student behavior takes time. On the other hand, the tenth item, “My teaching is often disrupted by students who lack discipline.” had the smallest item mean (M = 3.19, SD = 1.59). Indeed, most of the science teachers (55 %) selected 2 or 3 on this item.

The smallest item mean of the scale is in the supervisory support subscale of the Perceived School Context Scale (PSCS). The 13th item, “In educational matters I can always seek help and advice from the school leadership.” had the smallest item mean (M = 2.78, SD = 1.53) of the scale. More than 50 % of the participating science teachers selected 1 and 2 for this item. This finding suggested that the relationship between teachers and school administration appears to be quite weak. Teachers' responses on the 14th item "My relation with the principal is one of mutual trust and respect." had the highest (M = 4.93, SD = 1.38) subscale mean. Mean scores of these two items showed that science teachers had a formal relationship with the school administration but they did not consult to school administration on educational matters. Moreover, half of the participating science teachers (50 %) selected 5 or 6 on the Likert scale for the item "The school leadership is supportive and praise good work". The mean scores of the items of relations with colleagues subscale ranged from M = 4.42 (SD = 1.32) to M = 4.471 (SD = 1.13). The items of this subscale has the narrowest range of all PSCS sub scales. For all items, more than 50% of the participating science teachers rated their relationships with their colleagues as 5 or 6 on the Likert scale. These results suggested that more than half of the teachers think that their relationship with their colleagues is good and they help each other in educational matters. Indeed, the low end of the scale had relatively low frequencies.

Table 4.10 Descriptive statistics of the items of the PSCS scale

				Percentage (%)					
				False		→			True
Subscale	Items	*M*	*SD*	1	2	3	4	5	6
Relations with Parents	7. I feel that the parents have trust in my teaching.	4.96	1.03	.70	3.00	3.00	20.10	38.80	34.30
	8. The parents are easy to work with.	3.46	1.45	11.20	15.70	22.40	27.60	13.40	9.70
	9. The parents trust and accept my decisions	4.66	1.13	.70	6.00	7.50	20.10	44.00	21.60
Discipline Problems	10. My teaching is often disrupted by students who lack discipline.	3.19	1.59	9.00	39.60	14.20	9.70	15.70	11.90
	11. Some students with behavior problems make it difficult to carry out lessons as planned.	3.87	1.56	6.70	20.10	12.70	14.90	30.60	14.90
	12. Controlling students' behavior takes a lot of time and effort.	3.94	1.59	8.20	15.70	12.70	20.10	23.90	19.40

Table 4.10 Descriptive statistics of the items of the PSCS scale (continued)

Subscale	Items	*M*	*SD*	Percentage (%) False → True: 1	2	3	4	5	6
Supervisory Support	13. In educational matters I can always seek help and advice from the school leadership.	2.78	1.53	24.60	26.90	17.20	14.20	11.20	6.00
	14. My relation with the principal is one of mutual trust and respect.	4.93	1.38	4.50	2.20	8.20	14.90	20.90	49.30
	15. The school leadership is supportive and praise good work.	4.31	1.44	6.00	5.20	15.70	23.10	24.60	25.40
Relations with Colleagues	16. In educational matters, I can always get good help from my colleagues.	4.42	1.32	2.20	7.50	14.90	20.90	30.60	23.90
	17. The relations among the colleagues at this school are characterized by friendliness and a concern for each other.	4.52	1.24	.70	6.70	14.20	21.60	31.30	25.40
	18. Teachers at this school help and support each other.	4.71	1.13	.70	3.00	11.90	20.90	35.80	27.60

4.1.4.3.2 Descriptive Statistics for School Goal Structures

Turkish science teachers' perception of the school goal structures were measured by the teachers' scales part of the Patterns of Adaptive Learning Survey (PALS) (Midgley et al., 2000). School Goal Structures Scale included two subscales which are school mastery goals and school performance goals. In the present study, mean score of the teachers perception of the school mastery goal structure was M = 3.74 (SD = .72) and mean score of the teachers' perception of the school performance goals was M = 3.56 (SD = .70). Mean scores of school goal structures imply that science teachers perceive their schools as mastery oriented (M = 3.74, SD = .72) more than performance oriented (M = 3.56, SD = .70). Their mean scores both scales are both above the scale midpoint of 2.5. Table 4.11 shows the basic descriptive characteristics of the SGSS.

Table 4.11 Descriptive statistics for SGSS subscales

SGSS Subscales	M	SD
School Mastery Goals	3.74	.72
School Performance Goals	3.56	.70

Item level analysis of school mastery goal structures (see Table 4.12) suggested that item 10, which is "In this school, a real effort is made to recognize students for effort and improvement" had the largest item mean (M = 4.13, SD = .92). Indeed, more than 75 % of the participating science teachers agreed on this items selecting 4 or 5 on the Likert scale. On the other hand, the smallest mean score for school mastery goal items belongs to item 6, which is "A lot of the work

Table 4.12 Descriptive statistics of the items of the SGSS

Subscale	Items	*M*	*SD*	Percentage (%) Strongly Disagree 1	2	Somewhat Agree 3	4	Strongly Agree 5
School Mastery Goals	In this school:							
	1. The importance of trying hard is really stressed to students.	4.04	.97	2.20	2.20	24.60	31.30	39.60
	2. Students are told that making mistakes is OK as long as they are learning and improving.	3.97	.97	1.50	4.50	26.10	31.30	36.60
	6. A lot of the work students do is boring and repetitious*	3.09	1.08	8.20	18.70	39.60	23.10	10.40
	8. Students are frequently told that learning should be fun.	3.48	1.05	4.50	9.00	40.30	26.90	19.40
	9. The emphasis is on really understanding schoolwork, not just memorizing it.	4.01	.99	1.50	5.20	23.90	29.90	39.60
	10. A real effort is made to recognize students for effort and improvement.	4.13	.92	0.00	6.70	15.70	35.10	42.50
	12. A real effort is made to show students how the work they do in school is related to their lives outside of school.	3.44	1.07	3.00	14.90	38.10	23.10	20.90

* Reverse scored item

Table 4.12 Descriptive statistics of the items of the SGSS (Continued)

Subscale	Items	*M*	*SD*	Percentage (%) Strongly Disagree 1	2	Somewhat Agree 3	4	Strongly Agree 5
School Performance Goals	In this school:							
	4. Students who get good grades are pointed out as an example to others.	3.75	1.02	2.20	8.20	29.10	33.60	26.90
	5. Students hear a lot about the importance of getting high test scores.	3.78	1.00	4.50	5.20	20.90	46.30	23.10
	7. Grades and test scores are not talked about a lot.	3.39	.95	3.00	10.40	44.80	28.40	13.40
	11. Students hear a lot about the importance of making the honor roll or being recognized at honor assemblies.	3.43	.96	3.00	10.40	41.00	31.30	14.20
	13. Students are encouraged to compete with each other academically.	3.43	1.06	3.70	12.70	39.60	24.60	19.40

students do is boring and repetitious" (this item was reverse coded) (M = 3.09, SD = 1.08).

Item level analysis of school performance goal structures (see Table 4.12) suggested that the largest item mean is for item 5, which is "In this school, Students hear a lot about the importance of getting high test scores" (M = 3.78, SD = 1.00). The largest mean score for this item implies that science teachers perceive that students are frequently told about the importance of getting high scores from the tests in their school.

In performance goal structures scale, the item means are not widely dispersed. All means lie between 3.39 and 3.78. The smallest mean of items in the school performance goal structure scale belongs to item 7, which is "In this school, grades and test scores are not talked about a lot", (M = 3.39, SD = 95). Although it is much higher than the scale midpoint of 3, it has smallest mean relative to other items. For this item, participating science teachers rated mostly 3 (44.80 %), whose anchor label is "somewhat agree". While teachers rated 4 and 5 more for the 4^{th} and 5^{th} items, teachers rated 3 more than other anchors for the items 7, 11 and 13.

4.1.4.4 Descriptive Statistics for Student Level Variables

In this part of the results chapter, descriptive statistics (means, standard deviations and item percentages) of student level variables, which were student motivation (Science Self-Efficacy, and Achievement Goals in Science measured in terms of Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals), and Student Engagement (Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement in Science) are presented.

4.1.4.4.1 Descriptive Statistics for Student Engagement

Student engagement questionnaire (SEQ) was used to assess 7th grade students agentic, behavioral, cognitive, and emotional engagement in science class. The SEQ was developed by Reeve and Tseng (2011) as seven point Likert type scale ranging from "1 = strongly disagree" to "4 = strongly agree". The SEQ includes 22-items in four subscales. The largest subscale mean (M = 3.37, SD =.52) belonged to the behavioral engagement subscale and the smallest subscale mean (M = 2.90, SD = .64) belonged to agentic engagement. These initial results suggested that students are more likely behaviorally engage in science classes than they put forth their agentic engagement. Table 4.13 presents basic descriptive statistics for SEQ subscales.

Table 4.13 Descriptive Statistics for SEQ subscales

SEQ Subscales	M	SD
Agentic Engagement	2.90	.64
Behavioral Engagement	3.37	.52
Cognitive Engagement	3.16	.53
Emotional Engagement	3.34	.57

Item level analysis for agentic engagement indicated that the largest item mean (M = 3.16, SD = .72) belonged to item 1, which is "During class, I ask questions". Although this item had the largest item mean, the highest frequency (53 %) was on the anchor "agree", not on the highest "strongly agree" (32 %). On the other hand, the smallest item mean (M = 2.64 SD = .96) belonged to item 2, which is "I tell the teacher what I like and what I don't like". For this item, the frequencies of "disagree" and "agree" responses are close to each other (31 % and 35 %, respectively). These findings indicated that while students ask questions to their teachers during science classes, they less likely express what they like and they do not like for science classes.

Item level analysis of Behavioral Engagement (see Table 4.14) subscale revealed that the largest item mean (M = 3.52, SD = .68) belonged to the item 8, which is “The first time my teacher talks about a new topic, I listen very carefully”. This item also had the largest item mean of the whole Student Engagement Scale. Indeed, the highest frequency (61 %) was “strongly agree”. Majority of students strongly agreed that they listen very carefully when their science teachers start a new topic. On the other hand, the smallest item mean (M = 3.21, SD = .73) belonged to the item 9, which is “I work hard when we start something new in class”. All of the item means are above the midpoint of the scale but item 9 had the relatively smallest mean. While items 6, 8, and 10 had the highest frequency (54 %, 61 %, and 52 % respectively) on the “strongly agree”, items 7 and 9 had their highest response frequency (49 %) on anchor 3, which is “agree”. These findings suggested that while students listen carefully, they do not work that much hard when their teachers start a new topic.

For emotional engagement subscale, item level analysis suggested that the largest item mean (M = 3.46, SD = .71) belonged to the item 11, which was **“**I enjoy learning new things in class”. On the other hand, the smallest item mean (M =3.27, SD = .85) belonged to the item 14, “Class is fun”. Although item 14 had the smallest item mean, the rest of the items (12 and 13) had item means very close to item 14 (M = 3.30 and M = 3.31, for items 13 and 14, respectively). For all of the emotional engagement items, majority of the students responded “strongly agree”.

Cognitive engagement subscale had the largest item mean M = 3.36 (SD = .77) for item 21, which is “As I study, I keep track of how much I understand, not just if I am getting the right answers". Half of the participating seventh grade students "strongly agree" that they keep track of how much they understood.

On the contrary, the smallest item mean (M = 3.03, SD = .84) belonged to the item 15, which is "When doing schoolwork, I try to relate what I'm learning to what I already know". While almost half (45 %) of the participating students "agree" that they relate what they are learning with what they have already known, 31 % of them strongly agreed on this item. Similar to behavioral and emotional engagement subscale items, cognitive engagement subscale items had item means quite above the scale midpoint of 2.

Table 4.14 Descriptive statistics of the items of the SEQ

				Percentage (%)			
				Strongly Disagree	Disagree	Agree	Strongly Agree
Subscale	Items	*M*	*SD*	1	2	3	4
Agentic Engagement	1. During class, I ask questions.	3.16	.72	2.30	12.30	53.10	32.40
	2. I tell the teacher what I like and what I don't like.	2.64	.96	13.10	30.80	34.70	21.40
	3. I let my teacher know what I'm interested in.	2.82	.93	8.90	27.30	36.90	26.90
	4. During class, I express my preferences and opinions.	3.03	.88	6.00	19.20	40.60	34.20
	5. I offer suggestions about how to make the class better.	2.87	.91	7.90	24.70	39.50	27.80
Behavioral Engagement	6. I listen carefully in class.	3.44	.69	1.80	6.20	38.20	53.70
	7. I try very hard in school.	3.25	.71	1.90	10.40	48.60	39.10
	8. The first time my teacher talks about a new topic, I listen very carefully.	3.52	.68	1.80	5.30	32.40	60.50
	9. I work hard when we start something new in class.	3.21	.73	2.00	12.20	48.50	37.40
	10. I pay attention in class.	3.41	.70	1.50	7.80	39.20	51.50

Table 4.14 Descriptive statistics of the items of the SEQ (continued)

Subscale	Items	*M*	*SD*	Percentage (%)			
				Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Emotional Engagement	11. I enjoy learning new things in class.	3.46	.71	2.10	6.40	34.50	57.00
	12. When we work on something in class, I feel interested.	3.30	.77	2.40	12.10	38.50	47.00
	13. When I am in class, I feel curious about what we are learning.	3.31	.76	2.40	10.80	40.80	46.00
	14. Class is fun.	3.27	.85	5.10	11.20	34.90	48.80
Cognitive Engagement	15. When doing schoolwork, I try to relate what I'm learning to what I already know.	3.03	.84	5.10	18.40	45.10	31.40
	16. When I study, I try to connect what I am learning with my own experiences.	3.09	.82	4.20	17.10	43.90	34.80
	17. I try to make all the different ideas fit together and make sense when I study.	3.10	.80	3.60	16.80	45.70	34.00
	18. I make up my own examples to help me understand the important concepts I study.	3.15	.82	3.80	16.00	41.60	38.60
	19. Before I begin to study, I think about what I want to get done.	3.23	.81	3.20	13.80	39.40	43.60
	20. When I'm working on my schoolwork, I stop once in a while and go over what I have been doing.	3.19	.80	3.60	13.5	43.20	39.70
	21. As I study, I keep track of how much I understand, not just if I am getting the right answers.	3.36	.77	3.00	8.80	38.00	50.30
	22. If what I am working on is difficult to understand, I change the way I learn the material.	3.13	.85	6.00	12.80	43.50	37.60

4.1.4.4.2 Descriptive Statistics for Student Motivation

Student motivation included students' achievement goals and self-efficacy beliefs in science. In the following sections, basic descriptive statistics regarding these motivation variables were presented.

4.1.4.4.2.1 Descriptive Statistics for Achievement Goals

In the present study, Achievement Goal Questionnaire (AGQ) was utilized to measure seventh grade students' goal orientations in science classes. The AGQ was originally developed by Elliot and McGregor (2001) to assess students' achievement goals orientations. It is designed as a five point Likert type scale ranging from "1 = strongly disagree" to "5 = strongly agree". The AGQ includes 15 items in 4 subscales that are mastery approach goals (3 items), mastery avoidance goals (3 items), performance approach goals (3 items) and performance avoidance goals (6) items. In the present study, the largest subscale mean was found for Mastery Approach Goals (M = 4.50, SD = .58) and the smallest was found for Mastery Avoidance Goals (M = 3.51, SD = 1.08). In general, seventh grade Turkish students favored approach goals than the avoidance goals. Basic descriptive statistics are presented in the Table 4.15 below.

Table 4.15 Basic descriptive statistics for TCES

AGQ Subscales	M	SD
Mastery Approach Goals	4.50	.58
Mastery Avoidance Goals	3.51	1.08
Performance Approach Goals	4.30	.81
Performance Avoidance Goals	3.83	.87

Item level analysis for Mastery Approach Goals subscale (Table4.16) suggested that item means ranged from 4.44 (SD = .77) to 4.58 (SD = .72). Participating seventh grade students responded “often” and “always” around 90 % for all items of mastery approach goals subscale. Such high frequencies on the high end of the scale revealed that a great majority of the students value learning and study for mastering the science content that they covered in science classes.

The item means ranged from 3.39 (SD = 1.35) to 3.66 (SD = 1.30) in the Mastery Avoidance Goals subscale items. The ranges of both item means and standard deviations were narrow and close to each other (see Table 4.16). The frequencies of responses gathered roughly equal on the anchors “sometimes”, “often” and “always”. Such a frequency distribution of item anchors suggested that participating seventh grade students had a moderate level of mastery avoidance goal to avoid not to master and learn the course material in science classes.

In terms of Performance Approach Goals subscale, the item means ranged from 4.24 (SD = 1.03) to 4.36 (SD = .97) (see Table 4.16). Similar to mastery avoidance goals, the ranges of both means and standard deviations of performance approach goals are narrow for performance approach goals subscale. Relatively few students responded “never” and “rarely” to performance approach goals items and a great majority preferred to respond to “often” and “always” to the items. The lowest mean score (M = 4.24, SD = 1.03) belonged to the item 7, “My goal in this class is to get a better grade than most of the other students”. Item level analysis indicated that participating seventh grade students try to surpass others and compete with each other in science classes.

The items of Performance Avoidance Goals subscale had the largest range of both item means and standard deviations (see Table 4.16). The item means and standard deviations ranged from M = 3.42, SD = 1.37 to M = 4.25, SD = 1.08 for performance avoidance goals. The largest item mean belonged to the item 13, which is "I just want to avoid doing poorly in this class". For this item, 57 % of the participating students responded anchor five, which is "always". On the other hand, the smallest item mean was on the item 5, which is "My fear of performing poorly in this class compared to others is often what motives me". The frequency distribution for this item was roughly equal for the anchors "sometimes" (3), "often" (4), and "always" (5) and it was around 25 %.

Table 4.16 Descriptive statistics of the items of the AGQ

Subscale	Items	*M*	*SD*	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
				Percentage (%)				
Mastery Approach	1. It is important for me to understand the content of this course as thoroughly as possible.	4.57	.69	.20	1.20	7.00	24.50	67.20
	4. I want to learn as much as possible from this class.	4.58	.72	.40	1.60	6.40	22.70	68.90
	6. I desire to completely master the material presented in this class.	4.44	.77	.40	2.00	8.80	30.50	58.30
Mastery avoidance	8. I worry that I may not learn all that I possibly could in this class.	3.66	1.30	10.00	9.40	19.80	26.30	34.40
	10. I am often concerned that I may not learn all that there is to learn in this class.	3.39	1.35	13.10	13.00	22.90	24.40	26.70
	12. Sometimes I'm afraid that I may not understand the content of this class as thoroughly as I'd like.	3.51	1.30	10.30	11.80	24.30	23.50	30.20

Table 4.16 Descriptive statistics of the items of the AGQ (continued)

Subscale	Items	*M*	*SD*	Percentage (%) Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Performance Approach	3. It is important for me to do better than other students.	4.36	.97	2.40	3.90	9.90	23.10	60.80
	7. My goal in this class is to get a better grade than most of the other students	4.24	1.03	3.40	4.20	11.30	27.40	53.70
	11. It is important for me to do well compared to others in this class.	4.31	.99	2.30	4.40	11.20	24.40	57.70
Performance Avoidance	2. My goal for this class is to avoid performing poorly compared to the rest of the class.	4.10	1.23	8.00	4.40	9.90	24.80	52.90
	5. My fear of performing poorly in this class compared to others is often what motives me	3.42	1.37	14.30	10.30	22.90	24.00	28.50
	9. I just want to avoid doing poorly in this class compared to others.	3.80	1.37	12.00	6.40	14.10	24.70	42.80
	13. I just want to avoid doing poorly in this class.	4.25	1.08	4.30	4.20	10.30	24.60	56.50
	14. My fear of performing poorly in this class is often what motivates me.	3.56	1.39	13.40	9.10	19.50	23.60	34.40
	15. My goal for this class is to avoid performing poorly.	3.81	1.36	11.00	7.50	14.20	23.40	43.90

4.1.4.4.2.2 Descriptive Statistics for Science Self-Efficacy

Science self-efficacy beliefs of 7th grade students was measured by the Science Self-Efficacy Scale (SSES) of motivated Strategies for Learning Questionnaire (MSLQ). MSLQ is a self-report instrument on a seven-point Likert scale, (1 = not at all true of me to 7 = very true of me), and it is developed by Pintrich, Smith, Garcia, and McKeachie (1993). Scale mean (M = 5.46, SD = 1.29) was above the scale midpoint. It means that participating seventh graders feel themselves efficacious in science classes. Table 4.17 below shows the results of the basic descriptive statistics.

The item means of the science self-efficacy scale (see Table 4.17) ranged from 4.91 (SD = 1.96) to 5.73 (SD = 1.69). All item means are above the midpoint of the seven-point scale of science self-efficacy. All items had their highest frequencies on anchors 6 and 7 which indicated that seventh grade students fairly believe in their capabilities to achieve in science classes. The low end of the scale had fairly less number of respondents. For all of the items, the low end of the scale had relatively few frequencies. The first three anchors (1, 2, and 3) had approximately 15 % of responses which indicated students' high level of self-efficacy in their capabilities in science classes.

Table 4.17 Descriptive statistics of the Self-Efficacy subscale of MSLQ

				Percentage (%)						
				Not at all true of me →					Very true of me	
Scale	Items	*M*	*SD*	1	2	3	4	5	6	7
Self-Efficacy	1. I believe I will receive an excellent grade in this class.	5.41	1.73	5.70	1.60	5.70	14.60	17.30	16.10	39.10
	2. I'm certain I can understand the most difficult material presented in the readings for this course.	4.91	1.96	8.90	5.50	9.60	14.60	14.80	16.30	30.30
	3. I'm confident I can understand the basic concepts taught in this course.	5.70	1.66	3.70	2.40	5.90	9.40	13.30	17.40	47.90
	4. I'm confident I can understand the most complex material presented by the instructor in this course.	4.92	1.97	9.70	4.60	9.60	13.30	15.60	16.90	30.30
	5. I'm confident I can do an excellent job on the assignments and tests in this course.	5.73	1.69	4.30	2.70	5.10	8.70	11.90	17.10	50.10
	6. I expect to do well in this class.	5.65	1.70	4.80	2.40	5.30	9.50	12.60	19.30	46.10
	7. I'm certain I can master the skills being taught in this class.	5.64	1.71	5.10	2.40	4.70	9.60	13.20	19.80	45.30
	8. Considering the difficulty of the course, the teacher, and my skills, I think I will do well in this class.	5.74	1.70	4.90	2.30	4.20	9.10	12.30	17.00	50.20

4.1.5 Bivariate Correlations of Teacher and Student Variables

The degree and the direction of the linear relationship between two quantitative variables is calculated by Pearson correlation (Gravetter & Walnau, 2013). Although Pearson correlation does not imply any causality, it provides an idea about the basic relationship between two variables. It is useful to examine bivariate correlations before jumping into further causal analysis. Thus, in this study, two separate correlation analyses were conducted in order to have an idea about the basic bivariate inter-correlations of both student and teacher variables. Firstly, correlation analyses were conducted for student level variables of science achievement test, science self-efficacy, agentic, behavioral, cognitive and emotional engagement, mastery approach-avoidance goals and performance approach-avoidance goals. Secondly, another correlation analysis was conducted to examine the bivariate relationships of teacher variables of school context variables (Autonomy, time pressure, discipline problems, relationships with parents, relationships with colleagues and supervisory support), school goal structures (mastery and performance), instructional approach goals (mastery and performance), teacher self-efficacy (efficacy for student engagement, efficacy for instructional strategy, and efficacy for classroom management), collective efficacy (group competence and task analysis) and professional perceptions (job satisfaction and motivation to leave the teaching profession). Results of the correlation analyses were presented in Table 4.18 for student variables and in Table 4.19 for teacher variables.

Table 4.18 Bivariate correlations of student level variables

	1	2	3	4	5	6	7	8	9	10
1.T_SAT	1									
2.T_SelfEf	.23**	1								
3.T_Agentic	.10**	.44**	1							
4.T_Behavior	.25**	.54**	.48**	1						
5.T_Emotional	.16**	.50**	.47**	**.66****	1					
6.T_Cognitive	.13**	.54**	.57**	**.66****	**.66****	1				
7.T_MastApr	.24**	.45**	.32**	.55**	.47**	.45**	1			
8.T_MastAvo	-.06**	**.06****	.16**	.16**	.16**	.24**	.21**	1		
9.T_PerfApr	**.05****	.32**	.25**	.34**	.29**	.33**	.41**	.31**	1	
10.T_PerfAvo	**-.06****	.15**	.19**	.19**	.19**	.28**	.23**	.59**	.52**	1

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

In student level variables (see Table 4.18), the largest positive bivariate correlations were found between *Emotional* and *Behavioral Engagement* (r = .66), *Cognitive* and *Behavioral Engagement* (r = .66), and *Cognitive* and *Emotional Engagement* (r = .66). The lowest, statistically significant, and positive correlations were found between *Performance Approach Goals* and S*cience Achievement Test* (r = .05) and M*astery Avoidance Goals* and *Science Self-Efficacy* (*r* = -.06). Additionally, the lowest, negative and statistically significant bivariate correlation was found between P*erformance Avoidance Goals* and S*cience Achievement Test* (*r* = -.06). Such low and trivial correlations were found statistically significant most probably due to the large student sample size (3394 students).

For teacher variables (see Table 4.19), the largest, positive and statistically significant bivariate correlations were found between *Efficacy for Student Engagement* and *Efficacy for Classroom Management* (*r* = .67), *Efficacy for Student Engagement* and *Efficacy for Instructional Strategies* (*r* = .65), and *School Mastery Goals* and *School Performance Goals* (*r* = .61). The lowest, statistically significant and positive correlations were found between *Supervisory Support* and *Mastery Approaches to Instruction* (*r* = .17), *Supervisory Support* and *Task Analysis* (r = .18), *School Performance Goals* and *Relations with Parents* (r = .18). The lowest, negative and statistically significant correlations were found between *discipline problems* and *efficacy for student engagement* and (r = -.18) and *discipline problems* and *group competence* (r = -.18), and *Discipline Problems* and *Task Analysis* (r = -.21).

Table 4.19 Bivariate correlations of teacher level variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	T_Parents	1													
2.	T_Discipline	**-.28****	1												
3.	T_Supervisor	.11	.01	1											
4.	T_Collagues	.16	-.04	**.31****	1										
5.	T_SG.Mast	**.27****	-.01	**.30****	**.36****	1									
6.	T_SG.Perf	**.18***	.09	**.29****	.15	**.61****	1								
7.	T_TSE.SE	**.52****	**-.31****	.12	.12	**.43****	**.26****	1							
8.	T_TSE.CM	**.45****	**-.39****	.08	.12	**.25****	.15	**.67****	1						
9.	T_TSE.IS	**.36****	**-.18***	.12	.14	**.48****	**.30****	**.65****	**.59****	1					
10.	T_GrComp	**.22***	**-.18***	.10	**.32****	**.57****	**.25****	**.37****	**.32****	**.43****	1				
11.	T_TaskAn	**.32****	**-.37****	**.18***	.09	**.39****	**.36****	**.52****	**.36****	**.46****	**.22****	1			
12.	T_Atis.Mast	**.34****	**-.21***	**.21***	.10	**.35****	**.23****	**.46****	**.25****	**.44****	**.25****	**.37****	1		
13.	T_Atis.Perf	.11	.06	**.17***	.02	**.24****	**.56****	.10	.08	.077	.04	**.19***	.11	1	
14.	T_Job.Sat	**.46****	**-.31****	**.23****	**.31****	**.18***	.02	**.33****	**.24****	**.23****	**.20***	**.30****	**.32****	.10	1

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

*Correlation is significant at the 0.05 level (2-tailed).

Note. T_ indicates total scores for sub scales.

4.2 Hierarchical Linear Modeling (HLM) Analyses

A set of HLM models were conducted to test the questions investigating the relationships between teacher and student level data. Prior to the analysis, basic assumptions were tested (see sections 4.1.1, 4.1.2, and 4.1.3). Additional assumptions of HLM were provided in Appendix D.

The continuous variables (both student and teacher) that were entered into the HLM analyses were standardized by using z scores (*M* = 0, SD = 1). Standardizing scores provides advantage for readers when making compatisons between predictor variables. In the current study, readers are cautioned that coefficients must be interpreted as standard deviation units which resemble to the interpretations of beta in ordinary least squares regression analysis.

4.2.1 Results of Research Question 1: Students' Engagements in Science Classes

The first set of HLM analysis were performed to provide solutions for the research questions related to students' engagement in science classes.

1. The first research question included 4 sub-questions:

    1. a. To what extent do students in different classes (taught by different teachers) vary in engagement dimensions *(*i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)*?

    1. b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' engagement (i.e.,

Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)?

1. c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) predict students' engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

1. d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) and engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

4.2.1.1 Results of Research Question 1.a: One-Way Random Effects ANOVA Model

1a. To what extent do students in different classes (taught by different teachers) vary in engagement dimensions *(*i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)*?

The regression equation formulated for this empty model is as follows:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$,

Class-level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

In the above equations, the elements represent:

Y_{ij} is the outcome variable (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable.

γ_{00} is the grand mean, that is, overall average score of outcome variable for all classes.

r_{ij} is the random effect of student *i* in class *j*.

u_{0j} is the random effect of class j

Students' engagement had four dimensions, which are *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*, and 4 individual One-Way Random Effects ANOVA models were established for each and every dimension of students' engagement. In these models, dimensions of engagement were included as the outcome variables. As mentioned before, predictor variables both from two levels were not included in the empty or null One-Way Random Effects ANOVA models. Since the continuous variables of the study were standardized before conducting HLM analysis, it is not unexpected that the intercepts are not statistically different from zero that they are non-significant. The resulting final estimations of fixed and random effects produced by the Random Effects ANOVA models were presented in Table 4.20 and, Table 4.21 respectively.

The results of the one-way random effects ANOVA suggested that maximum likelihood estimations of variance components at class level (τ_{00}) for four dimensions of engagement were statistically significant. It means that the variance of class means were varying from class to class. The class (teacher) level variances for engagement dimensions are as follows: *Agentic Engagement* (τ_{00} = .046, χ^2 = 305.08, df = 133, p < .001), *Behavioral Engagement* (τ_{00} = .029, χ^2 = 253.30, df = 133, p < .001), *Cognitive Engagement* (τ_{00} = .030, χ^2= 253.08, df = 133, p < .001), and *Emotional Engagement* (τ_{00} = .049, χ^2 = 333.33, df = 133, p < .001). These findings suggested that conducting HLM analysis is appropriate for the engagement dimensions.

The Intra-Class Correlation (ICC) is stated as the proportion of second level variance (τ_{00}) to the total variance (τ_{00} + σ^2) in the model. Therefore, the ICC can be calculated to see how much variation exists in the second level (Raudenbush & Bryk, 2002; Hox, 2010). The formula for the ICC is as follows:

$$\rho = \tau_{00} / (\tau_{00} + \sigma^2).$$

As an example, the ICC for the students *Agentic Engagement* is calculated as:

$$ICC_{Agentic\ Engagement} = 0.046 / (0.046+0.889) = 0.05$$

Table 4.21 below indicates the ICC’s of the 4 dimensions of student engagement. Accordingly, 5 % of the total variance in *Agentic Engagement,* 4 % of the total variance in *Behavioral Engagement,* 3 % of the total variance in *Cognitive Engagement, and* 6 % of the total variance in Emotional *Engagement* existed between classes, which means these variability might be explained by the second level variables.

The reliability estimates are also calculated by the one-way random effects ANOVA model analysis. The reliability estimate in multilevel models is an indication of the goodness of fit of the group mean to the true group mean. In other words, reliability is the measure of the representability of the group mean and it is the average of the all group (or class) reliabilities (Raudenbush & Bryk, 2002). The formula for the reliability coefficient is:

$$\lambda = \tau_{00} / (\tau_{00} + \sigma^2/n_j).$$

The reliability estimates for the current study are presented in Table 4.21. The reliability estimates range from .47 to .60.

Table 4.20 Final Estimation of Fixed Effects for Student Engagement Dimensions: One-Way Random Effects ANOVA Model

Fixed Effects	Coefficient	SE
Agentic Engagement Average class mean, γ_{00}	.034	.025
Behavioral Engagement Average class mean, γ_{00}	.046	.021
Cognitive Engagement Average class mean, γ_{00}	.041	.022
Emotional Engagement Average class mean, γ_{00}	.038	.025

Table 4.21 Final Estimation of Variance Components for Student Engagement Dimensions: One-Way Random Effects ANOVA Model

Random Effects	Variance Components	df	χ^2	ICC (ρ)	Reliability(λ)
Agentic Engagement					
Class mean, u_{0j}	.046	133	305.081***	.05	.56
Level-1 Effect, *rij*	.889				
Behavioral Engagement					
Class mean, u_{0j}	.029	133	253.300***	.04	.47
Level-1 Effect, *rij*	.811				
Cognitive Engagement					
Class mean, u_{0j}	.030	133	253.080***	.03	.47
Level-1 Effect, *rij*	.865				
Emotional Engagement					
Class mean, u_{0j}	.049	133	333.33***	.06	.60
Level-1 Effect, *rij*	.817				

Note. ICC = Intraclass correlation,
*** $p < .001$

4.2.1.2 Results of Research Question 1.b: Means as Outcomes Model

1. b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' engagement (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

The question above, which is related to students' engagements in science classes, was tested through a *Means as Outcomes Model*. In HLM analysis, *Means as Outcomes Model* is used for predicting an outcome variable which is at the level one by level two variables. Since the information provided by One-Way Random Coefficients model tested in section 4.3.2.1 suggested modelling level two variables, teacher (class) level variables were included in this model. Results of means as outcomes model for engagement dimensions were presented in Table 4.22 and Table 4.23, respectively.

Students' engagement in science classes was assessed through Students' Engagement Questionnaire (SEQ), which included 4 subscales namely Agentic Engagement subscale, Behavioral Engagement subscale, Cognitive Engagement subscale, and Emotional Engagement subscale. Four separate *Means as Outcomes Model* were constructed to investigate the individual contributions of level two variables to predict students' engagement dimensions. In these level two variables only models, level two variance, τ_{00}, is described as the residual or conditional variance after controlling for other level two variables (Raudenbush & Bryk, 2002).

The regression equation for this question is as follows:

Student level (level-1) model:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + \gamma_{02}(\text{ZT\_AtISP}) + \gamma_{03}(\text{ZT\_TSESE}) + \gamma_{04}(\text{ZT\_TSEIS}) + \gamma_{05}(\text{ZT\_TSECM}) + \gamma_{06}(\text{ZT\_GRCOMP}) + \gamma_{07}(\text{ZT\_TASKAN}) + \gamma_{08}(\text{ZT\_JOBSAT}) + u_{0j}$$

The elements in the above equations represent:

Y_{ij} is the outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{00} is the grand mean, that is, overall average score of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) for all classes.

γ_{01} is the differentiating effect of teacher's Mastery Approaches to Instruction on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{02} is the differentiating effect of teacher's Performance Approaches to Instruction on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{03} is the differentiating effect of teacher's Efficacy Beliefs for Student Engagement on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{04} is the differentiating effect of teacher's Efficacy Beliefs for Instructional Strategies on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{05} is the differentiating effect of teacher's Efficacy Beliefs for Classroom Management on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{06} is the differentiating effect of teacher’s Collective Efficacy Beliefs for Group Competence on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{07} is the differentiating effect of teacher’s Collective Efficacy Beliefs for Task Analysis on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

γ_{08} is the differentiating effect of teacher’s Job Satisfaction on class mean of outcome variable (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*).

r_{ij} is the level-1 residual.

u_{0j} is the level-2residual.

The entering order of the level two variables were determined as was done for self-efficacy in section 4.3.1.2. The final estimations model included only significant level two variables. Results of the final estimations of Means as Outcomes Models constructed for students’ engagement dimensions were presented in Table 4.22 and Table 4.23.

The results of the Means as Outcomes Model constructed for Agentic Engagement dimension suggested that none of the teacher level variables predicted students’ agentic engagement. In other words, while One-Way Random Coefficients ANOVA model suggested an existence of level two variance component for Agentic Engagement, the specified level two variables were not able to capture any portion of this variability between classes. However, the results of Means as Outcomes Model constructed for Behavioral Engagement suggested significant level two predictors for the level two variance component of *Behavioral Engagement*. Teachers' *Mastery Approaches to Instruction* (ZT_AtISM; $\gamma = .062$, se = .024, $p < .05$) was found as positively significantly associated and teachers' Collective Efficacy for Task Analysis (ZT_TASKAN; $\gamma = -.049$, se = .022, $p < .05$) was found as negatively significantly associated with students' Behavioral Engagement in science classes. Such findings suggested that students taught by teachers whose instruction is based on mastery approaches engaged behaviorally more in science classes. Moreover, students taught by teachers making less analysis of teaching were found to engage behaviorally more in science classes. For *Cognitive Engagement*, while teachers' *Mastery Approaches to Instruction* (ZT_AtISM; $\gamma = .054$, se = .026, $p < .05$) was found as positively significantly associated, teachers' *Self Efficacy for Student Engagement* (ZT_TSESE; $\gamma = -.065$, se = .024, $p < .05$) was found as negatively significantly associated with students' *Cognitive Engagement* in science classes. These findings indicated that, similar to behavioral engagement, students' cognitive engagement in science class is higher in classes where science teachers utilize mastery approaches in their instruction. On the other hand, students taught by teachers who are less confident in engaging students' in science class were found more cognitively engaged in science classes. Concerning Emotional engagement, Means as Outcomes Model results suggested that while teachers' *Mastery Approaches to Instruction* (ZT_AtISM; $\gamma = .071$, se = .027, $p < .05$) was found as positively significantly associated, teachers' *Self Efficacy for Student Engagement* (ZT_TSESE; $\gamma = -.076$, se = .026, $p < .05$) was found as negatively significantly associated with students' *Emotional Engagement* in science classes. Results of Means as Outcomes Model for emotional engagement overlaps with the results of same analysis on cognitive engagement. When science teachers use mastery approaches in their science instruction, students are more emotionally engaged in science. However, students who are in classes of teachers possessing low efficacy in engaging students to science are more emotionally engaged in science classes.

The comparison of the residual variances (τ_{00}) of previously established *One-Way Random Effects ANOVA Model* with *Means as Outcomes Model* indicated that there is a decrease in the variance components of *Means as Outcomes Model* for behavioral, cognitive and emotional engagement dimensions. As mentioned before, any of the level two variables predicted agentic engagement. Therefore, there is no need to check the difference between residual variance components of agentic engagement. The proportion of variance explained at class level, R^2, can be calculated by subtracting τ_{00} calculated by *Means as Outcomes Model* from τ_{00} calculated by *One-Way Random Effects ANOVA Model*. This calculation is done separately for every dimension of engagement. For illustrative purposes, the calculation of R^2 for behavioral engagement is shown below:

R^2 = Proportion of variance explained by β_{0j}

$$= \frac{\tau_{00}(\,Random\ Effects\ ANOVA\ Model) - \tau_{00}(Means\ as\ Outcomes\ Model)}{\tau_{00}(\,Random\ Effects\ ANOVA\ Model)}$$

Proportion of variance explained by level two variables for behavioral engagement is calculated as

$$= \frac{0.02884 - 0.02548}{0.02884} = 0.117$$

As shown in the Table 4.23, 11.7 % of the true between-class variance in students' behavioral engagement in science class was explained by the teachers' *Mastery Approaches to Instruction* and *Collective Efficacy for Task Analysis*. The same calculation procedure was used to find out the R^2 for cognitive and emotional engagement. The proportion of variance explained by β_{0j} for cognitive engagement was 11.1 %, which was explained by the teacher variables of *Mastery Approaches to Instruction* and *Efficacy for Student*

Engagement. The proportion of variance explained by β_{0j} for emotional engagement was 11.0 %. Similar to cognitive engagement, the same teacher variables, *Mastery Approaches to Instruction* and *Efficacy for Student Engagement,* explained the level two variance for emotional engagement. Additionally, for behavioral, cognitive, and emotional engagement χ^2 statistic is still significant (see Table 4.23). This means that, there is still a considerable amount of residual variance for behavioral, cognitive and emotional engagement varying among classes and these predicting teacher variables were not sufficient to explain the whole amount of residual variance.

Table 4.22 Final estimations of fixed effects for teacher level predictors - Means as Outcomes Model for Engagement Dimensions

Fixed Effects	Behavioral Engagement		Cognitive Engagement		Emotional Engagement	
	γ	SE	γ	SE	γ	SE
Model for Class Means						
Intercept	.047	.021	.042	.021	.039	.024
ZT_AtISM (Mastery Approaches to Instruction)	.062*	.024	0.54*	.026	.071	.027
ZT_TSESE Efficacy for Student Engagement			-.065*	.024	-.076*	.026
ZT_TASKAN Task Analysis	-.049*	.022				

Note. Only predictors in final models were included in the table. The all continuous teacher level variables were grand mean centered.
*p < .05

Table 4.23 Final Estimation of Variance Components for Engagement Dimensions: Means as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2
Agentic Engagement				
Class mean, u_{0j}	.048	125	293.042***	-
Level-1 Effect, *rij*	.924			
Behavioral Engagement				
Class mean, u_{0j}	.025	131	236.306***	.117
Level-1 Effect, *rij*	.811			
Cognitive Engagement				
Class mean, u_{0j}	.027	131	236.882***	.111
Level-1 Effect, *rij*	.865			
Emotional Engagement				
Class mean, u_{0j}	.044	131	307.102***	.110
Level-1 Effect, *rij*	.817			

*** $p < .001$

4.2.1.3 Results of Research Question 1.c: Random Coefficients Model

1. c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) predict students' engagements (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)?

The research question above investigated the contribution of student level variables of self-efficacy and achievement goals (i.e. *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) on students' engagements (i.e. *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*). For this purpose, a Random Coefficients Model was constructed for each dimension of students' engagement in science classes. In these models, students' self-efficacy in science classes and achievement goals (*Mastery*

Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals) were entered as level one predictors and students' engagements (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)* as outcome variables. In Random Coefficients Model, an equation consisting of intercepts and slopes are constructed for every class and this model provides information about the average of the all classes' intercepts and slopes. Additionally, the variation caused by the regression equations from class to class is also provided in the model output. The hypothesized relationships between predictors and outcomes, the slopes, can be fixed or random. A "Fixed slope" means that the degree of the relationship between predictor and outcome variable is approximately the same in each class. However, if the degree of the relationship is a "random slope", then it means that the degree of the relationship between the predictor and the outcome varies from class to class. In other words, the slopes may be steep or flat in different classes.

The regression equation for the research question 3.c is as follows:

Student level (level-1) model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + \beta_{5j} *(ZT\_PERFAVO) + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

.

.

.

$\beta_{qj} = \gamma_{q0} + u_{qj}$

In these models, the parameters indicate,

Y_{ij} is the outcome variable (i.e., *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*)

β_{0j} is the mean on each engagement dimension (i.e., average scores of the all classes on related outcome variable)

β_{1j} is the differentiating effect of students' self-efficacy in class j (i.e., the degree to which perceptions of student self-efficacy among students related to outcome variable)

β_{2j} is the differentiating effect of students' mastery approach goals in class j (i.e., the degree to which perceptions of mastery approach goals among students related to outcome variable)

β_{3j} is the differentiating effect of students' mastery avoidance goals in class j (i.e., the degree to which perceptions of mastery avoidance goals among students related to outcome variable)

β_{4j} is the differentiating effect of students' performance approach goals in class j (i.e., the degree to which perceptions of performance approach goals among students related to outcome variable)

β_{5j} is the differentiating effect of students' performance avoidance goals in class j (i.e., the degree to which perceptions of mastery approach goals among students related to outcome variable)

β_{qj} is the coefficient for variable q for class j after accounting for other variables

γ_{00} is the average of class means on the outcome variable across the population of classes

γ_{q0} is the average regression slope across those classes

u_{0j} the unique increment to the intercept associated with class j

u_{qj} the unique increment to the slope associated with class j

In the above regression equations, β_{0j} represented the intercepts and all other β's represented the slope parameters for each predictor variables.

The Random Coefficient Models of engagement dimensions were constructed based on the recommendations of Raudenbush and Bryk (2002). In order to be able to construct the final model, all level one predictors were entered the model and the analysis was run. The t-ratios of predictor variables were examined and they were ranked in a descending order. The variable with the highest absolute t-ratio was determined as the first predictor. Subsequently, remaining variables were entered in the model in a descending order in their t-ratios. Level one predictors in random coefficients model can vary between classes. Therefore, different from means as outcomes model, examining only the significance of t-ratios in the fixed effects part of the output is not sufficient for random coefficients model. As the name of the model implies, the slope coefficients may be random in the second level. Variance components section should be examined for the randomness of the slopes. In such a model, four different significance scenarios could be possible: (1) a level one predictor variable may be both fixed and random, (2) a level one predictor variable may be only fixed, (3) a level one predictor variable may be only random, and (4) a level one predictor variable may be neither fixed nor random. Based on the recommendations of Raudenbush and Bryk (2002), if a predictor variable is both fixed and random, it was kept in the model as randomly varying. If a level one predictor variable is only fixed, then it is kept as fixed. If a level one predictor variable is random but not fixed, then it was kept as random. And lastly, if a level one predictor variable is neither fixed nor random then it was excluded from the model. After constructing the final version of the model, the results of the Random Coefficient Model for each dimension of engagement, final estimation of fixed effects and random effects were presented in Table 4.24 and Table 4.25, respectively. The final estimation of random coefficient models were detailed separately for each dimension of students' engagement below.

4.2.1.3.1 Agentic Engagement: Random Coefficients Model

Results of the Random coefficients model for agentic engagement revealed that among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), fixed effects of *Self-Efficacy* (*ZT_SELF*; $\gamma = .358$, se = .017, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; $\gamma = .122$, se = .018, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; $\gamma = .093$, se = .015, $p < .001$), and *Performance Approach Goals* (ZT_PERFAP; $\gamma = .062$, se = .018, $p < .01$) were positively and significantly correlated with *Agentic Engagement*. There was not a significant relationship between agentic engagement and performance avoidance goals of students in science classes. These findings indicated that students having high self-efficacy in science, setting mastery approach, mastery avoidance and performance approach goals tend to be more agentic engaged in science class. In trustingly, however, none of the slope coefficients of level one variables varied significantly between classes. Thus, all of the level one variables predicting agentic engagement were kept as fixed effects in the model.

The decrease in the level one variance (σ^2) due to the adding of level one predictors was calculated by subtracting the level one variance of Random Coefficients model constructed for agentic engagement from level one variance (σ^2) of null model (One-Way Random Effects ANOVA) constructed previously for agentic engagement. The formula of explained variance (R^2) for agentic engagement was calculated as follows:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.88866 - 0.68923}{0.88866} = .224$$

According to the calculations based on above formula, *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals,* and *Performance Approach Goals* all together explained 22.4 % of the within class variability of agentic engagement.

4.2.1.3.2 Behavioral Engagement: Random Coefficients Model

Results of the Random coefficients model for behavioral engagement revealed that among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), fixed effects of *Self-Efficacy* (*ZT_SELF*; γ = .338, se = .016, p < .001), *Mastery Approach Goals* (ZT_MASTAP; γ = .368, se = .020, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; $\gamma = .043$, se = .014, $p < .01$), and *Performance Approach Goals* (ZT_PERFAP; $\gamma = .064$, se = .015, $p < .001$) were positively and significantly correlated with *Behavioral Engagement*. There was not a significant relationship between behavioral engagement and performance avoidance goals of students in science classes. These findings indicated that students that have high self-efficacy in science, setting mastery approach, and mastery avoidance and performance approach goals tend to be more behaviorally engaged in science class. For variance components of the predictors of behavioral engagement slopes, results suggested that the slope of *Self-Efficacy – Behavioral Engagement* (χ^2 = 176.042, $p < .01$), the slope of *Mastery Approach Goals – Behavioral Engagement* (χ^2 = 190.752, $p < .001$), and the slope of *Performance Approach Goals – Behavioral Engagement* (χ^2 = 163.666, $p < .05$) varied significantly randomly among classes. In other words, the relationship between predictors and outcome is stronger in some classes and weaker in some classes. This means that class differences, which may be due to teacher characteristics, may account for some portion of variability of slopes lines. Lastly, performance avoidance goals has a significant fixed effect on behavioral engagement, although its random effect was not found as significant. Therefore, it was kept in the model as fixed.

To reveal how much variation of Behavioral Engagement was explained by the inclusion of level one variables, the level one variance (σ^2) of One-Way Random Effects ANOVA model for Behavioral Engagement and the level one variance (σ^2) of Random Coefficients Model for Behavioral Engagement Model were compared. The reduced variance, R^2, was calculated for Behavioral Engagement as follows:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.81118 - 0.46562}{0.81118} = .425$$

The inclusion of level one variables (self-efficacy, mastery approach goals, mastery avoidance goals, and performance approach goals) in the Random Coefficients Model for Behavioral engagement accounted for 42.5 % of the within class variance in students' behavioral engagement in science classes.

Concerning the reliability coefficients of the intercept and randomly varying slopes, the findings suggested that reliability of the mastery approach slope (.26) was more reliable than the reliability of the other slopes (.21 for self-efficacy and .10 for performance approach) and the intercept (.23).

4.2.1.3.3 Cognitive Engagement: Random Coefficients Model

Results of the random coefficients model for cognitive engagement revealed that among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), fixed effects of *Self-Efficacy* (*ZT_SELF*; γ = .405, se = .015, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; γ = .232, se = .019, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; γ = .113, se = .018, $p < .001$), and *Performance Avoidance Goals* (ZT_PERFAVO; γ = .091, se = .018, $p < .001$) were positively and significantly correlated with *Cognitive Engagement*. There was not a significant relationship between cognitive engagement and performance approach goals of students in science classes. These findings suggested that students possessing high self-efficacy in science, setting mastery approach, mastery avoidance and performance avoidance goals tend to be more cognitively engaged in science classes. For variance components of the predictors of cognitive engagement slopes, results of random coefficients model suggested that the slope of *Self-Efficacy – Cognitive Engagement* (χ^2 = 196.051, $p < .001$) and the slope of *Mastery Avoidance Goals*

– *Cognitive Engagement* (χ^2 = 178.600, p < .01) varied significantly randomly among classes. These findings suggest that class differences, which may be caused by teacher level variables, may explain some portion of these differences. Lastly, performance approach goals had neither fixed nor random significant effect on cognitive engagement. Therefore, it was removed from the model.

To find out how much variance of Cognitive Engagement was explained by the inclusion of level one variables, the level one variance (σ^2) of One-Way Random Effects ANOVA model built for Cognitive Engagement and the level one variance (σ^2) of Random Coefficients Model built for Cognitive Engagement Model were compared. The reduced variance, R^2, was calculated for Cognitive Engagement as follows:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.86484 - 0.53136}{0.86484} = .385$$

The inclusion of level one variables (self-efficacy, mastery approach goals, mastery avoidance goals, and performance avoidance goals) in the Random Coefficients Model for Cognitive engagement accounted for 38.5 % of the within class variance in students' cognitive engagement in science classes.

Concerning the reliability coefficients of the intercept and randomly varying slopes, the findings indicated that reliability of the intercept and performance avoidance slopes (.28) were found more reliable than mastery approach slope (.21).

4.2.1.3.4 Emotional Engagement: Random Coefficients Model

Lastly, for emotional engagement dimension of students' engagement in science classes, results of the random coefficients model revealed that among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), fixed effects of *Self-Efficacy* (*ZT_SELF*; $\gamma = .336$, se = .018, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; $\gamma = .292$, se = .022, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; $\gamma = .068$, se = .014, $p < .001$), and *Performance Approach Goals* (ZT_PERFAP; $\gamma = .039$, se = .018, $p < .05$) were positively and significantly linked with *Emotional Engagement*. There was not a significant relationship between emotional engagement and performance avoidance goals of students in science classes. These findings suggested that students having high levels of self-efficacy, setting mastery approach, mastery avoidance and performance approach goals tend to be more emotionally engaged in science classes. For variance components of the predictors of emotional engagement slopes, results of random coefficients model suggested that the slope of *Self-Efficacy – Emotional Engagement* ($\chi^2 = 194.178$, $p < .01$), the slope of *Mastery Approach Goals – Emotional Engagement* ($\chi^2 = 198.936$, $p < .001$), and the slope of *Performance Approach Goals – Emotional Engagement* ($\chi^2 = 189.179$, $p < .01$) varied significantly randomly among classes. These findings suggested that class differences, which may be caused by level two variables, may account for some portion of these differences. Lastly, performance avoidance goals had neither fixed nor random significant effect on emotional engagement. Therefore, it was excluded from the model.

To investigate how much variance of Emotional Engagement was explained by the inclusion of level one variables, the level one variance (σ^2) of One-Way Random Effects ANOVA model constructed for Emotional Engagement and the level one variance (σ^2) of Random Coefficients Model constructed for Emotional Engagement Model were compared. The reduced variance, R^2, was calculated for Emotional Engagement as follows:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.81699 - 0.53293}{0.81699} = .347$$

The inclusion of level one variables (self-efficacy, mastery approach goals, mastery avoidance goals, and performance approach goals) in the Random Coefficients Model for emotional engagement explained 34.7 % of the within class variance in students' emotional engagement in science classes.

Concerning the reliability coefficients of the intercept and randomly varying slopes, the findings indicated that reliability of the intercept (.44) was found to be more reliable than the reliability of self-efficacy slope (.28), mastery approach slope (.27) and performance approach slope (.19).

Table 4.24 Final estimations of fixed effects for level one predictors – Random Coefficients Model for Engagement Dimensions

	Agentic Engagement		Behavioral Engagement		Cognitive Engagement		Emotional Engagement	
Fixed Effects	γ	SE	γ	SE	γ	SE	γ	SE
Model for Class Means Intercept	.036	.021	.049	.014	.041	.015	.044	.018
ZT_SELF (Self-Efficacy)	.358***	.017	.338***	.016	.405***	.015	.336***	.018
ZT_MASTAP Mastery Approach Goals	.122***	.018	.368***	.020	.232***	.019	.292***	.022
ZT_MASTAVO Mastery Avoidance Goals	.093***	.015	.043**	.014	.113***	.018	.068***	.014
ZT_PERFAPP Performance Approach Goals	.062**	.018	.064***	.015			.039*	.018
ZT_PERFAVO Performance Avoidance Goals					.091***	.018		

Note. Only predictors in final models were included in the table. Predictors that have no coefficient value in the table were excluded variables from the related model because of its non-significant fixed and random effect on outcome variable.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.25 Final Estimation of Variance Components for Engagement Dimensions: Random Coefficients Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Agentic Engagement					
Class mean, u_{0j}	.034	133	300.765***	.224	.55
Level-1 Effect, *rij*	.689				
Behavioral Engagement					
Class mean, u_{0j}	.007	133	183.599**		.23
ZT_SELF	.008	133	176.042**		.21
ZT_MASTAP	.015	133	190.752**		.26
ZT_PERFAP	.004	133	163.666*		10
Level-1 Effect, *rij*	.465			.425	
Cognitive Engagement					
Class mean, u_{0j}	.010	133	196.654 ***		.28
ZT_MASTAP	.009	133	196.051***		.21
ZT_PERFAVO	.010	133	178.600**		.28
Level-1 Effect, *rij*	.531			.385	
Emotional Engagement					
Class mean, u_{0j}	.022	133	275.286***		.44
ZT_SELF	.014	133	194.178**		.28
ZT_MASTAP	.017	133	198.936***		.27
ZT_PERFAP	.009	133	189.179**		.19
Level-1 Effect, *rij*	.533			.347	

*$p < .05$, **$p < .01$, *** $p < .001$

4.2.1.4 Results of Research Question 1.d: Intercepts and Slopes as Outcomes Model

1. d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) and engagement (i.e., *Agentic*

Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)?

To be able to test the research question above, an Intercepts and Slopes as Outcomes model was constructed. In this model, previously conducted Means as Outcomes Models and Random Coefficients Models were used. Randomly varying slopes detected by Random coefficients Model were modeled again by incorporating each teacher level variable to the random slopes to find out whether teacher level variables exert influence on the related slope. The influence of level two variables are named as interaction effect across level, which is a moderation effect by teacher level variables.

As mentioned above, in order to conduct intercepts and slopes as outcomes model, the results of previously conducted means as outcomes model and random coefficients model are required. Means as outcomes model provides the class level factors that account for the variability in intercepts of each dimension of outcome variable and random coefficients model provides student level predictors of the outcome variable whether they are fixed or randomly varying. Based on these technical explanations, for research question 3.d, intercepts and slopes as outcomes models were constructed for every dimension of students' engagement.

4.2.1.4.1 Agentic Engagement: Results of Intercepts and Slopes as Outcomes Model

Previously conducted means as outcomes model and random coefficients model for agentic engagement suggested that while none of the teacher level variables predicted the intercept of students' agentic engagement, level one variables of *Self-Efficacy* (*ZT_SELF*; $\gamma = .358$, se = .017, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; $\gamma = .122$, se = .018, $p < .001$), *Mastery Avoidance Goals*

(ZT_MASTAVO; γ = .093, se = .015, p < .001), and *Performance Approach Goals* (ZT_PERFAP; γ = .062, se = .018, p < .01) were positively and significantly correlated with *Agentic Engagement*. However, none of the level one slopes varied significantly among classes. Since there were no random slopes in agentic engagement dimension of students' engagement, there is no need to build an intercepts and slopes as outcomes model for agentic engagement.

The final model for agentic engagement is presented below:

Student level (level-1) model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}$$

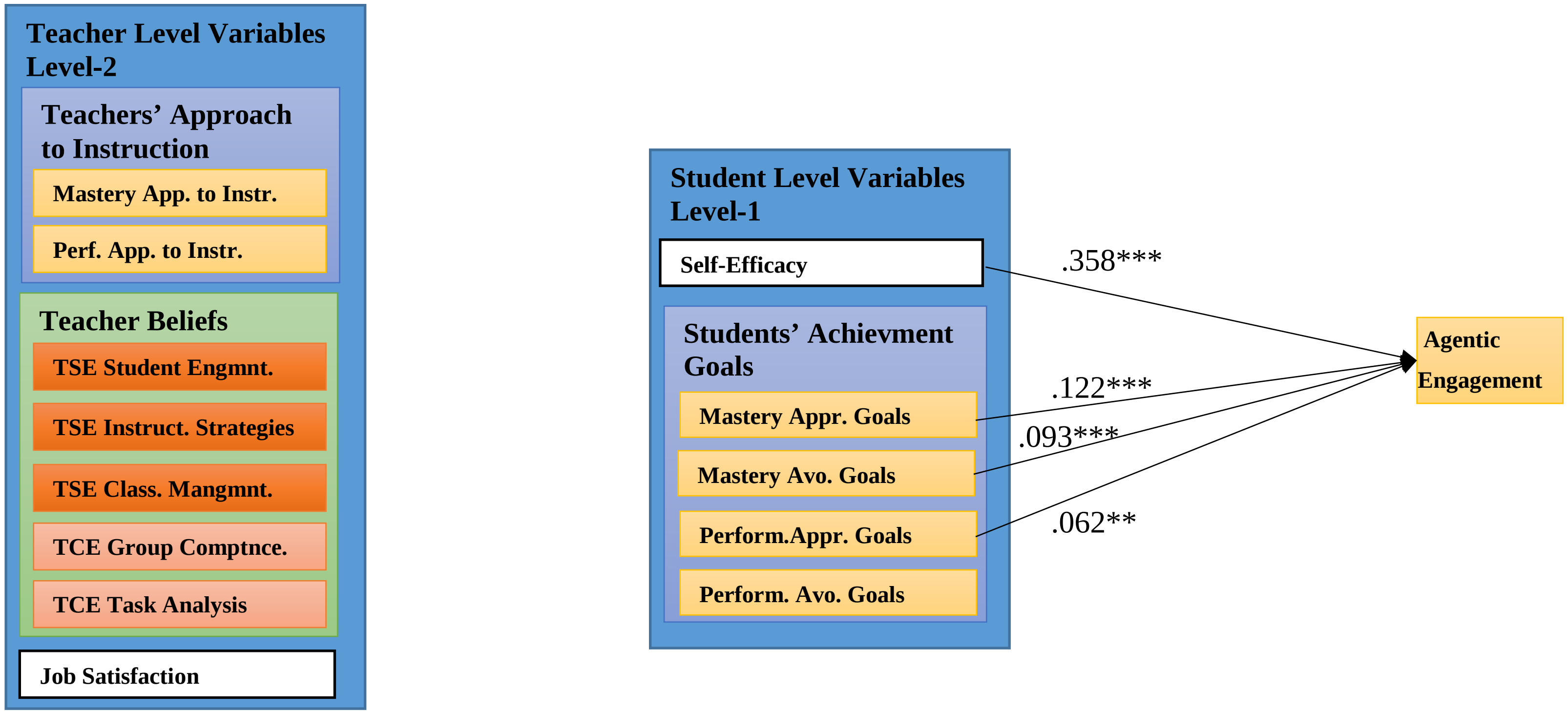

Figure 4.1 Predicting Agentic Engagement by self-efficacy, achievement goals (level-1), and teacher level variables (level-2)

Note: Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

**p* < .05, ***p* <.01, ****p* < .001

4.2.1.4.2 Behavioral Engagement: Results of Intercepts and Slopes as Outcomes Model

Intercepts and Slopes as Outcomes model was constructed for behavioral engagement by taking results of the previously conducted means as outcomes and random coefficients models into consideration. Student level variables (level one) and teacher level variables (level two) variables were included in the current model subsequently. As the first step, the significantly associated teacher level variables with the intercept of the behavioral engagement in Means as Outcomes Model (*Mastery Approaches to Instruction*) and significantly associated student level variables of behavioral engagement in Random Coefficients Model (*Self-Efficacy*, *Mastery Approach Goals*, *Mastery Avoidance Goals*, and *Performance Approach Goals)* were run in a single model.

The equations for the first model in these analyses are:

Student Level (level-1) Model:

Behavioral engagement (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (ZT\_AtISM)}_j + \gamma_{02} \text{ (ZT\_TASKAN)}_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

The analysis of the above model suggested that two teacher level variables, which predicted the intercept of behavioral engagement, became non-significant after including student level variables. Therefore, these two teacher level variables, *teachers' Mastery Approaches to Instruction and Task Analysis,* were removed from the model.

In the next step, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictors (*Self-Efficacy, Mastery Approach Goals*, and *Performance Approach Goals*) of behavioral engagement.

Below equations show the incorporated level two variables into the slope of self-efficacy – behavioral engagement.

Student Level (level-1) Model:

Behavioral engagement (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Class level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{ZT\_AtISM})_j + \gamma_{12}(\text{ZT\_AtISP}) + \gamma_{13}(\text{ZT\_TSESE}) + \gamma_{14}(\text{ZT\_TSEIS}) + \gamma_{15}(\text{ZT\_TSECM}) + \gamma_{16}(\text{ZT\_GRCOMP}) + \gamma_{17}(\text{ZT\_TASKAN}) + \gamma_{18}(\text{ZT\_JOBSAT}) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40} + u_{4j}$$

Results of the model above indicated that none of the 8 teacher level variables were significant. Thus, all of the teacher level variables were removed from the model of *Self-Efficacy-Behavioral Engagement* slope.

Then, the same procedure of incorporating level two variables into the randomly varying slopes of level one predictors was followed in the test for *Mastery Approach Goals*. The equations were as follows:

Behavioral engagement (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$\beta_{2j} = \gamma_{20} + \gamma_{11}(\text{ZT\_AtISM})_j + \gamma_{12}(\text{ZT\_AtISP}) + \gamma_{13}(\text{ZT\_TSESE}) + \gamma_{14}(\text{ZT\_TSEIS}) + \gamma_{15}(\text{ZT\_TSECM}) + \gamma_{16}(\text{ZT\_GRCOMP}) + \gamma_{17}(\text{ZT\_TASKAN}) + \gamma_{18}(\text{ZT\_JOBSAT}) + u_{2j}$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

Similar to *Self-Efficacy- Behavioral Engagement* slope, none of the teacher level variables were found significant for *Mastery Approach Goals – Behavioral Engagement* slope. Therefore, they were all removed from the model.

Lastly, 8 teacher level variables were tested for Performance Approach Goals – Behavioral Engagement slope. The equations this analysis are:

Behavioral engagement (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Class level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

$\beta_{2j} = \gamma_{20} + u_{2j}$

$\beta_{3j} = \gamma_{30}$

$$\beta_{4j} = \gamma_{40} + \gamma_{11}(ZT\_AtISM)_j + \gamma_{12}(ZT\_AtISP) + \gamma_{13}(ZT\_TSESE) + \gamma_{14}(ZT\_TSEIS) + \gamma_{15}(ZT\_TSECM) + \gamma_{16}(ZT\_GRCOMP) + \gamma_{17}(ZT\_TASKAN) + \gamma_{18}(ZT\_JOBSAT) + u_{4j}$$

Similar to *Self-Efficacy- Behavioral Engagement* slope, and *Mastery Approach Goals – Behavioral Engagement* slope, none of the teacher level variables were found significant for *Performance Approach – Behavioral Engagement Slope*. Therefore, they were all removed from the model as well. For the final form of the intercepts and slopes as outcomes model, the following equation remained:

Behavioral engagement (Y_{ij})

$$= \beta_{0j} + \beta_{1j}*(ZT\_SELF) + \beta_{2j}*(ZT\_MASTAP) + \beta_{3j}*(ZT\_MASTAVO) + \beta_{4j}*(ZT\_PERFAP) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40} + u_{4j}$$

Final version of Intercepts and slopes as outcomes model indicated that while teachers' mastery approaches to instruction and task analysis were significant predictors in means as outcomes model, they became non-significant after adding random coefficients model results and running the analysis all together.

Moreover, none of the teacher level variables were significant for the randomly varying slopes of self-efficacy-behavioral engagement, mastery approach goals-behavioral engagement, and performance approach goals-behavioral engagement. Therefore, it is not appropriate to talk about the moderation effect of level two variables on the slopes of random predictor variables. Nevertheless, the results of the final form of Intercepts and Slopes as outcomes model indicated that slopes of self-efficacy (χ^2 = 176.042, p < .01), mastery approach goals (χ^2 = 190.752, p < .01), and performance approach goals (χ^2 = 163.666, p < .05) still varied significantly among classes and teacher level variables of the present study were unable to capture this variability. Table 4.26 and Table 4.27 shows the fixed effects and random components of Intercepts and slopes as Outcomes model for behavioral engagement dimension.

Table 4.26 Final estimations of fixed effects for Behavioral Engagement – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.049	.014
ZT_SELF (Self-Efficacy)	.338***	.016
ZT_MASTAP Mastery Approach Goals	.368***	.020
ZT_MASTAVO Mastery Avoidance Goals	.043**	.014
ZT_PERFAPP Performance Approach Goals	.064***	.015

Note. Only predictors in final models were included in the table.
*p < .05, **p < .01, ***p < .001

Table 4.27 Final Estimation of Variance Components for Behavioral Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Behavioral Engagement					
Class mean, u_{0j}	.007	133	183.599**		.23
ZT_SELF	.008	133	176.042**		.21
ZT_MASTAP	.015	133	190.752**		.26
ZT_PERFAP	.004	133	163.666*		10
Level-1 Effect, *rij*	.465			.425	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

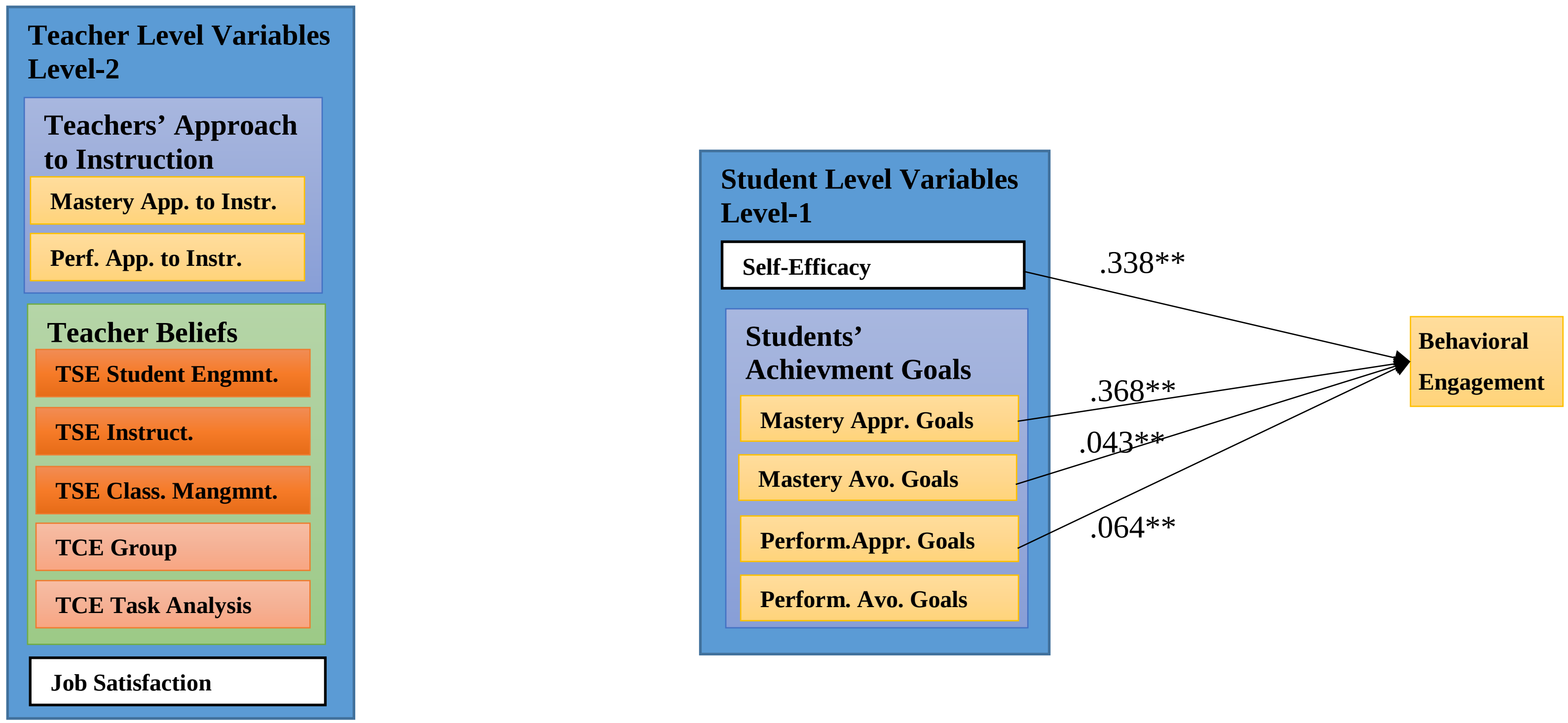

Figure 4.2 Predicting Behavioral Engagement by self-efficacy, achievement goals (level-1), and teacher level variables (level-2)

Note: Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

*p < .05, **p <.01, ***p < .001

4.2.1.4.3 Cognitive Engagement: Results of Intercepts and Slopes as Outcomes Model

A set of Intercepts and Slopes as Outcomes models were constructed for Cognitive Engagement by incorporating the results of the previously constructed models for cognitive engagement. The variables at level one and level two were included in the current model subsequently. At first, the teacher level variables which were previously found as significantly linked with intercept of Cognitive Engagement in Means As Outcomes Model (*teachers' Mastery Approaches to Instruction* and *teachers' Efficacy for Student Engagement*) and student level variables which were previously found as significant predictors of Cognitive Engagement in Random Coefficients Model (*Self-Efficacy*, *Mastery Approach Goals*, *Mastery Avoidance Goals*, and *Performance Avoidance Goals*) were run in a composite model.

The equations for the first model are:

Student Level (level-1) Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAVO) + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_{j} + \gamma_{02}(\text{ZT\_TSESE}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

Results of the above model indicated that teachers' Mastery Approaches to Instruction was not found significantly associated with the intercept of cognitive engagement. Thus, it was removed from the model and the rest of the models were built only with teachers' Efficacy for Student Engagement variable.

Afterwards, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction*, *Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence*, *Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictors (*Self-Efficacy and Mastery Avoidance Goals)* of cognitive engagement.

The same procedure was followed for each randomly varying slope (i.e. *Mastery Approach Goals and Performance Avoidance Goals*) in the model as was done for the behavioral engagement and non-significant variables were removed from the model. The final form of the equations for the Intercepts and Slopes as Outcomes Model for Cognitive Engagement was as follows:

$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAVO) + r_{ij}$

Teacher level (level-2) model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_TSESE}) + u_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20} + \gamma_{21}$ (ZT_JOBS) $+ u_{2j}$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40} + \gamma_{41}$(ZT_TSESE) $+ u_{4j}$

The results of the final estimations of fixed effects of the final full Intercepts and Slopes as Outcomes Model for cognitive engagement were shown in Table 4.28. Students' average scores on Cognitive Engagement significantly but negatively associated with teachers' efficacy for student engagement (ZT_TSESE; $\gamma = -.034$, se = .013, $p < .01$). Moreover, Intercepts and Slopes as Outcomes Model included the results of Random Coefficients Model. These results suggested that, among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), *Self-Efficacy* (*ZT_SELF*; $\gamma = .410$, se = .015, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; $\gamma = .231$, se = .018, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; $\gamma = .113$, se = .018, $p < .001$), and *Performance Avoidance Goals* (ZT_PERFAVO; $\gamma = .091$, se = .018, $p < .001$) were positively and significantly correlated with *Cognitive Engagement*. There might be slight differences in slope coefficient in the random coefficients models and intercepts and slopes as outcomes model. This might be the result of adding level two variables in the model.

Results of final full Intercepts and Slopes as Outcomes Model suggested some cross-level interactions among the predictors of *Cognitive Engagement*. There were two cross level interactions in the Intercepts and Slopes as Outcomes Model for cognitive engagement. Firstly, teachers' job satisfaction moderated the relationship between mastery approach goals and cognitive engagement

(ZT_JOBS; γ = .040, se = .016, $p < .05$) significantly. This means that the effect of mastery approach goals on cognitive engagement was moderated by teachers' job satisfaction. Students who set mastery goals are more cognitively engaged and this relationship gets stronger for students in the class of teachers who are satisfied from being science teacher. Secondly, teachers' efficacy for student engagement moderated the relationship between performance avoidance goals and cognitive engagement (ZT_TSESE; γ = .032, se = .014, $p < .05$). Students setting performance avoidance goals are more cognitively engaged to science class. This relationship gets stronger in the classes of teachers who are confident in engaging students in science classes.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Cognitive Engagement were presented in Table 4.29. The proportion of variance explained in each cognitive engagement slope model with significant class level predictors were calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

β_{qj} is Cognitive Engagement or the slope coefficient for a given variable

Proportion of variance explained in *Cognitive Engagement*, β_{0j}:

$$R^2 = \frac{0.00965 - 0.00879}{0.00965} = .089$$

Proportion of variance explained in *Mastery Approach Goals*, β_{2j}:

$$R^2 = \frac{0.00930 - 0.00796}{0.00930} = .144$$

Proportion of variance explained in *Performance Avoidance Goals*, β_{2j}:

$$R^2 = \frac{0.01047 - 0.01007}{0.01047} = .038$$

R^2 values indicated that approximately 9 % of the between class variance in cognitive engagement was explained by the teachers' efficacy for student engagement variable. For mastery approach goals, 14.4 % of the variance was explained by teachers' job satisfaction, there are still significant variation among classes (χ^2 = 185.910, p < 0.01). Lastly, for performance avoidance goals, relatively low amount of variability (3.8 %) was explained by teachers' efficacy for student engagement. For performance avoidance goals, there still remained a significant amount of variance (χ^2 = 177.053, p < 0.01) as well.

Table 4.28 Final estimations of fixed effects for Cognitive Engagement – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.042**	.015
ZT_TSESE Teachers Efficacy for Student Engagement	-.034**	.013
ZT_SELF Self-Efficacy	.410***	.015
ZT_MASTAP Mastery Approach Goals	.231***	.019
ZT_JOBS Teachers' Job Satisfaction	.040*	.016
ZT_MASTAVO Mastery Avoidance Goals	. 113***	.018
ZT_PERFAVO Performance Avoidance Goals	.091***	.018
ZT_TSESE Teachers Efficacy for Student Engagement	.032*	.014

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.29 Final Estimation of Variance Components for Cognitive Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Cognitive Engagement					
Class mean, u_{0j}	.009	132	187.566**	.089	.26
ZT_MASTAP	.008	132	185.911**	.144	.19
ZT_PERFAVO	.010	132	177.053**	.038	.27
Level-1 Effect, *rij*	.531			.385	

Note. Only predictors in final model were included in the table
p < .05, **p* < .01, *** *p* < .001.

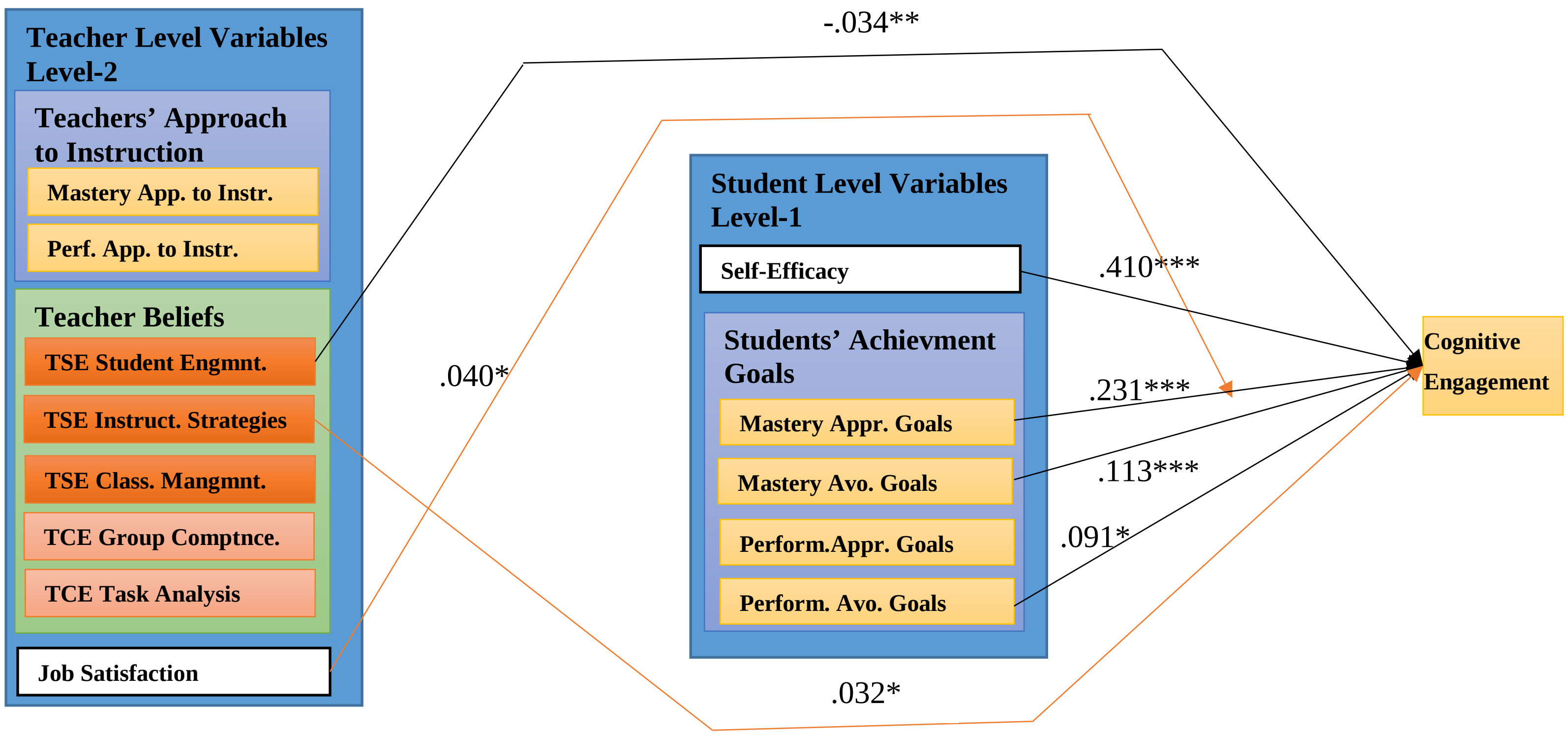

Figure 4.3 Predicting Cognitive Engagement by self-efficacy, achievement goals (level-1), and teacher level variables (level-2)

Note: **p* < .05, ***p* <.01, ****p* < .001. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables. Orange lines indicate interaction of level one and level two variables.

4.2.1.4.4 Emotional Engagement: Results of Intercepts and Slopes as Outcomes Model

Intercepts and Slopes as Outcomes models were built for Emotional Engagement by considering the results of the previously formed models for emotional engagement. The variables at student level and teacher level were entered in the current model subsequently. In the first step, teacher level variables, which were previously found as significantly linked with intercept of Emotional Engagement in Means As Outcomes Model (*teachers' Mastery Approaches to Instruction* and *teachers' Efficacy for Student Engagement*) and student level variables which were previously found as significant predictors of Emotional Engagement in Random Coefficients Model (*Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals,* and *Performance Approach Goals*), were tested in a beginning model.

The equations for the beginning model are:

Student Level (level-1) Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + \gamma_{02}(\text{ZT\_TSESE}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

The model above was tested and the results suggested that teachers' Mastery Approaches to Instruction and teachers' Efficacy for Student Engagement were found as significantly associated with the intercept of emotional engagement. Therefore, they were retained in the model.

In the following step, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictors (*Self-Efficacy and Mastery Approach Goals, and Performance Approach Goals)* of emotional engagement.

The same procedure was followed exactly the same for each randomly varying slope (i.e. *Self-Efficacy and Mastery Approach Goals, and Performance Approach Goals*) in the model as was done for the behavioral engagement and cognitive engagement. Then, non-significant variables were removed from the model. The final form of the equations for the Intercepts and Slopes as Outcomes Model for Emotional Engagement was as follows:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + \beta_{2j} *(ZT\_MASTAP) + \beta_{3j} *(ZT\_MASTAVO) + \beta_{4j} *(ZT\_PERFAP) + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + \gamma_{02}(\text{ZT\_TSESE}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{ZT\_TASKAN}) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(\text{ZT\_GRCOM}) + u_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40} + u_{4j}$$

The results of the final estimations of fixed effects of the final full Intercepts and Slopes as Outcomes Model for emotional engagement were presented in Table 4.30. Students' average scores on *Emotional Engagement* correlated positively and significantly with teachers' *Mastery Approaches to Instruction* (ZT_AtISTM; γ = .040, se = .019, $p < .05$). Moreover, *Emotional Engagement* significantly but negatively associated with teachers' *Efficacy for Student Engagement (*ZT_TSESE; γ = -.055, se = .017, $p < .01$). Moreover, Intercepts and Slopes as Outcomes Model also provided the results of Random Coefficients Model. These results suggested that, among the five level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), *Self-Efficacy* (*ZT_SELF*; γ = .335, se = .018, $p < .001$), *Mastery Approach Goals* (ZT_MASTAP; γ = .292, se = .021, $p < .001$), *Mastery Avoidance Goals* (ZT_MASTAVO; γ = .067, se = .014, $p < .001$), and *Performance Approach Goals* (ZT_PERFAP; γ = .039, se = .018, $p < .05$) were positively and significantly correlated with *Emotional Engagement*. There might be slight differences in slope coefficient in the random coefficients models and intercepts and slopes as outcomes model. This might be the result of adding level two variables in the model.

Obtained results of final full Intercepts and Slopes as Outcomes Model suggested some cross-level interactions among the predictors of *Emotional Engagement*. There were two cross level interactions in the Intercepts and Slopes as Outcomes Model for emotional engagement. The dimensions of teachers' collective efficacy moderated (ZT_TASKAN; γ = .031, se = .015, $p < .05$, (ZT_GRCOM; γ = .042, se = .017, $p < .05$).) the relationship of teacher level predictors with emotional engagement. Teachers' analysis of teaching tasks moderated the relationship between self-efficacy and emotional engagement significantly. This means that the effect of students' self-efficacy in science class on emotional engagement was moderated by teachers' analysis of teaching task. Students who possess high self-efficacy in science class are more emotionally engaged and this relationship gets stronger for students in the class of teachers who are more confident in their collective belief of analysis of teaching tasks. Secondly, teachers' collective efficacy as a science teachers group moderated the relationship between mastery approach goals and emotional engagement. Students setting mastery approach goals are more emotionally engaged to science class. This relationship gets stronger in the classes of teachers who have high confident in their skills as group of science teachers in their school. Lastly, although performance approach goals were both significant at random and fixed effects, none of the teacher level variables moderated this variability in performance approach slope.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Emotional Engagement were presented in Table 4.31. The proportion of variance explained in each emotional engagement slope model with significant class level predictors were calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

β_{qj} is Emotional Engagement or the slope coefficient for a given variable

Proportion of variance explained in *Emotional Engagement*, β_{0j}:

$$R^2 = \frac{0.02173 - 0.01977}{0.02173} = .090$$

Proportion of variance explained in *Self-Efficacy*, β_{1j}:

$$R^2 = \frac{0.01394 - 0.01296}{0.01394} = .070$$

Proportion of variance explained in *Mastery Approach Goals*, β_{2j}:

$$R^2 = \frac{0.01749 - 0.01579}{0.01749} = .097$$

R^2 values showed that approximately 9 % of the between class variance in emotional engagement was explained by the teachers' mastery approaches to Instruction and efficacy for student engagement variable.

For self-efficacy, 7 % of the variance was explained by teachers' collective efficacy in Task Analysis (χ^2 = 190.426, $p < 0.01$) but there are still significant variation among classes that could be explained by teacher level variables. For mastery approach goals, 9.7 % of the variance was explained by teachers' collective efficacy in group competence and also there are still significant variation among classes (χ^2 = 193.730, $p < 0.01$). Lastly, for performance approach goals, there is a significant amount of variance (χ^2 = 189.268, $p < 0.01$) but current teacher level variables were unable to explain such a variability among classes.

Table 4.30 Final estimations of fixed effects for Emotional Engagement – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.044**	.018
ZT_AtISM Teachers' Mastery Approaches to Instruction	.040*	.019
ZT_TSESE Teachers Efficacy for Student Engagement	-.055**	.017
ZT_SELF Self-Efficacy	.335***	.015
ZT_TASKA Task Analysis	.031*	.015
ZT_MASTAP Mastery Approach Goals	.292***	.021
ZT_GRCOMP Group Competence	.042*	.017
ZT_MASTAVO Mastery Avoidance Goals	. 067***	.017
ZT_PERFAP Performance Avoidance Goals	.039*	.018

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.31 Final Estimation of Variance Components for Cognitive Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Cognitive Engagement					
Class mean, u_{0j}	.020	131	262.314***	.090	.42
ZT_SELF	.013	132	190.426**	.070	.27
ZT_MASTAP	.016	132	193.730**	.097	.25
ZT_PERFAP	.08	133	189.268**		.19
Level-1 Effect, *rij*	.533			.347	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

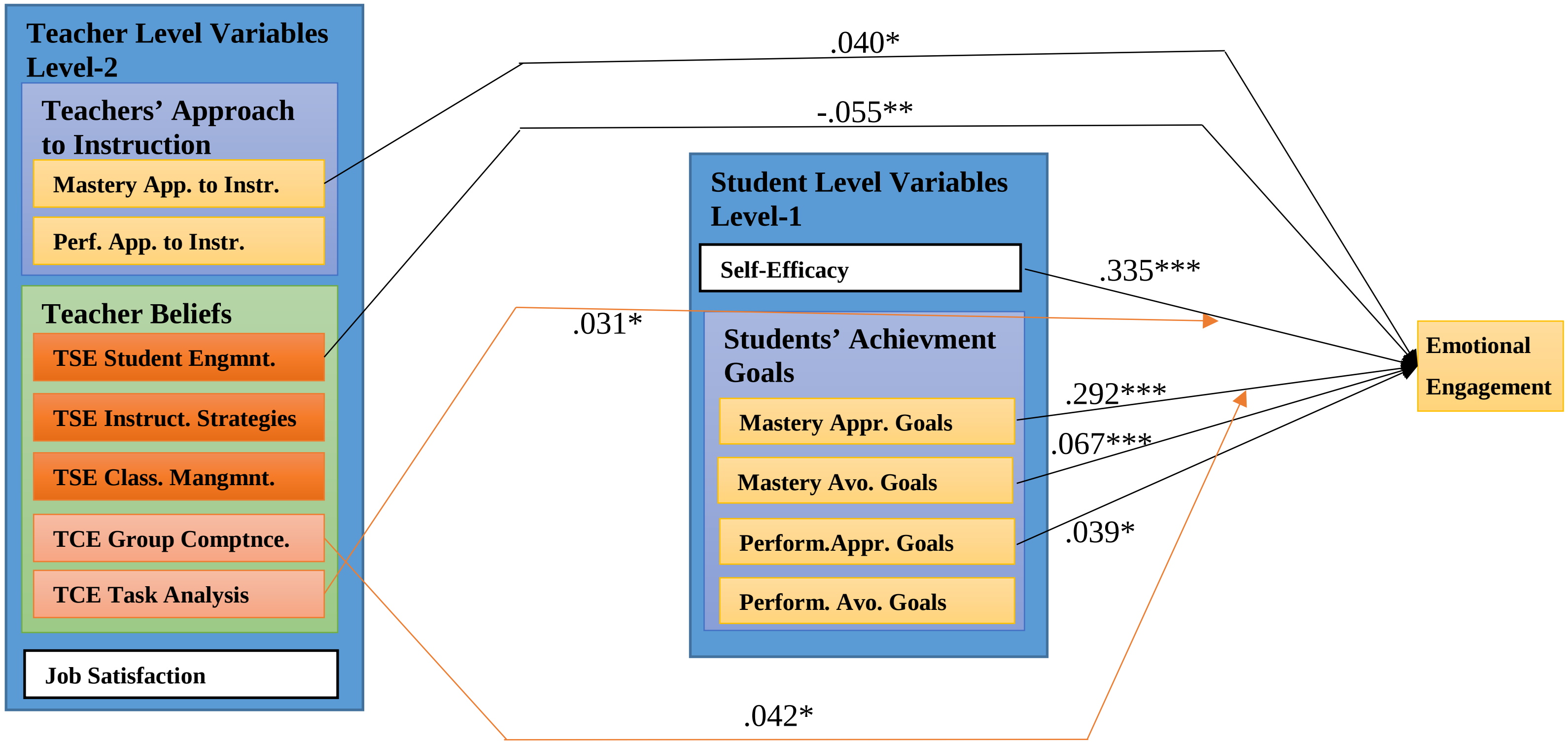

Figure 4.4 Predicting Emotional Engagement by self-efficacy, achievement goals (level-1), and teacher level variables (level-2)

Note: **p* < .05, ***p* <.01, ****p* < .001. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables. Orange lines indicate interaction of level one and level two variables.

4.2.2 Results of Research Question 2: Students' Achievement Goals in Science Classes

The second research question included 4 sub-questions:

2. a. To what extent do students in different classes (taught by different teachers) vary in achievement goals dimensions *(*i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals)*?

2.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction*, *Performance Approaches to Instruction*, *Efficacy for Student Engagement*, *Efficacy for Instructional Strategies*, *Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' achievement goals (i.e., *Mastery Approach Goals*, *Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

2.c. To what extent do students' self-efficacy beliefs predict students' achievement goals (i.e., *Mastery Approach Goals*, *Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

2.d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction*, *Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between students' Self-Efficacy and students' achievement goals *(i.e., Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

4.2.2.1 Results of Research Question 2.a: One-Way Random Effects ANOVA Model

2. a. To what extent do students in different classes (taught by different teachers) vary in achievement goals dimensions (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals)*?

The question above was analyzed by using One-Way Random Effects ANOVA Model. The regression equation constructed for this research question is as follows:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$,

Class-level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

In the above equations, the elements represent:

Y_{ij} is the outcome variable (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable.

γ_{00} is the grand mean, that is, overall average score of outcome variable for all classes.

r_{ij} is the random effect of student *i* in class *j*.

u_{0j} is the random effect of class *j*.

Students achievement goals were measured by Achievement Goal Questionnaire, whivh included 4 dimensions (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*). For each of the dimensions, 4 separate One-Way random effects ANOVA model was formed by assigning each dimension as the outcome variable of the regression equation. Table 4.32 and Table 4.33 shows the results of the final estimations of fixed and random effects for AGQ dimensions.

Four separate one-way random effects ANOVA model analysis suggested that the final estimations of variance components at class level for *Mastery Approach Goals*, *Mastery Avoidance Goals*, *Performance Approach Goals*, *and Performance Avoidance Goals* were statistically significant, where τ_{00} is the variance of the true class means, β_{0j}, around the grand-mean, γ_{00}. This finding indicated that there is an amount of variance for *Mastery Approach Goals* (τ_{00} =. 043, χ^2= 322.302, df = 133, $p < .001$), *Mastery Avoidance Goals* (τ_{00} =. 016, χ^2= 191.315, df = 133, $p < .001$), *Performance Approach Goals* (τ_{00} =. 023, χ^2= 227.621, df = 133, $p < .001$), *and Performance Avoidance Goals*(τ_{00} =. 027, χ^2= 232.358, df = 133, $p < .001$) varying among class means. These findings suggested that predictors in the second level could be assigned to explain the second level variance for Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals. In other words, HLM analyses are appropriate.

The ICC calculated for each dimension of AGO by the formula $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$ was presented in the Table 4.33. In the present study, the calculated ICC suggested that 5 % of the total variance in *Mastery Approach Goals*, 3 % of the total variance in *Mastery Avoidance Goals*, 3 % of the total variance in *Performance Approach Goals*, and 3 % of the total variance in *Performance Avoidance Goals* were explained by the between-class variability. One-way random effects ANOVA model also calculates the reliability coefficient for the group means. The group mean reliability coefficient ranges from .30 to .58.

Table 4.32 Final Estimation of Fixed Effects for Achievement Goals Dimensions: One-Way Random Effects ANOVA Model

Fixed Effects	Coefficient	SE
Mastery Approach Goals Average class mean, γ_{00}	.042	.023
Mastery Avoidance Goals Average class mean, γ_{00}	.021	.020
Performance Approach Goals Average class mean, γ_{00}	.041	.020
Performance Avoidance Goals Average class mean, γ_{00}	.025	.022

Table 4.33 Final Estimation of Variance Components for Self-Efficacy: One-Way Random Effects ANOVA Model

Random Effects	Variance Components	Df	χ^2	ICC (ρ)	Reliability (λ)
Mastery Approach Goals		133	322.302***	.05	.58
Class mean, u_{0j}	.043				
Level-1 Effect, *rij*	.752				
Mastery Avoidance Goals		133	191.315***	.03	.30
Class mean, u_{0j}	.016				
Level-1 Effect, *rij*	.943				
Performance Approach Goals		133	227.621***	.03	.41
Class mean, u_{0j}	.023				
Level-1 Effect, *rij*	.924				
Performance Avoidance Goals		133	232.358***	.03	.42
Class mean, u_{0j}	.027				
Level-1 Effect, *rij*	.913				

Note. ICC = Intraclass correlation,
*** $p < .001$

4.2.2.2 Results of Research Question 2.b: Means as Outcomes Model

2. b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' achievement goals (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

The above question tested whether teacher level variables (level 2) predicted achievement goal orientations or not. For this purpose, a Means as Outcomes model was constructed. In HLM analysis, Means as Outcomes model is utilized to predict level one outcome variable (dimensions of Achievement Goals in this question) with the level two predictors. A prerequisite for modeling level two predictors is the existence of level two variance component, which is tested through One-Way Random Effects ANOVA model. Sufficient information regarding the significance of variance components was provided by the One-Way Random Effects ANOVA model in section 4.3.3.1. Therefore, the dimensions of Achievement Goals were modeled in Means as Outcomes model. Results of means as outcomes model for Achievement Goals dimensions were presented in Table 4.34 and Table 4.35**,** respectively.

The regression equation for this question is as follows:

Student level (level-1) model:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + \gamma_{02}(\text{ZT\_AtISP}) + \gamma_{03}(\text{ZT\_TSESE}) + \gamma_{04}(\text{ZT\_TSEIS}) + \gamma_{05}(\text{ZT\_TSECM}) + \gamma_{06}(\text{ZT\_GRCOMP}) + \gamma_{07}(\text{ZT\_TASKAN}) + \gamma_{08}(\text{ZT\_JOBSAT}) + u_{0j}$$

The elements in the above equations represent:

Y_{ij} is the outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{00} is the grand mean, that is, overall average score of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) for all classes.

γ_{01} is the differentiating effect of teacher's Mastery Approaches to Instruction on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{02} is the differentiating effect of teacher's Performance Approaches to Instruction on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{03} is the differentiating effect of teacher's Efficacy Beliefs for Student Engagement on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{04} is the differentiating effect of teacher's Efficacy Beliefs for Instructional Strategies on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{05} is the differentiating effect of teacher's Efficacy Beliefs for Classroom Management on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{06} is the differentiating effect of teacher's Collective Efficacy Beliefs for Group Competence on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{07} is the differentiating effect of teacher's Collective Efficacy Beliefs for Task Analysis on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

γ_{08} is the differentiating effect of teacher's Job Satisfaction on class mean of outcome variable (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*).

r_{ij} is the level-1 residual.

u_{0j} is the level-2residual.

Students Achievement Goals were measured by the Achievement Goal Questionnaire (AGQ) which included four dimensions, namely *Mastery Approach Goals*, *Mastery Avoidance Goals*, *Performance Approach Goals*, and *Performance Avoidance Goals.* In order to find out which teacher level variables predict students achievement goals, four separate Means as Outcomes model was constructed. In these Means as Outcomes Models, level two variance, τ_{00}, is defined as the residual or conditional variance after controlling for other teacher (class) level variables (Raudenbush & Bryk, 2002).

In the model construction process, entering order of level two predictors was determined as was done for self-efficacy in section 4.3.1.2. In the final estimations model, there were only significant predictors remained, non-significant one were excluded. Results of the final estimations of Means as Outcomes Models constructed for students' Achievement Goals dimensions were presented in Table 4.34 and Table 4.35.

The results of the Means as Outcomes Model constructed for Mastery Approach Goals dimension suggested that only teachers' *Efficacy for Classroom Management* (ZT_TSECM; $\gamma = .039$, se = .019, $p < .05$) was found as positively significantly associated with students' mastery approach goals in science classes. In other words, this finding indicated that students in classes of science teachers whose confidence in classroom management is high set mastery approach goals more in science classes. For mastery avoidance goals, Means as Outcomes model suggested that only teacher *Job Satisfaction* (ZT_JSAT; $\gamma = -.042$, se = .019, $p < .05$) was found as negatively significantly associated with students' mastery avoidance goals. This means that students' who are taught by less satisfied teachers set more mastery avoidance goals in science classes. Concerning performance approach goals, none of the teacher level variables significantly predicted the variance of performance approach goals varying between classes. Although there exists an amount of level two variance between classes for performance approach goals, none of the teacher level variables were able to cover significant portion of it in performance approach goals for students. Lastly, for performance avoidance goals, Means as Outcomes model suggested that teachers' *Collective Efficacy for Task Analysis* (ZT_TASKAN; $\gamma = -.042$, se = .019, $p < .05$) was found as negatively significantly associated with students' performance avoidance goals in science classes. This finding indicated that students in classes of teachers whose collective efficacy for analysis of teaching tasks were lower set more performance avoidance goals in science classes.

The comparison of the residual variances (τ_{00}) of previously established *One-Way Random Effects ANOVA Model* with *Means as Outcomes Model* indicated that there is a decrease in the variance components of *Means as Outcomes Model* for Mastery Approach Goals, Mastery Avoidance Goals and Performance Avoidance Goals dimensions. As mentioned in the above section, none of the level two variables predicted performance approach goals. Therefore, there is no need to check the difference between residual variance components of performance approach goals of students. The proportion of variance explained at class level, R^2, can be calculated by subtracting τ_{00} of *Means as Outcomes Model* from τ_{00} of *One-Way Random Effects ANOVA Model.* This calculation is done separately for each dimension of students' Achievement Goals. For illustrative purposes, the calculation of R^2 for mastery approach goals is shown below:

R^2 = Proportion of variance explained by β_{0j}

$$= \frac{\tau_{00}(\ Random\ Effects\ ANOVA\ Model) - \ \tau_{00}(Means\ as\ Outcomes\ Model)}{\tau_{00}(\ Random\ Effects\ ANOVA\ Model)}$$

Proportion of variance explained by level two variables for mastery approach goals is calculated as

$$= \frac{0.04245 - \ 0.04137}{0.04245} = 0.025$$

Table 4.34 Final estimations of fixed effects for teacher level predictors - Means as Outcomes Model for Achievement Goals dimensions

	Mastery Approach Goals		Mastery Avoidance Goals		Performance Approach Goals	
Fixed Effects	γ	SE	Γ	SE	γ	SE
Model for Class Means						
Intercept	.042	.023	.021	.020	.025	.021
ZT_TSECM Efficacy for Classroom Management	.039*****	.020				
ZT_TASKAN Task Analysis					-.042*****	.019
ZT_JOBSAT Job Satisfaction			-.042*****	.019		

Note. Only predictors in final models were included in the table. The all continuous teacher level variables were grand mean centered

*****$p < .05$

Table 4.35 Final Estimation of Variance Components for Achievement Goals dimensions: Means as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2
Mastery Approach Goals				
Class mean, u_{0j}	.041	132	315.360***	.025
Level-1 Effect, *rij*	.752			
Mastery Avoidance Goals				
Class mean, u_{0j}	.015	132	185.168**	.001
Level-1 Effect, *rij*	.943			
Performance Approach Goals				
Class mean, u_{0j}	.021	125	209.854***	-
Level-1 Effect, *rij*	.832			
Performance Avoidance Goals Class mean, u_{0j}	.025	132	225.065***	.002
Level-1 Effect, *rij*	.913			

** $p < .01$, *** $p < .001$

As shown in the Table 4.35, approximately 3 % of the true between-class variance in students' mastery approach goals in science class was explained by the teachers' *Efficacy for Classroom Management*. The same calculation procedure was used to find out the R^2 for mastery avoidance and performance avoidance goals. The proportion of variance explained by β_{0j} for mastery avoidance goals was .1 %, which was explained by the teachers *Job Satisfaction*. Lastly, the proportion of variance explained by β_{0j} for performance avoidance goals was .2 %, which was explained by the teachers *Collective Efficacy for Task Analysis.*

4.2.2.3 Results of Research Question 2.c: Random Coefficients Model

2. c. To what extent do students' self-efficacy beliefs predict students' achievement goals (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

The question above was formed to examine the contribution of student self-efficacy to students' achievement goals (i.e. *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*). Since all the variables are in the student level (level one), a Random Coefficients Model was constructed where each dimension of Achievement Goal Orientations are outcomes and self-efficacy is the predictor variable. The same logic applies here as was discussed in section 4.3.2.3 for engagement dimensions. The same procedure with section 4.3.2.3 was applied here as well.

The regression equation for the research question 4.c is as follows:

Student level (level-1) model:

$$Y_{ij} = \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Teacher level (level-2) model:

$$B_{0j} = \gamma_{00} + u_{0j}$$

.

.

.

$$\beta_{qj} = \gamma_{q0} + u_{qj}$$

In these models, the parameters indicate,

Y_{ij} is the outcome variable (i.e., *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)

β_{0j} is the mean on each achievement goal dimension (i.e., average scores of the all classes on related outcome variable)

β_{1j} is the differentiating effect of students' self-efficacy in class j (i.e., the degree to which perceptions of student self-efficacy among students related to outcome variable)

β_{qj} is the coefficient for variable q for class j after accounting for other variables

γ_{00} is the average of class means on the outcome variable across the population of classes

γ_{q0} is the average q factor- outcome variable slope across those classes

u_{0j} the unique increment to the intercept associated with class j

u_{qj} the unique increment to the slope associated with class j

In the regression equations above, β_{0j} represented the intercepts and all other β's represented the slope parameters for each predictor variable. However, there is only one level one predictor for the dimensions of Achievement Goals. Therefore, β's are the coefficients of only students' science self-efficacy.

The Random Coefficient Models of achievement goals dimensions were constructed based on the recommendations of Raudenbush and Bryk (2002). The model building strategy, which was done for engagement dimension in the section 4.3.2.3., was used in achievement goal dimensions exactly the same. After constructing the final version of the models for, the results of the Random Coefficient Model for each dimension of achievement goal dimensions, final estimation of fixed effects and random effects were presented in Table 4.36 and Table 4.37, respectively

Since the achievement goal models include only self-efficacy as the level one predictor, all achievement goal dimensions were examined in this section. Separate sections were not created for every dimension of achievement goals. Results of the Random coefficients model for mastery approach goals suggested that fixed effects of *self-efficacy* significantly and positively predicted students' mastery approach goals (*ZT_SELF*; $\gamma = .404$, se = .016, $p < .001$), mastery avoidance goals (*ZT_SELF*; $\gamma = .063$, se = .018, $p < .01$), performance approach goals (*ZT_SELF*; $\gamma = .303$, se = .017, $p < .001$) , and lastly performance avoidance goals (*ZT_SELF*; $\gamma = 151$, se = .019, $p < .001$). These findings suggested that students' self-efficacy beliefs positively correlated with all achievement goals students set in science classes. In terms of variance components, the slope coefficient of *Self-Efficacy-Mastery Approach Goals* ($\chi^2 = 189.884$, $p < .01$), *Self-Efficacy-Performance Approach Goals* ($\chi^2 = 162.168$, $p < .05$), and *Self-Efficacy Performance Avoidance Goals* ($\chi^2 = 166.480$, $p < .05$) were found to be varying randomly among classes. Lastly, although self-efficacy has a significant fixed effect on mastery avoidance goals, its random effect was not found as significant. Therefore, it was kept in the model as fixed.

To find out how much variation of Achievement Goals dimensions was explained by the inclusion of self-efficacy, the level one variance (σ^2) of One-Way Random Effects ANOVA model for Achievement Goals Dimensions and the level one variance (σ^2) of Random Coefficients Model for Achievement Goals Dimensions were compared. The reduced variance, R^2, was calculated for Mastery Approach Goals as follows for the illustration:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.75221 - 0.59526}{0.75221} = .208$$

Incorporating of self-efficacy in the Random Coefficients Model for mastery approach goals accounted for 20.8 % of the within class variance in students' mastery approach goals in science classes. The same calculation formula was used for the remaining dimensions of students'' Achievement Goals in science classes. Accordingly, it was found that self-efficacy explained .4 % of the within class variance in students' mastery avoidance goals, 11 % of the within class variance in students' performance approach goals, and 3.5 % of the within class variance in students' performance avoidance goals.

Regarding reliability estimates of intercept and randomly varying slopes, for mastery approach goals, intercept (.52) was more reliable than the self-efficacy slope (.29). For performance approach goals, similar to mastery approach goals, intercept (.36) was more reliable than self-efficacy (.17) slope. Lastly, for performance avoidance slope, intercept (.41) was again found to be more reliable than the self-efficacy slope (.20).

Table 4.36 Final estimations of fixed effects for level one predictors – Random Coefficients Model for Achievement Goals Dimensions

	Mastery Approach Goals		Mastery Avoidance Goals		Performance Approach Goals		Performance Avoidance Goals	
Fixed Effects	γ	SE	γ	SE	γ	SE	γ	SE
Model for Class Means Intercept	.046	.019	.021	.020	.042	.019	.024	.022
ZT_SELF (Self-Efficacy)	.404***	.016	.063**	.018	.303***	.017	.151***	.019

Note. Only predictors in final models were included in the table. Predictors that have no coefficient value in the table were excluded variables from the related model because of its non-significant fixed and random effect on outcome variable.
*$p < .05$, **$p < .01$, ***$p < .001$

Table 4.37 Final Estimation of Variance Components for Achievement Goals Dimensions: Random Coefficients Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Mastery Approach Goals					
Class mean, u_{0j}	.028	133	286.698***		.52
ZT_SELF	.011	133	189.884**		.29
Level-1 Effect, *rij*	.595			.208	
Mastery Avoidance Goals					
Class mean, u_{0j}	.016	133	190.369**		.30
Level-1 Effect, *rij*	.939			.004	
Performance Approach Goals					
Class mean, u_{0j}	.018	133	217.389***		.36
ZT_SELF	.007	133	162.168*		.17
Level-1 Effect, *rij*	.741			.110	
Performance Avoidance Goals					
Class mean, u_{0j}	.026	133	228.406***		.41
ZT_SELF	.010	133	166.480*		.20
Level-1 Effect, *rij*	.882			.035	

*$p < .05$, **$p < .01$, *** $p < .001$

4.2.2.4 Results of Research Question 2.d: Intercepts and Slopes as Outcomes

2. d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between students' *self-efficacy* and students' achievement goals *(i.e., Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*)?

4.2.2.4.1 Mastery Approach Goals: Intercepts and Slopes as Outcomes

The means as outcomes model and the random coefficients model tested before for Mastery Approach Goals revealed that teachers' *Efficacy for Classroom Management* (*ZT_TSECM;* γ = .039, se = .019, $p < .05$) and student' *Self-Efficacy* (*ZT_SELF*; γ = .404, se = .016, $p < .001$) associated positively and significantly with mastery approach goals. Additionally, Random Coefficients Model constructed for mastery approach goals revealed that students' self-efficacy-mastery approach goals slope varied significantly among the classes. Thus, an intercepts and slopes as outcomes model for self-efficacy-mastery approach goals was constructed in this section. Firstly, the results obtained from Means as Outcomes Model and Random Coefficients Model for mastery approach goals were combined and tested together. Related regression equations for this model were as follows.

Student Level (level-1) Model:

Mastery Approach Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \text{ (ZT\_TSECM)}_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

The analysis of the above first model indicated that teachers' *Efficacy for Classroom Management* still predicted intercept of mastery approach goals (Table 4.38). Therefore, teachers' *Efficacy for Classroom Management* was kept in the model for further investigation.

Then, as a second step, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slope of significant level one predictor of *Self-Efficacy* on behavioral engagement.

Below equations show the incorporated level two variables into the slope of self-efficacy – mastery approach goals.

Student Level (level-1) Model:

Mastery Approach Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (ZT\_TSECM)_{j} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(ZT\_AtISM)_{j} + \gamma_{12}(ZT\_AtISP) + \gamma_{13}(ZT\_TSESE) + \gamma_{14}(ZT\_TSEIS) + \gamma_{15}(ZT\_TSECM) + \gamma_{16}(ZT\_GRCOMP) + \gamma_{17}(ZT\_TASKAN) + \gamma_{18}(ZT\_JOBSAT) + u_{1j}$$

Since there was only one student level predictor (self-efficacy) for mastery approach goals, abovementioned model was the final estimations for Intercepts and Slopes as Outcomes Model. The results suggested that none of the teacher level variables significantly associated with self-efficacy – mastery approach goals slope. However, there was still a significant amount of variance varying between classes (χ^2 = 186.297, p < .001) (Table 4.39). This means that teacher level variables were unable to capture any portion of variability of self-efficacy – mastery approach goals slope existing among classes. The final form of the regression equation for mastery approach goals was as follows:

Mastery Approach Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (ZT\_TSECM)_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Mastery Approach Goals were presented in Table 4.39. The proportion of variance explained in the intercept of mastery approach goals by the level two predictor were calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\text{ Random Coefficient}) - \tau_{qq}(\text{Intercepts and Slopes as Outcomes})}{\tau_{qq}(\text{ Random Coefficient})}$$

β_{qj} is Mastery approach Goals or the slope coefficient for a given variable

Proportion of variance explained in Mastery approach Goals, β_{0j}:

$$R^2 = \frac{0.02786 - 0.02634}{0.02786} = .055$$

R^2 value showed that approximately 6 % of the between class variance in mastery approach goals was explained by the teachers' efficacy for classroom management. For self-efficacy, explained variance was not calculated because there were no teacher level moderator for self-efficacy slope. Nevertheless, there still remained a significant amount of variance ($\chi^2 = 186.297$, $p < 0.01$) in self-efficacy slope to be explained by teacher level variables.

Table 4.38 Final estimations of fixed effects for Mastery Approach Goals – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.045*	.019
ZT_TSECM	.042*	.016
ZT_SELF (Self-Efficacy)	.405***	.016

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.39 Final Estimation of Variance Components for Behavioral Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Mastery Approach Goals					
Class mean, u_{0j}	.026	132	275.466***		.50
ZT_SELF	.012	125	186.297***		.34
Level-1 Effect, *rij*	.596			.208	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

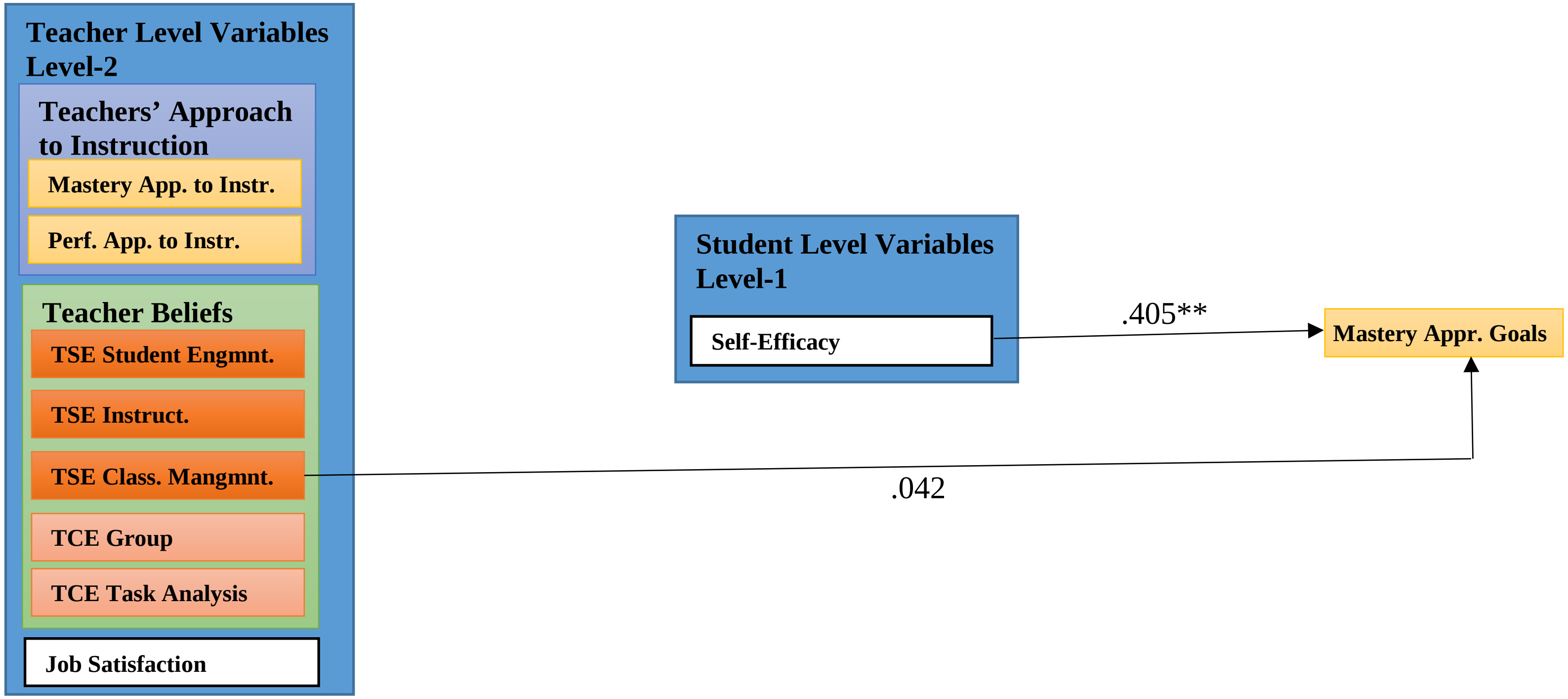

Figure 4.5 Predicting Mastery Approach Goals by self-efficacy (level-1), and teacher level variables (level-2)

Note: **p* < .05, ***p* <.01, ****p* < .001. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

4.2.2.4.2 Mastery Avoidance Goals: Intercepts and Slopes as Outcomes

Previously conducted means as outcomes model suggested that the intercept of mastery avoidance goals was significantly but negatively predicted by teachers job satisfaction (γ = -.042, se = .019, $p < .05$). Random coefficients model suggested that mastery avoidance goals was predicted by students Self-Efficacy (γ = .062, se = .018, $p < .01$). In other words, fixed effect of self-efficacy on mastery avoidance goals was significant. However, random coefficients section of Random Coefficients Model indicated that self-efficacy-mastery avoidance goals slope did not vary randomly among classes. Since there is only one student level predictor (self-efficacy) for mastery avoidance goals and there is not a random variation among classes for self-efficacy-mastery avoidance goals slope, there is no need to construct an intercepts and slopes as outcomes model for mastery avoidance goals. The combination of Means as outcomes model and random coefficients model was tested for significance and related regression equations are listed below.

Student Level (level-1) Model:

Mastery Avoidance Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (ZT\_JOBS)_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

Test of the above-mentioned model suggested that teachers' job satisfaction was found as significantly associated with mastery avoidance goals and was kept in the model. The final form of the model included self-efficacy as a fixed effect for mastery avoidance goals. Below Table 4.40 and Table 4.41 present the fixed effects and random effects for mastery avoidance goals.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Mastery Avoidance Goals were presented in Table 4.41. The proportion of variance explained in the intercept of mastery avoidance goals by the level two predictor were calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

β_{qj} is Mastery avoidance Goals or the slope coefficient for a given variable

Proportion of variance explained in Mastery Avoidance Goals, β_{0j}:

$$R^2 = \frac{0.01595 - 0.01461}{0.01595} = .084$$

R^2 value showed that approximately 8.4 % of the between class variance in the intercept of mastery avoidance goals was explained by the teachers' job satisfaction. For self-efficacy, explained variance was not calculated because random effect of self-efficacy for mastery avoidance goals was fixed.

Table 4.40 Final estimations of fixed effects for Mastery Avoidance Goals – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.021	.020
ZT_JOBS	-.042*	.019
ZT_SELF (Self-Efficacy)	.063***	.018

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.41 Final Estimation of Variance Components for Behavioral Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Mastery Avoidance Goals					
Class mean, u_{0j}	.015	132	184.157**		.28
Level-1 Effect, *rij*	.940			.004	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

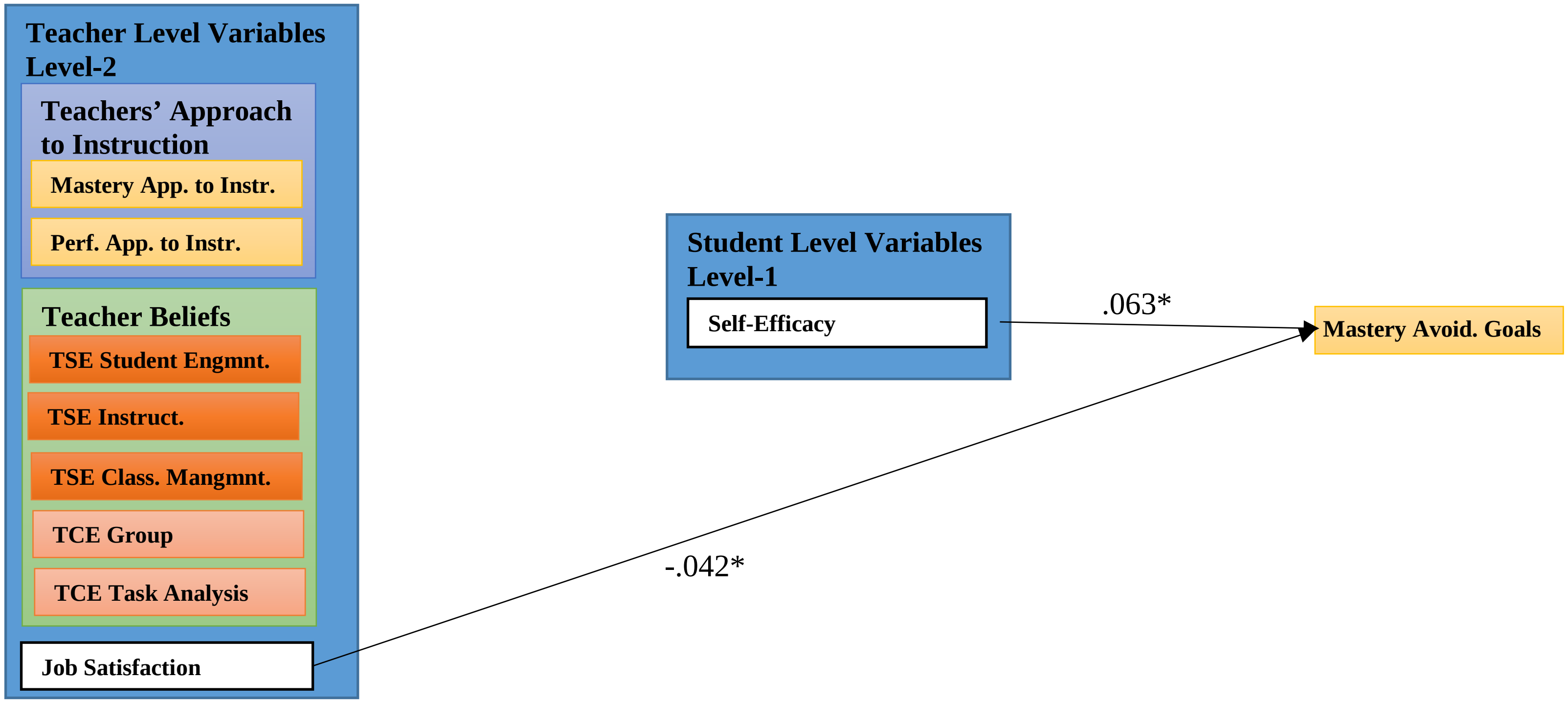

Figure 4.6 Predicting Mastery Avoidance Goals by self-efficacy (level-1), and teacher level variables (level-2)

Note: **p* < .05, ***p* <.01, ****p* < .001. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

4.2.2.4.3 Performance Approach Goals: Intercepts and Slopes as Outcomes

Intercepts and Slopes as Outcomes models were built for *Performance Approach Goals* by taking the results of the previously constructed models for *Performance Approach Goals.* The variables at student level and teacher level were entered in the present model subsequently. At first, teacher level variables, which were previously found as significantly linked with intercept of Performance Approach Goals (there was none) in Means as Outcomes Model and student level variables which were previously found as significant predictors of Performance Approach Goals in Random Coefficients Model (*Self-Efficacy)* were tested in a starter model.

The equations for the starter model are:

Student Level (level-1) Model:

Performance Approach Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

The model above was tested and the results suggested that the slope of self-efficacy randomly varied among classes.

In the following step, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student*

Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictor (*Self-Efficacy)* of performance approach goals.

The same procedure was followed exactly the same for randomly varying slope (i.e. *Self-Efficacy*) in the model as was done for previously conducted intercepts and slopes as outcomes model. Then, non-significant variables were excluded from the model. The final form of the equations for the Intercepts and Slopes as Outcomes Model for Performance Approach Goals was as follows:

Student Level (level-1) Model:

Performance Approach Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(ZT\_JOBS) + u_{1j}$$

The results of the final estimations of fixed effects of the final full Intercepts and Slopes as Outcomes Model for performance approach goals were presented in Table 4.42. Students' average scores on *performance approach goals did not correlate with any of the* teacher level variables. Moreover, Intercepts and Slopes as Outcomes Model also provided the results of Random Coefficients Model. These results suggested that, *Self-Efficacy* (*ZT_SELF*; γ = .303, se = .017, p < .001) was positively and significantly correlated with *Performance*

Approach Goals. There might be slight differences in slope coefficient in the random coefficients models and intercepts and slopes as outcomes model. This might be the result of adding level two variables in the model.

Obtained results of final full Intercepts and Slopes as Outcomes Model suggested a cross-level interaction among the predictors of performance approach goals. The dimensions of teachers' collective efficacy moderated the relationship of teacher level predictors with emotional engagement. Teachers' job satisfaction moderated the relationship between self-efficacy and performance approach goals (ZT_JOBS; $\gamma = -.034$, se = .016, $p < .05$) significantly. Students who possess high self-efficacy in science class are setting performance approach goals and this relationship gets weaker for students in the class of teachers who are satisfied with being a science teacher.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Performance Approach Goals were presented in Table 4.43. The proportion of variance explained in self-efficacy performance approach goals slope model was calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

Proportion of variance explained in *Self-Efficacy*, β_{1j}:

$$R^2 = \frac{0.00713 - 0.00611}{.00713} = .143$$

R^2 value indicated that for self-efficacy, 14.3 % of the variance was explained by teachers' job satisfaction ($\chi^2 = 155.748$, $p > 0.05$) and the remaining variance is not significant.

Table 4.42 Final estimations of fixed effects for Performance Approach Goals – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means Intercept	.043*	.019
ZT_SELF (Self-Efficacy)	.303***	.017
ZT_JOBS Teacher Job Satisfaction	-.034*	.016

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
*$p < .05$, **$p < .01$, ***$p < .001$

Table 4.43 Final Estimation of Variance Components for Behavioral Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Performance Approach Goals					
Class mean, u_{0j}	.018	132	184.157**		.36
ZT_SELF	.006	132	155.747		.15
Level-1 Effect, *rij*	.741			.110	

Note. Only predictors in final model were included in the table
*$p < .05$, **$p < .01$, *** $p < .001$.

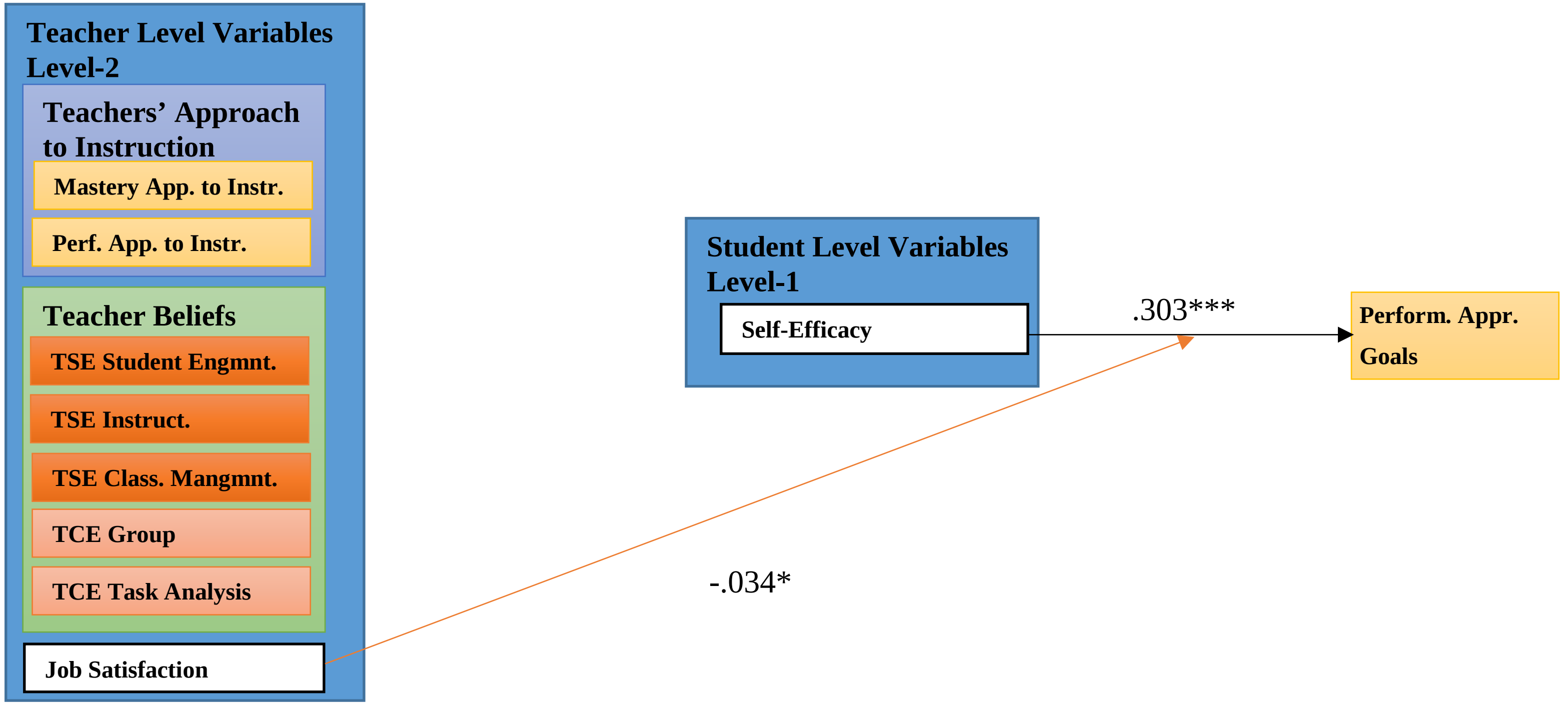

Figure 4.7 Predicting Performance Approach Goals by self-efficacy (level-1), and teacher level variables (level-2)

Note: $*p < .05$, $**p < .01$, $***p < .001$. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

Orange lines indicate interaction of level one and level two variables.

4.2.2.4.4 Performance Avoidance Goals: Intercepts and Slopes as Outcomes

Intercepts and Slopes as Outcomes models were formed for Performance Avoidance Goals by taking the results of the previously formed models for Performance Avoidance Goals into account. The variables at student level (level one) and teacher level (level two) were entered in the current model subsequently. In the first step, teacher level variables, which were previously found as significantly linked with intercept of Performance Avoidance Goals in Means as Outcomes Model (*teachers' Collective Efficacy for Analysis of Teaching Task*) and student level variables which were previously found as significant predictors of Performance Avoidance Goals in Random Coefficients Model (*Self-Efficacy*) were tested in the first model.

The equations for the first model are:

Student Level (level-1) Model:

Performance Avoidance Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_TASKAN}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

The model above was tested and the results suggested that the slope of self-efficacy randomly varied among classes and teachers' collective efficacy for the analysis of teaching task were found significant.

In the following step, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictor (*Self-Efficacy)* of performance avoidance goals.

The same procedure was followed exactly the same for randomly varying slope (i.e. *Self-Efficacy*) in the model as was done for previously conducted intercepts and slopes as outcomes model. Then, non-significant variables were excluded from the model. The final form of the equations for the Intercepts and Slopes as Outcomes Model for Performance Avoidance Goals was as follows:

Student Level (level-1) Model:

Performance Avoidance Goals (Y_{ij})

$$= \beta_{0j} + \beta_{1j} *(ZT\_SELF) + r_{ij}$$

Class level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_TASKAN}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{ZT\_TSEIS}) + u_{1j}$$

The results of the final estimations of fixed effects of the final full Intercepts and Slopes as Outcomes Model for performance avoidance goals were presented in Table 4.44. Students' average scores on *performance avoidance goals* was significantly but negatively predicted by teachers' *Collective Efficacy for Task Analysis* (*ZT_TASKAN*; γ = -.041, se = .019, $p < .05$). Moreover, Intercepts and Slopes as Outcomes Model also provided the results of Random Coefficients Model. These results suggested that, *Self-Efficacy* (*ZT_SELF*; γ = .150, se = .019, p < .001) was positively and significantly correlated with *Performance Avoidance Goals*. There might be slight differences in slope coefficient in the random coefficients models and intercepts and slopes as outcomes model. This might be the result of adding level two variables in the model.

The results provided by final full Intercepts and Slopes as Outcomes Model suggested a cross-level interaction among the predictors of performance avoidance goals. Teachers' self-efficacy for instructional strategies moderated the relationship between self-efficacy and performance avoidance goals (ZT_TSEIS; γ = - .043, se = .018, p < .05) significantly. Students who possess high self-efficacy in science class are setting performance avoidance goals and this relationship gets weaker for students in the class of teachers who are confident in their skills in instructional strategies.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Performance Approach Goals were presented in Table 4.45. The proportion of variance explained in self-efficacy performance avoidance goals slope model was calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

Proportion of variance explained in *Performance Avoidance Goals*, β_{0j}:

$$R^2 = \frac{0.02648 - 0.02487}{0.02648} = .060$$

Proportion of variance explained in *Self-Efficacy*, β_{1j}:

$$R^2 = \frac{0.01040 - 0.00852}{0.01040} = .180$$

R^2 values showed that 6 % of the between class variance in performance avoidance goals was explained by the teachers' analysis of teaching task variable. For self-efficacy, 18 % of the variance was explained by teachers' efficacy for Instructional Strategies (χ^2 = 159.990, p < 0.05) but there are still significant variation among classes that could be explained by teacher level variables.

Table 4.44 Final estimations of fixed effects for Performance Avoidance Goals – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means		
Intercept	.024	.021
ZT_TASKA Teachers' Collective Efficacy for Task Analysis	-.041*	.019
ZT_SELF Self-Efficacy	.150***	.019
ZT_TSEIS Teachers' Efficacy for Instructional Strategies	-.043*	.018

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
*p < .05, **p < .01, ***p < .001

Table 4.45 Final Estimation of Variance Components for Behavioral Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Performance Avoidance Goals					
Class mean, u_{0j}	.025	132	223.703***		.39
ZT_SELF	.009	132	159.990*		.17
Level-1 Effect, *rij*	.882			.035	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

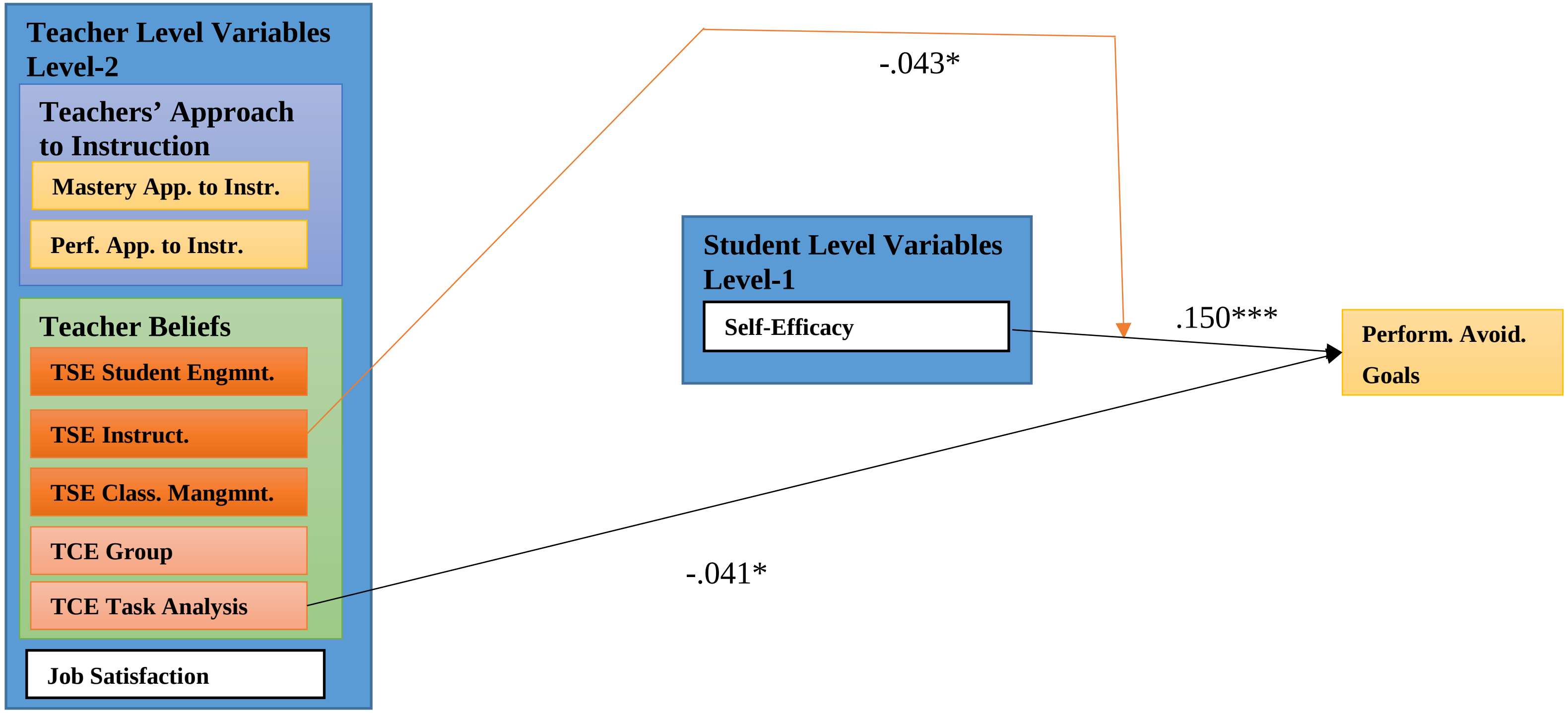

Figure 4.8 Predicting Performance Avoidance Goals by self-efficacy (level-1), and teacher level variables (level-2)

Note: $*p < .05$, $**p < .01$, $***p < .001$. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

Orange lines indicate interaction of level one and level two variables.

4.2.3 Results of Research Question 3: Student's Self-Efficacy

The fthird set of HLM analysis were performed to provide results for the research questions related to students' self-efficacy beliefs in science class.

The second research questions included 2 sub-questions:

> 3.a. To what extent do students in different classes (taught by different teachers) vary in their self-efficacy beliefs in science classes?
>
> 3.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' self-efficacy beliefs in science classes?

4.2.3.1 Results of Research Question 3.a: One-Way Random Effects ANOVA Model

3.a. To what extent do students in different classes (taught by different teachers) vary in their self-efficacy beliefs in science classes?

The research question above addressed the empty or null model of HLM analysis. Rudenbush and Bryk (2002) suggested starting any HLM model with this empty or null model because of two major reasons. Firstly, the null or empty model does not include any level 1 or level 2 predictors. It includes only an outcome variable. That's why it is called empty or null. Secondly, the empty or null model provides important information about the variance components (level 1 and level 2 variances). The proportion of level 2 variance to the total variability in the model yields an important construct, Intra Class Correlation Coefficient (ICC), which presents critical information about the necessity of a multilevel model. Additionally, the empty or null model provides information about the reliability of the predictive power of intercepts to the outcome of interest.

The regression equation established for this research question is as follows.

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$,

Class-level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

In the above equations, the elements represent:

Y_{ij} is the outcome variable (i.e., *Self-Efficacy*)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable.

γ_{00} is the grand mean, that is, overall average score of outcome variable for all classes.

r_{ij} is the random effect of student *i* in class *j*.

u_{0j} is the random effect of class *j*.

Students' self-efficacy is a single sub-scale of Motivated Strategies for Learning Questionnaire (MSLQ). An individual One-Way random effects ANOVA model was formed by using self-efficacy variable. Table 4.46 and Table 4.47 indicates the results of the final estimations of fixed and random effects.

One-way random effects ANOVA model analysis suggested that the final estimations f variance components at class level for self-efficacy was statistically significant, where τ_{00} is the variance of the true class means, β_{0j}, around the grand-mean, γ_{00}. This means that there is an amount of variance varying among class means for self-efficacy (τ_{00} =. 036, χ^2= 266.842, df = 133, p < .001). These findings suggested that conducting HLM analysis is appropriate for self-efficacy.

The ICC as calculated by the formula $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$ was presented in the Table 4.47. In this study, the calculated ICC suggested that 4 % of the total variance in Self-Efficacy was explained by the between-class variability. Additionally, the reliability estimate calculated by the one-way random effects ANOVA model was .49. It suggested that the sample means of self-efficacy moderately reliable for the true class means.

Table 4.46 Final Estimation of Fixed Effects for Self-Efficacy: One-Way Random Effects ANOVA Model

Fixed Effects	Coefficient	SE
Self-Efficacy Average class mean, γ_{00}	.014	.023

Table 4.47 Final Estimation of Variance Components for Self-Efficacy: One-Way Random Effects ANOVA Model

Random Effects	Variance Components	df	χ^2	ICC (ρ)	Reliability(λ)
Self-Efficacy					
Class mean, u_{0j}	.036	133	266.842***	.04	.49
Level-1 Effect, r_{ij}	.924				

Note. ICC = Intraclass correlation,
*** $p < .001$

4.2.3.2 Results of Research Question 3.b: Means as Outcomes Model

3.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' self-efficacy beliefs in science classes?

A *Means as Outcomes Model* was utilized to test the abovementioned question. In this question, students' self-efficacy beliefs in science classes were predicted by the teacher (class level variables) based on the information suggested by the One-way Random Coefficients ANOVA model (Empty or null). As mentioned before, empty or null model does not include predictor variables in any levels and provides information about the partition of variance between levels. If there is statistically significant amount of variation in the level two, then it is appropriate to construct an HLM model including level two predictors. Thus, a means as outcomes model was constructed for self-efficacy to investigate whether there are teacher (class) level variables explaining variance in self-efficacy beliefs of students. Results of means as outcomes model were presented in Table 4.48 and Table 4.49 respectively.

The regression equation for this question is as follows:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(ZT\_AtISM)_j + \gamma_{02}(ZT\_AtISP) + \gamma_{03}(ZT\_TSESE) + \gamma_{04}(ZT\_TSEIS) + \gamma_{05}(ZT\_TSECM) + \gamma_{06}(ZT\_GRCOMP) + \gamma_{07}(ZT\_TASKAN) + \gamma_{08}(ZT\_JOBSAT) + u_{0j}$$

The elements in the above equations represent:

Y_{ij} is the outcome variable (Self-efficacy)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable (self-efficacy).

γ_{00} is the grand mean, that is, overall average score of outcome variable (self-efficacy) for all classes.

γ_{01} is the differentiating effect of teacher's Mastery Approaches to Instruction on class mean of outcome variable (self-efficacy).

γ_{02} is the differentiating effect of teacher's Performance Approaches to Instruction on class mean of outcome variable (self-efficacy).

γ_{03} is the differentiating effect of teacher's Efficacy Beliefs for Student Engagement on class mean of outcome variable (self-efficacy).

γ_{04} is the differentiating effect of teacher’s Efficacy Beliefs for Instructional Strategies on class mean of outcome variable (self-efficacy).

γ_{05} is the differentiating effect of teacher’s Efficacy Beliefs for Classroom Management on class mean of outcome variable (self-efficacy).

γ_{06} is the differentiating effect of teacher’s Collective Efficacy Beliefs for Group Competence on class mean of outcome variable (self-efficacy).

γ_{07} is the differentiating effect of teacher’s Collective Efficacy Beliefs for Task Analysis on class mean of outcome variable (self-efficacy).

γ_{07} is the differentiating effect of teacher’s Job Satisfaction on class mean of outcome variable (self-efficacy).

r_{ij} is the level-1 residual.

u_{0j} is the level-2 residual.

In this level two variables only model, level two variance, which is denoted by τ_{00}, is described as the residual or conditional variance after controlling for other level two variables (Raudenbush & Bryk, 2002).

Since there are a number of level two variables, the entering order of these variables to the means as outcomes model was determined by the magnitude of t-values of each predictor. Firstly, all level two variables were entered in the model and the analysis was run. Then, by considering the magnitude of t-values the variables, the entering order of was determined. Then, the variable with the highest t value was entered the first and other variables were entered subsequently in accordance with their descending t values. The variables were entered step by step and significant ones were kept in the model, nonsignificant ones were removed. The final model included only significant variables after this step by step procedure. Results of the final estimations of means as outcomes models were presented in Table 4.48 and Table 4.49.

The results of the means as outcomes model for *Self-Efficacy* suggested that teachers' *Mastery Approaches to Instruction* (ZT_AtISM; $\gamma = .062$, se = .025, $p < .05$) was found as positively significantly associated and teachers' Efficacy for Instructional Strategies (ZT_TSEIS; $\gamma = -.055$, se = .024, $p < .05$) was found as negatively significantly associated with students' science *Self-Efficacy*. These results suggested that students who were in classes of teachers implementing science instruction based on mastery approaches believed in their ability in science more and students taught by teachers with high efficacy beliefs in their instruction had less self-efficacy belief in science classes.

The comparison of the residual variances (τ_{00}) of two models (*One-Way Random Effects ANOVA Model* and *Means as Outcomes Model*) established for *Self-Efficacy* indicated that there is a decrease in favor of *Means as Outcomes Model*. In other words, inclusion of level two variables (*teachers' Mastery Approaches to Instruction and Efficacy for Instructional Strategies*) accounted for some portion of residual variance existing between the classes. The proportion of variance explained at class level, denoted by R^2, can be calculated by subtracting τ_{00} calculated by *Means as Outcomes Model* from τ_{00} calculated by *One-Way Random Effects ANOVA Model.*

R^2 = Proportion of variance explained by β_{0j}

$$= \frac{\tau_{00}(\,Random\ Effects\ ANOVA\ Model) - \tau_{00}\ (Means\ as\ Outcomes\ Model)}{\tau_{00}(\,Random\ Effects\ ANOVA\ Model)}$$

Proportion of variance explained by level two variables for self-efficacy is calculated as

$$= \frac{0.03626 - 0.03284}{0.03626} = 0.094$$

As can be seen in the Table 4.49, 9.4 % of the true between-class variance in students' self-efficacy beliefs in science class was explained by the teachers' *Mastery Approaches to Instruction* and *Efficacy for Instructional Strategies*. Examination of Table 4.49 indicated that χ^2 statistic is still significant for students' self-efficacy variable, which means that there is still a considerable amount of residual variance for self-efficacy varying among classes and these two teacher variables were not sufficient to explain this residual variance.

Table 4.48 Final estimations of fixed effects for teacher level predictors - Means as Outcomes Model

	Self-Efficacy	
Fixed Effects	γ	SE
Model for Class Means Intercept	.015	.023
ZT_AtISM (Mastery Approaches to Instruction)	.062*	.025
ZT_TSEIS Efficacy for Instructional Strategies	-.055*	.024

Note. Only predictors in final models were included in the table. The all continuous teacher level variables were grand mean centered
*p < .05

Table 4.49 Final Estimation of Variance Components for Self-Efficacy: Means as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2
Self-Efficacy				
Class mean, u_{0j}	.033	133	251.683***	.094
Level-1 Effect, *rij*	.924			

*** $p < .001$

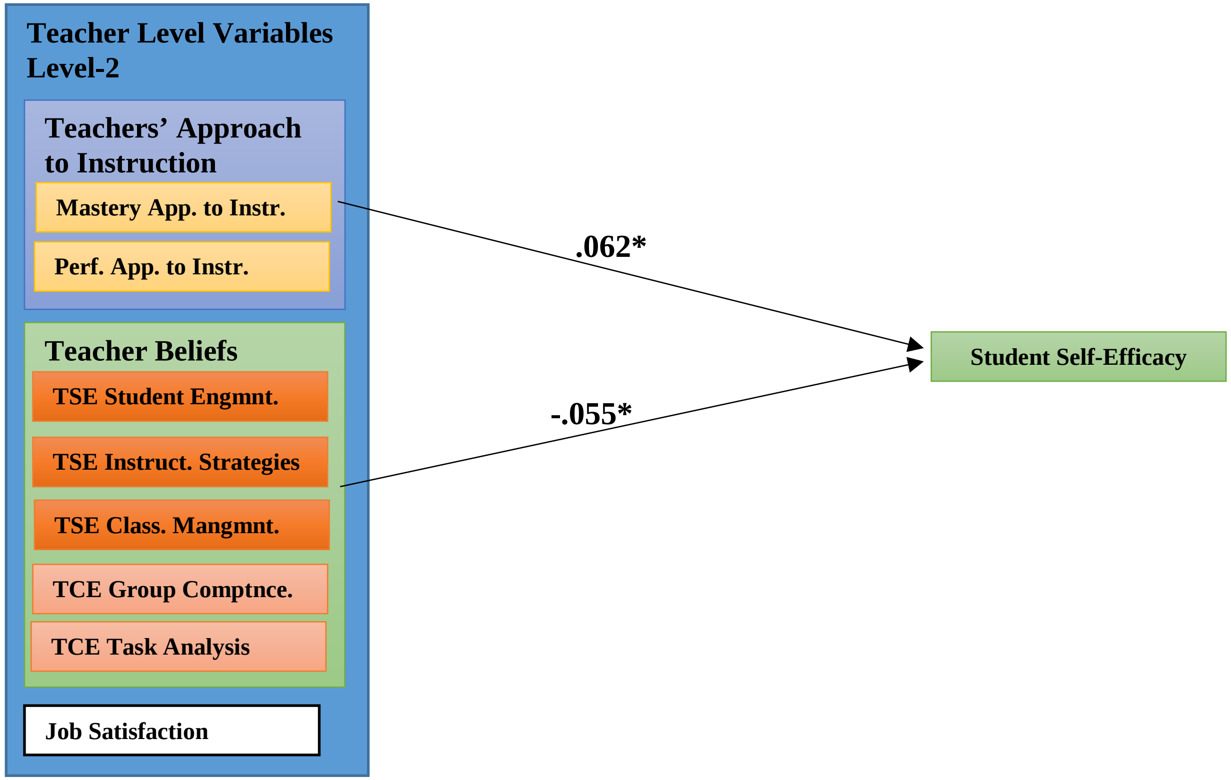

Figure 4.9 Predicting students' self-efficacy by teacher variables (level-2)

Note. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variable.

*p < .05

4.2.4 Results of Research Question 4: Students' Science Achievement

The fourth set of HLM analysis were performed to provide solutions for the research questions related to students' science achievement.

4. The fourth research question included 4 sub-questions:

> 4.a. To what extent do students in different classes (taught by different teachers) vary in science achievement?
>
> 4.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' science achievement?
>
> 4.c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) predict students' science achievement?
>
> 4.d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) and students' science achievement?

4.2.4.1 Results of Research Question 4.a: One-Way Random Effects ANOVA Model

4.a. To what extent do students in different classes (taught by different teachers) vary in science achievement?

The above question was tested through One-Way Random Effects ANOVA Model in order to see whether there lies variances in means of Students' Science Achievement among classes. The regression equation for the related sub-question is:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$,

Class-level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

In the above equations, the elements represent:

Y_{ij} is the outcome variable (i.e., *Science Achievement*)

β_{0j} is regression intercept of class j, that is, class mean on *Science Achievement*.

γ_{00} is the grand mean, that is, overall average score of *Science Achievement* for all classes.

r_{ij} is the random effect of student *i* in class *j*.

u_{0j} is the random effect of class *j*.

An individual One-Way random effects ANOVA model was established by using science achievement test scores. Table 4.50 and Table 4.51 indicate the results of the final estimations of fixed and random effects.

One-way random effects ANOVA model analysis suggested that the final estimations of variance components at class level for science achievement was statistically significant, where τ_{00} is the variance of the true class means, β_{0j}, around the grand-mean, γ_{00}. This means that there is an amount of variance varying among class means for science achievement (τ_{00} =. 541, χ^2= 1493.727, df = 133, p < .001). These findings suggested that conducting HLM analysis is appropriate for science achievement.The ICC as calculated by the formula $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$ was presented in the Table 4.51. In this study, the calculated ICC suggested that 29 % of the total variance in Science Achievement was explained by the between-class variability. Additionally, the reliability estimate calculated by the one-way random effects ANOVA model was .91. It suggested that the sample means of science achievement highly reliable for the true class means.

Table 4.50 Final Estimation of Fixed Effects for Science Achievement: One-Way Random Effects ANOVA Model

Fixed Effects	Coefficient	SE
Science Achievement Average class mean, γ_{00}	-.009	.049

Table 4.51 Final Estimation of Variance Components for Science Achievement: One-Way Random Effects ANOVA Model

Random Effects	Variance Components	df	χ^2	ICC (ρ)	Reliability (λ)
Science Achievement					
Class mean, u_{0j}	.295	133	1493.727***	.29	.91
Level-1 Effect, *rij*	.714				

Note. ICC = Intraclass correlation,
*** $p < .001$

4.2.4.2 Results of Research Question 4.b: Means as Outcomes Model

4.b. To what extent do teacher (class) level variables (i.e., *Mastery Approaches to Instruction*, *Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) predict students' science achievement?

In order to test the above question regarding students' science achievement, a Means as Outcomes model was constructed. Based on the information presented by the One-Way Random Effects ANOVA Model, the variance components of students' science achievement are significant at both student and teacher levels. Therefore, a Means as Outcomes Model was constructed to explain the variance at teacher (class) level with teacher variables. Results of means as outcomes model constructed for science achievement were presented in Table 4.52 and Table 4.53 respectively.

The regression equation for this question is as follows:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + r_{ij}$

Teacher level (level-2) model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(ZT\_AtISM)_j + \gamma_{02}(ZT\_AtISP) + \gamma_{03}(ZT\_TSESE) + \gamma_{04}(ZT\_TSEIS) + \gamma_{05}(ZT\_TSECM) + \gamma_{06}(ZT\_GRCOMP) + \gamma_{07}(ZT\_TASKAN) + \gamma_{08}(ZT\_JOBSAT) + u_{0j}$$

The elements in the above equations represent:

Y_{ij} is the outcome variable (Science Achievement)

β_{0j} is regression intercept of class j, that is, class mean on outcome variable (Science Achievement).

γ_{00} is the grand mean, that is, overall average score of outcome variable (Science Achievement) for all classes.

γ_{01} is the differentiating effect of teacher's Mastery Approaches to Instruction on class mean of outcome variable (Science Achievement).

γ_{02} is the differentiating effect of teacher's Performance Approaches to Instruction on class mean of outcome variable (Science Achievement).

γ_{03} is the differentiating effect of teacher's Efficacy Beliefs for Student Engagement on class mean of outcome variable (Science Achievement).

γ_{04} is the differentiating effect of teacher's Efficacy Beliefs for Instructional Strategies on class mean of outcome variable (Science Achievement).

γ_{05} is the differentiating effect of teacher's Efficacy Beliefs for Classroom Management on class mean of outcome variable (Science Achievement)

γ_{06} is the differentiating effect of teacher's Collective Efficacy Beliefs for Group Competence on class mean of outcome variable (Science Achievement).

γ_{07} is the differentiating effect of teacher's Collective Efficacy Beliefs for Task Analysis on class mean of outcome variable (Science Achievement).

γ_{08} is the differentiating effect of teacher's Job Satisfaction on class mean of outcome variable (Science Achievement).

r_{ij} is the level-1 residual.

u_{0j} is the level-2residual.

Raudenbush and Bryk (2002) stated that in means as Outcomes model, which included only level two variables, the variance at the second level, τ_{00}, is the residual or conditional variance after other level two variables are controlled. In this study, there are a number of level two variables and each of them were entered in the Means as Outcomes Model to test whether they were predicting students science achievement. The entering order of these teacher level variables were determined as was done for the self-efficacy in section 4.3.1.2. Exactly the same procedure with self-efficacy was applied in this model as well. The final model constituted of only significant teacher level variables. Results of the final estimations of means as outcomes models constructed for students' science achievement were presented in Table 4.52 and Table 4.53.

The results of the means as outcomes model for Science Achievement suggested that only teachers' *Mastery Approaches to Instruction* (ZT_AtISM; γ

= .158, se = .045, $p < .05$) was found as positively and significantly associated with students' science achievement. This finding indicated that students' are more successful in classes of science teachers who utilize mastery approaches in their science instruction. In other words, when students are taught by teachers employing various teaching strategies, taking into account students skills when assigning homework, and considering student progress more than their test scores, they are more successful in comparison with students of other teachers.

The comparison of the residual variances (τ_{00}) of two models, *One-Way Random Effects ANOVA Model* and *Means as Outcomes Model*, established for *Science Achievement* suggested that there is a decrease in *Means as Outcomes Model.* The Inclusion of level two variable, *teachers' Mastery Approaches to Instruction,* accounted for some portion of residual variance existing between the classes. The proportion of variance explained at class level, R^2, can be calculated by subtracting τ_{00} of *Means as Outcomes Model* from τ_{00} of *One-Way Random Effects ANOVA Model.*

For *Science Achievement;*

R^2 = Proportion of variance explained by β_{0j}

$$= \frac{\tau_{00}(\,Random\ Effects\ ANOVA\ Model) - \tau_{00}(Means\ as\ Outcomes\ Model)}{\tau_{00}(\,Random\ Effects\ ANOVA\ Model)}$$

Proportion of variance explained by level two variables for science achievement is calculated as:

$$= \frac{0.29497 - 0.27215}{0.29497} = 0.077$$

As shown in the Table 4.53, 7.7 % of the true between-class variance in students' science achievement was explained by the teachers' *Mastery Approaches to Instruction*. Table 4.53 indicated that χ^2 statistic is still significant for students' science achievement variable, which means that there is still an amount of residual variance for student achievement varying among classes and teachers' *Mastery Approaches to Instruction* was not sufficient to explain the whole amount of residual variance.

Table 4.52 Final estimations of fixed effects for teacher level predictors - Means as Outcomes Model for Science Achievement

	Science Achievement	
Fixed Effects	γ	SE
Model for Class Means		
Intercept	-.009	.047
ZT_AtISM (Mastery Approaches to Instruction)	.157**	.045

Note. Only predictors in final models were included in the table. The all continuous teacher level variables were grand mean centered
**p* < .05, ***p* < .01

Table 4.53 Final Estimation of Variance Components for Self-Efficacy: Means as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2
Science Achievement				
Class mean, u_{0j}	.295	133	1493.727***	.077
Level-1 Effect, *rij*	.714			

*** *p* < .001

4.2.4.3 Results of Research Question 4.c: Random Coefficients Model

4.c. To what extent do student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) predict students' science achievement?

The research question above examined the contribution of student level variables of self-efficacy, achievement goals (i.e. *Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*), and students' engagements (i.e. *Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) on the students' science achievement. To investigate this research question, a Random Coefficients Model was constructed for students' achievement in science class. In this model, students' self-efficacy, achievement goals (*Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals*) and students' engagements (*Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement)* in science classes were entered as level one predictors and science achievement as the outcome variable. In Random Coefficients Model, a regression equation consisting of intercepts and slopes are constructed for every class and this model provides information about the average of the all classes' intercepts and slopes. Additionally, the variation caused by the regression equations from class to class is also provided in the model output. The hypothesized relationships between predictors and outcomes, the slopes, can be fixed, random, both or none. A "Fixed slope" means that the degree of the relationship between predictor and outcome variable is approximately the same in each class. However, if the degree of the relationship is a "random slope", then it means that the degree of the relationship between the predictor and the outcome varies from class to class. In other words, while in some of the classes the relationship was strong, in other classes it is weak.

The regression equation for the research question 5.c is as follows:

Student level (level-1) model:

$Y_{ij} = \beta_{0j} + \beta_{1j}$ *(ZT_SELF) + β_{2j} *(ZT_MASTAP) + β_{3j} *(ZT_MASTAVO) + β_{4j} *(ZT_PERFAP) + β_{5j} *(ZT_PERFAVO) + β_{6j} *(ZT_ENGAG) + β_{7j} *(ZT_ENGBH) + β_{8j} *(ZT_ENGCG) + β_{9j} *(ZT_ENGEM) + r_{ij}

Teacher level (level-2) model:

$\beta_{0j} = \gamma_{00} + u_{0j}$

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$\beta_{0j} = \gamma_{q0} + u_{qj}$

In these models, the parameters indicate,

Y_{ij} is the outcome variable (i.e., *Science Achievement*)

β_{0j} is the mean on science achievement (i.e., average scores of the all classes on related outcome variable)

β_{1j} is the differentiating effect of students' self-efficacy in class j (i.e., the degree to which perceptions of student self-efficacy among students related to outcome variable)

β_{2j} is the differentiating effect of students' mastery approach goals in class j (i.e., the degree to which perceptions of mastery approach goals among students related to outcome variable)

β_{3j} is the differentiating effect of students' mastery avoidance goals in class j (i.e., the degree to which perceptions of mastery avoidance goals among students related to outcome variable)

β_{4j} is the differentiating effect of students' performance approach goals in class j (i.e., the degree to which perceptions of performance approach goals among students related to outcome variable)

β_{5j} is the differentiating effect of students' performance avoidance goals in class j (i.e., the degree to which perceptions of mastery approach goals among students related to outcome variable)

β_{6j} is the differentiating effect of students' agentic engagement in class j (i.e., the degree to which perceptions of agentic engagement among students related to outcome variable)

β_{7j} is the differentiating effect of students' behavioral engagement in class j (i.e., the degree to which perceptions of behavioral engagement among students related to outcome variable)

β_{8j} is the differentiating effect of students' cognitive engagement in class j (i.e., the degree to which perceptions of cognitive engagement among students related to outcome variable)

β_{5j} is the differentiating effect of students' emotional engagement in class j (i.e., the degree to which perceptions of emotional engagement among students related to outcome variable)
β_{qj} is the coefficient for variable q for class j after accounting for other variables

γ_{00} is the average of class means on the outcome variable across the population of classes
γ_{q0} is the average q factor- outcome variable slope across those classes

u_{0j} the unique increment to the intercept associated with class j

u_{qj} the unique increment to the slope associated with class j

In the above regression equations, β_{0j} represented the intercepts and all other β's represented the slope parameters for each predictor variables.

The Random Coefficient Models of students' science achievement was established based on the suggestions of Raudenbush and Bryk (2002). The same regression equation building strategy with the section 4.3.2.3 (for engagement dimensions) were followed exactly the same in the model building process for science achievement. After constructing the final version of the model, the results of the Random Coefficient Model for science achievement, final estimation of fixed effects and random effects were presented in Table 4.54 and Table 4.55, respectively. The final estimation of random coefficient models were detailed for science achievement below.

Results of the Random coefficients model for science achievement revealed that among the nine level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*), fixed effects of *Self-Efficacy* (*ZT_SELF*; γ = .114, se = .021, p < .001), *Mastery Approach Goals* (ZT_MASTAP; γ = .147, se = .021, p < .001) and Behavioral Engagement (ZT_ENGBH; γ = .180, se = .024, p < .001) were positively and significantly correlated with Science Achievement. On the other hand, *Cognitive Engagement* (ZT_ENGCG; γ = -.052, se = .022, p < .05), *Mastery Avoidance Goals* (ZT_MASTAVO; γ = -.047, se = .018, p < .05), and *Performance Avoidance Goals* (ZT_PERFAVO; γ = -.074, se = .021, p < .01) were found negatively significantly correlated with science achievement. From the level one variables, *Emotional Engagement* and *Performance Approach Goals* did not associate with students' science achievement. In terms of variance components, Random coefficients model suggested that *Self-Efficacy - Science Achievement* slope (χ^2 = 174.166, p < .05), *Agentic Engagement – Science Achievement* slope (χ^2 = 163.056, p < .05), *Mastery Avoidance Goals – Science Achievement* slope (χ^2 = 162.298, p < .05), and *Performance Avoidance Goals – Science Achievement* slope (χ^2 = 188.002, p < .01) varied significantly randomly among classes. Additionally, since fixed and random effects of performance approach goals on science achievement was not significant, it was removed from the model. Lastly, while the fixed effect of agentic engagement was not significant on science achievement, its random effect was significant. Therefore, it was kept in the model as a random variable. Similarly, random effects of self-efficacy, mastery avoidance goals, and performance avoidance goals were significant on both fixed and random effects. They were kept as random variables. Behavioral engagement, cognitive engagement and mastery approach goals only had significant fixed effects. Therefore, they were kept in the model as fixed variables. These findings suggested that, the variables which had random effects could be modeled further to investigate the sources of randomness in the class level. This is to say that, teacher characteristics may account for some portion of these differences among classes.

To calculate how much variation of Science Achievement was explained by the inclusion of level one variables, the level one variance (σ^2) of One-Way Random Effects ANOVA model for science achievement and the level one variance (σ^2) of Random Coefficients Model science achievement were compared. The reduced variance, R^2, was calculated for science achievement as follows:

$$R^2 = \frac{\sigma^2(\,Random\ Effects\ ANOVA) - \sigma^2(Random\ Coefficients)}{\sigma^2(\,Random\ Effects\ ANOVA)}$$

$$= \frac{0.71388 - 0.60108}{0.71388} = .158$$

The inclusion of level one variables (*Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, And Emotional Engagement*) in the Random Coefficients Model for Science achievement accounted for 15.8 % of the within class variance in students’ science achievement.

Concerning the reliability coefficients of the intercept and randomly varying slopes, the findings suggested that reliability of the intercept (.89) fairly high in comparison with other randomly varying slopes of performance avoidance (.21), self-efficacy (.16), agentic engagement (.14), and mastery avoidance goals (.12).

Table 4.54 Final estimations of fixed effects for level one predictors – Random Coefficients Model for Science Achievement

Fixed Effects	Science Achievement	
	γ	SE
Model for Class Means Intercept	-.010	.047
ZT_SELF (Self-Efficacy)	.114***	.021
ZT_MASTAP (Mastery Approach Goals)	.147***	.021
ZT_MASTAVO (Mastery Avoidance Goals)	-.047*	.018
ZT_PERFAVO (Performance Avoidance Goals)	-.074**	.021
ZT_ENGBH (Behavioral Engagement)	.180***	.024
ZT_ENGCG (Cognitive Engagement)	-.052*	.022

Note. Only predictors in final models were included in the table.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.55 Final Estimation of Variance Components for Science Achievement: Random Coefficients Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Science Achievement					
Class mean, u_{0j}	.277	133	1287.905***		.89
ZT_SELF	.008	133	174.166*		.16
ZT_ENGAG	.007	133	163.056*		.14
ZT_MASTAVO	.006	133	162.298*		.12
ZT_PERFAVO	.014	133	188.002**		.21
Level-1 Effect, *rij*	.601			.158	

p < .05, **p* < .01, *** *p* < .001

4.2.4.4 Results of Research Question 4.d: Intercepts and Slopes as Outcomes Model

4.d. To what extent do class (teacher) level variables (i.e., *Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) influence the relationship between student level variables (i.e., *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, and Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*) and students' science achievement?

A set of Intercepts and Slopes as Outcomes models were constructed for Students' science achievement by including the results of the previously constructed models for science achievement. The variables at level one and level two were included in the present model subsequently. At first, the teacher level variables which were previously found as significantly linked with intercept of science achievement in Means As Outcomes Model (*teachers' Mastery Approaches to Instruction)* and student level variables which were previously found as significant predictors of science achievement in Random Coefficients Model (*Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Avoidance Goals, Behavioral Engagement, and Cognitive Engagement*) were run in a combined model. Additionally, Agentic engagement was not fixed but randomly varying slope. Therefore, it was included in the below model equations as a random level one variable.

The equations for the first model are:

Student Level (level-1) Model:

$Y_{ij} = \beta_{0j} + \beta_{1j}*(ZT\_SELF) + \beta_{2j}*(ZT\_MASTAP) + \beta_{3j}*(ZT\_MASTAVO) + \beta_{4j}*(ZT\_PERFAVO) + \beta_{5j}*(ZT\_ENGAG) + \beta_{6j}*(ZT\_ENGBH) + \beta_{7j}* ZT\_ENGCG) + r_{ij}$

Teacher level (level-2) model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30} + u_{3j}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

$\beta_{5j} = \gamma_{50} + u_{5j}$

$\beta_{6j} = \gamma_{60}$

$\beta_{7j} = \gamma_{70}$

Results of the above model indicated that teachers' Mastery Approaches to Instruction was found significantly associated with the intercept of science achievement. Thus, it was kept in the model.

Afterwards, 8 teacher level variables (*Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis, and Job Satisfaction*) were entered in the model to test whether they have a moderating effect on the randomly varying slopes of significant level one predictors (*Self-Efficacy, Mastery Avoidance Goals, Performance Avoidance Goals, and Agentic Engagement)* of cognitive engagement.

The same procedure was followed for each randomly varying slope (i.e. *Self-Efficacy, Mastery Avoidance Goals, Performance Avoidance Goals, and Agentic Engagement*) in the model as was done for the previously conducted intercepts and slopes as outcomes models and non-significant variables were removed from the model. The final form of the equations for the Intercepts and Slopes as Outcomes Model for Science Achievement was as follows:

Student Level (level-1) Model:

$Y_{ij} = \beta_{0j} + \beta_{1j}*(ZT\_SELF) + \beta_{2j}*(ZT\_MASTAP) + \beta_{3j}*(ZT\_MASTAVO) + \beta_{4j}*(ZT\_PERFAVO) + \beta_{5j}*(ZT\_ENGAG) + \beta_{6j}*(ZT\_ENGBH) + \beta_{7j}* ZT\_ENGCG) + r_{ij}$

Teacher level (level-2) model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ZT\_AtISM})_j + u_{0j}$

$\beta_{1j} = \gamma_{10} + u_{1j}$

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30} + u_{3j}$

$\beta_{4j} = \gamma_{40} + u_{4j}$

$\beta_{5j} = \gamma_{50} + u_{5j}$

$\beta_{6j} = \gamma_{60}$

$\beta_{7j} = \gamma_{70}$

The results of the final estimations of fixed effects of the final full Intercepts and Slopes as Outcomes Model for science achievement were shown in Table 4.56. Students' average scores on Science Achievement test significantly but negatively associated with teachers' Mastery Approaches to Instruction (ZT_AtISM; γ = .134, se = .042, p < .01). Moreover, Intercepts and Slopes as Outcomes Model included the results of Random Coefficients Model. These results suggested that, among the nine level one variables (i.e. *Self-Efficacy, Mastery Approach Goals, Mastery Avoidance Goals, Performance Approach Goals, Performance Avoidance Goals, Agentic Engagement, Behavioral Engagement, Cognitive Engagement, and Emotional Engagement*), *Self-Efficacy* (*ZT_SELF*; γ = .114, se = .021, p < .001), *Mastery Approach Goals* (ZT_MASTAP; γ = .147, se = .021, p < .001), and Behavioral Engagement (ZT_ENGBH; γ = .180, se = .024, p < .001), were positively and significantly correlated with students Science achievement. On the other hand, *Mastery Avoidance Goals* (ZT_MASTAVO; γ = -.047, se = .018, p < .05), *Performance Avoidance Goals* (ZT_PERFAVO; γ = -.074, se = .021, p < .01), and Cognitive Engagement (ZT_ENGCG; γ = -.051, se = .022, p < .05) were found to have negative correlations with students' achievement in science. There might be slight differences in slope coefficient in the random coefficients models and intercepts and slopes as outcomes model. This might be the result of adding level two variables in the model.

Unfortunately, results of final full Intercepts and Slopes as Outcomes Model suggested any cross-level interactions among the predictors of *Science* *achievement*. Although there were still significant amount of variances among the classes in terms of variance components of self-efficacy (χ^2 = 174.141, p < .05), agentic engagement (χ^2 = 163.056, p < .05), mastery avoidance (χ^2 = 162.272, p < .05), and performance avoidance (χ^2 = 187.984, p < .01), the teacher variables were not able capture any portion of this variability among classes.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model for Science achievement were presented in Table 4.57. Since there were any teacher level variable that could moderate the relationship between student level variable and science achievement, explained variance was not calculated for them. However, the proportion of variance explained by level two predictors in the intercept of students' science achievement was calculated. This variance was calculated by comparing variance components obtained from Random Coefficient Model and final full Intercepts and Slopes as Outcomes Model as follows:

Proportion of variance explained in β_{qj}

$$R^2 = \frac{\tau_{qq}(\,Random\ Coefficient) - \tau_{qq}(Intercepts\ and\ Slopes\ as\ Outcomes)}{\tau_{qq}(\,Random\ Coefficient)}$$

β_{qj} is Science achievement or the slope coefficient for a given variable

Proportion of variance explained in *Science achievement*, β_{0j}:

$$R^2 = \frac{0.27654 - 0.25916}{0.27654} = .062$$

R^2 value showed that 6.2 % of the between class variance in science achievement was explained by the teachers' mastery approaches to instruction variable. There remained a considerable amount of variability among classes in terms of science achievement to be explained by teacher level variables (χ^2 = 1213.432, $p < 0.01$).

Table 4.56 Final estimations of fixed effects for Science Achievement – Intercepts and Slopes as Outcomes Model

Fixed Effects	Coefficient	SE
Model for Class Means		
Intercept	-.010	.046
ZT_AtISM Teachers Mastery Approaches to Instruction	.134**	.042
ZT_SELF Self-Efficacy	.114***	.021
ZT_MASTAP Mastery Approach Goals	.147***	.021
ZT_MASTAVO Mastery Avoidance Goals	-.047*	.018
ZT_PERFAVO Performance Avoidance Goals	-.074*	.021
ZT_ENGBH Behavioral Engagement	.180***	.024
ZT_ENGCG Cognitive Engagement	-.051*	.022

Note. Only predictors in final models were included in the table. All continuous teacher level variables were grand mean centered.
**p* < .05, ***p* < .01, ****p* < .001

Table 4.57 Final Estimation of Variance Components for Cognitive Engagement: Intercepts and Slopes as Outcomes Model

Random Effects	Variance Components	df	χ^2	R^2	Reliability (λ)
Science Achievement					
Class mean, u_{0j}	.259	132	1213.432***	.062	.88
ZT_SELF	.008	133	174.141*		.16
ZT_ENGAG	.007	133	163.056*		.14
ZT_MASTAVO	.006	133	162.272*		.12
ZT_PERFAVO	.013	133	187.984**		.21
Level-1 Effect, *rij*	.601			.158	

Note. Only predictors in final model were included in the table
p* < .05, ***p* < .01, * *p* < .001.

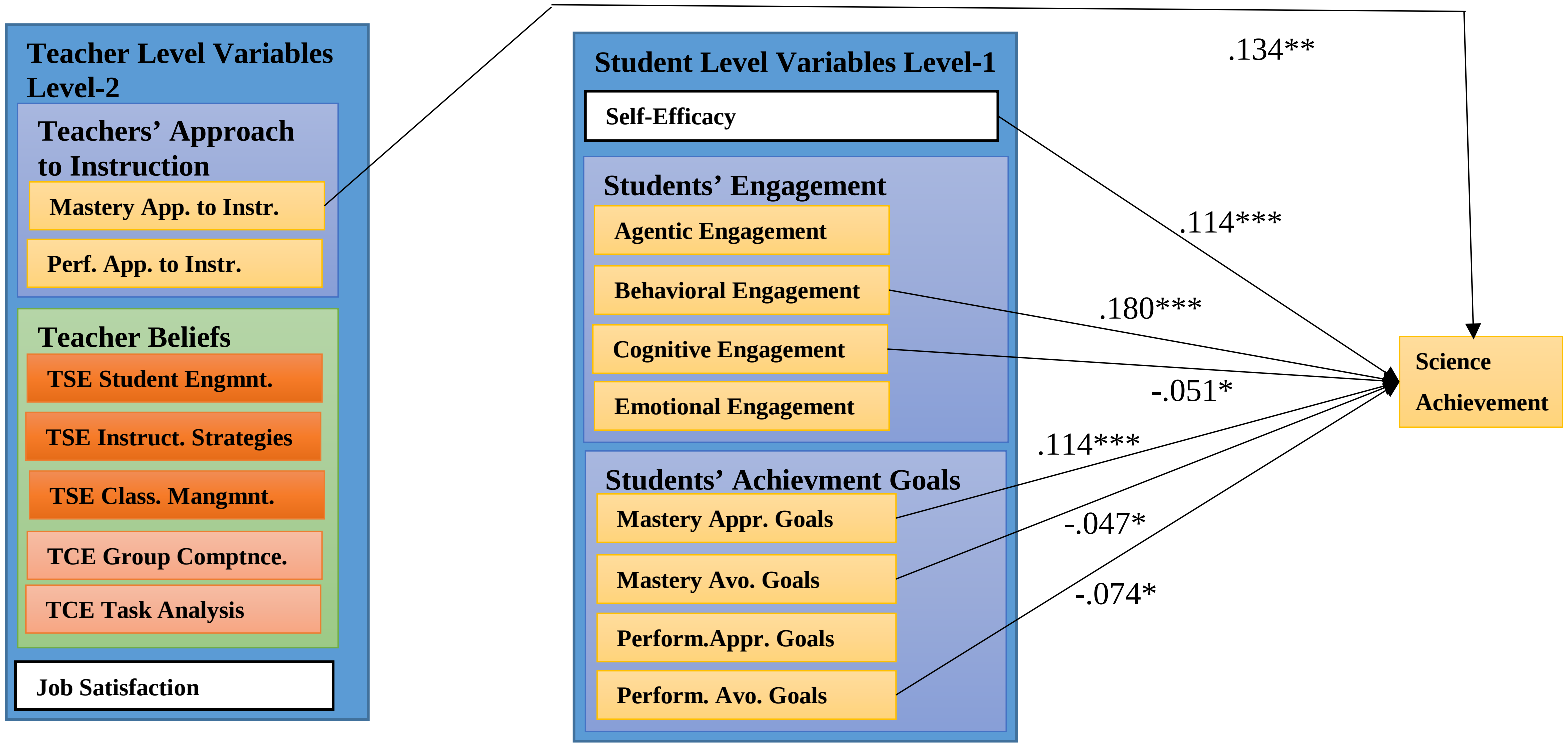


Figure 4.10 Predicting Science Achievement by Student Self-Efficacy, Achievement Goals, Engagement (level-1) and teacher variables (level-2)

Note. Arrows do not indicate causal relationships. Their directions are from predictors to outcome variables.

$*p < .05$, $**p < .01$, $***p < .001$.

4.3 Path Analysis

Path analysis is a special form of Structural Modeling and uses observed variable scores unlike structural equation modeling which uses latent variable while constructing structural models. Both SEM and path analysis share the same assumptions before conducting analysis. Next section explains briefly the assumptions checked before conducting path analysis.

4.3.1 Assumptions of Structural Equation Modeling

Assumptions of structural equation modeling are explained briefly in this section. Tabachnick and Fidell (2013) stated that adequate sample size, nonexistence of missing data, outliers, normality, linearity, absence of multicollinearity and singularity, and residuals need to be checked before conducting structural equation modeling.

Firstly, SEM requires large sample sizes but there is not a clear cut number for the adequate sample size. According to Kline (2011), sample size between 100 and 200 subjects are considered as a medium sample size. In the current study, 134 teachers were recruited. Therefore, sample size was adequate enough to conduct path analysis.

For missing data, outliers and, normality sections 4.1.1, 4.1.2, and 4.1.3 provide detailed information and they were all in acceptable ranges. Regarding linearity, Tabachnick and Fidell (2013) suggested testing linearity through selecting certain variables and examining their linear bivariate scatterplot. In the current study, scatterplots were examined for variables and no serious violations of linearity assumption was encountered.

Perfect linear combinations and extremely high correlations between variables are indications of singularity and multicollinearity, respectively (Tabachnick & Fidell, 2013). Bivariate correlations value of .90 may point out existence of multicollinearity and singularity and should be checked. Moreover, LISREL software signals warning messages when program encounters such inconveniences. In the current study, bivariate correlations between variables for high correlations were examined in section 4.1.4 and no violations were met. Moreover, warning messages of LISREL were also examined and there was not a problem in terms of multicollinearity and singularity. Lastly, residuals in SEM are represented by residual covariances. The residual covariances should be small and around zero with a symmetrical frequency distribution (Tabachnick & Fidell, 2013). Standardized residuals are preferred to interpret in z scores and LISREL output provides these scores. In the current study, standardized residuals, which were provided by LISREL, were checked in addition to modification indices of confirmatory factor analysis and path analysis.

4.3.2 Results of Research Question 5:

The fifth research question addressed the relationships among school context variables and teacher characteristics variables. This research question was tested through by conducting a path analysis.

5. What are the relationships among the teachers' perception of school environment variables *(i.e., School Mastery Goals, School Performance Goals, Relations with Parents, Relations with Colleagues, Supervisory Support, and Discipline Problems)* teachers' motivation *(i.e., Mastery Approaches to Instruction, Performance Approaches to Instruction, Efficacy for Student Engagement, Efficacy for Instructional Strategies, Efficacy for Classroom Management, Group Competence, Task Analysis),* and Job Satisfaction ?

In order to test the fifth research question, a path model was specified. The specified path model was shown in Figure 4.11. The test of the relationships shown in the Figure 4.11 below was tested through LISREL 8.80 statistical package program and the fit indices suggested an acceptable fit to the model (χ^2 = 54.30, RMSEA = .07, CFI = .98, SRMR = .04, and NFI = .96). Since the model did not include any mediation effect, the standardized path coefficients (*β*s) for direct effects were examined. The standardized path coefficients for direct effects are graphically presented in Table 4.58.

In the path model, teachers' relations with parents, discipline problems they had in the classroom, supervisory support they receive, mastery and performance goal structure of the school variables accounted for 23 % of the variance in teachers' mastery approaches to instruction. More specifically, results suggested that relations with parents (*β=.21*) and school mastery goals structure (*β=.30*) significantly and positively associated with teachers' mastery approaches to instruction. These results implied that science teachers having positive relationships with parents, and perceiving their school's goal structure as mastery oriented were likely adopt mastery approaches to their instruction. For performance approaches to instruction, supervisory support, school mastery goals and school performance goals explained 34 % of the variance. Only positive and significant predictor of the teachers' performance approaches to instruction was school performance goals (*β=.64*). This means that when teachers perceive that their school emphasizes performance oriented goals, they tend to implement performance approaches in their science instruction.

For the group competence dimension of teachers' collective efficacy, results demonstrated that 39 % of the variance in group competence was explained by relations with parents, discipline problems, supervisory support, and relations with colleagues, school mastery goals, and school performance goals. In terms of significant relationships, results suggest that group competence was predicted by school mastery goals (*β=.62*) significantly and positively. Discipline problems teachers have in their classrooms negatively and significantly predicted (*β=-.15*) teachers' belief in their abilities in teaching as a group. This means that, when schools communicate mastery goals, teachers' belief in their competence as a group are likely to increase. Additionally, similar to the findings regarding teachers' mastery approaches to instruction, as science teachers perceive discipline problems at lower levels, their belief in their teaching capability as a group tend to enhance .

Concerning the second dimension of teachers' Collective Efficacy, 33 % of the variance in Task Analysis was explained by teachers' relations with students' parents, discipline problems, supervisory support, school mastery and performance goals. While school mastery (*β=.20*) and performance (*β=.23*) goals associate with task analysis significantly and positively, discipline problems (*β=-.36*) associate negatively. This is to say that, while in school where mastery and performance goals are emphasized, teachers' belief in their collective efficacy to analyze teaching task increases. As expected, discipline problem diminishes teachers' collective belief in their ability to analyze teaching task.

With regard to teachers' self-efficacy beliefs dimensions, teachers' relations with students' parents, discipline problems, supervisory support, school mastery and performance goals explained 39 % of the variance in teachers' efficacy for student engagement. While relations with parents (*β=.37*) and school mastery goals (*β=.32*) associate significantly and positively with teachers' efficacy for student engagement, discipline problems associate significantly and negatively (*β=-.19*). Teachers' beliefs in their capability to engage students in science classes increases in schools emphasizing mastery goals. Likewise, stronger teacher-parent relationships increase teachers' belief in their ability to engage students to science class. On the other hand, having discipline problems in science classes decrease teachers' belief in their ability to engage students to science classes. The same teachers' perceived school context variables as predictors were tested for the second dimension of teachers' efficacy for instructional strategies. The results suggested that 33 % of the variance was explained by the predictor variables in teachers' efficacy for instructional strategies. Teachers' relations with parents (β = .22) and school mastery goal structure (β = .44) correlated significantly and positively with teachers' efficacy for instructional strategies. These results demonstrated that positive parent-teacher relationship and mastery oriented school goal structure increased teachers efficacy in their belief to implement instructional strategies. Lastly, the same predictor school context variables explained 29 % of the variance in the third dimension of teacher self-efficacy, namely efficacy for classroom management. For teachers' efficacy for classroom management, results indicated that while parent relationships (β = .29) significantly and positively associated with teachers' belief in their capability to manage the classroom, as expected, discipline problems (β = -.30) influenced significantly and negatively. This means that teachers feel more confident in classroom management when they have positive relationships with students' parents and when they had discipline problems during their teaching, their efficacy belief in managing the classroom decreased.

Lastly, for teachers' job satisfaction variable, results suggested that 37 % of the variance was explained by teachers' relations with students' parents, discipline problems, supervisory support, relations with colleagues and school mastery goals. While relations with parents (β = .38), supervisory support (β = .16), and relations with colleagues (β = .21), predicted teachers' job satisfaction significantly and positively, discipline problems (β = -.20), predicted it significantly and negatively. These results suggested that teachers' job satisfaction is free from the goal structure of the school. In other words, what is emphasized by the school in terms of school goals did not influence teachers' professional satisfaction. Teachers' gauge their professional perceptions based on the relations with students' parents, relations with their colleagues, the support they receive from the school administration and the discipline problems they had during their teaching.

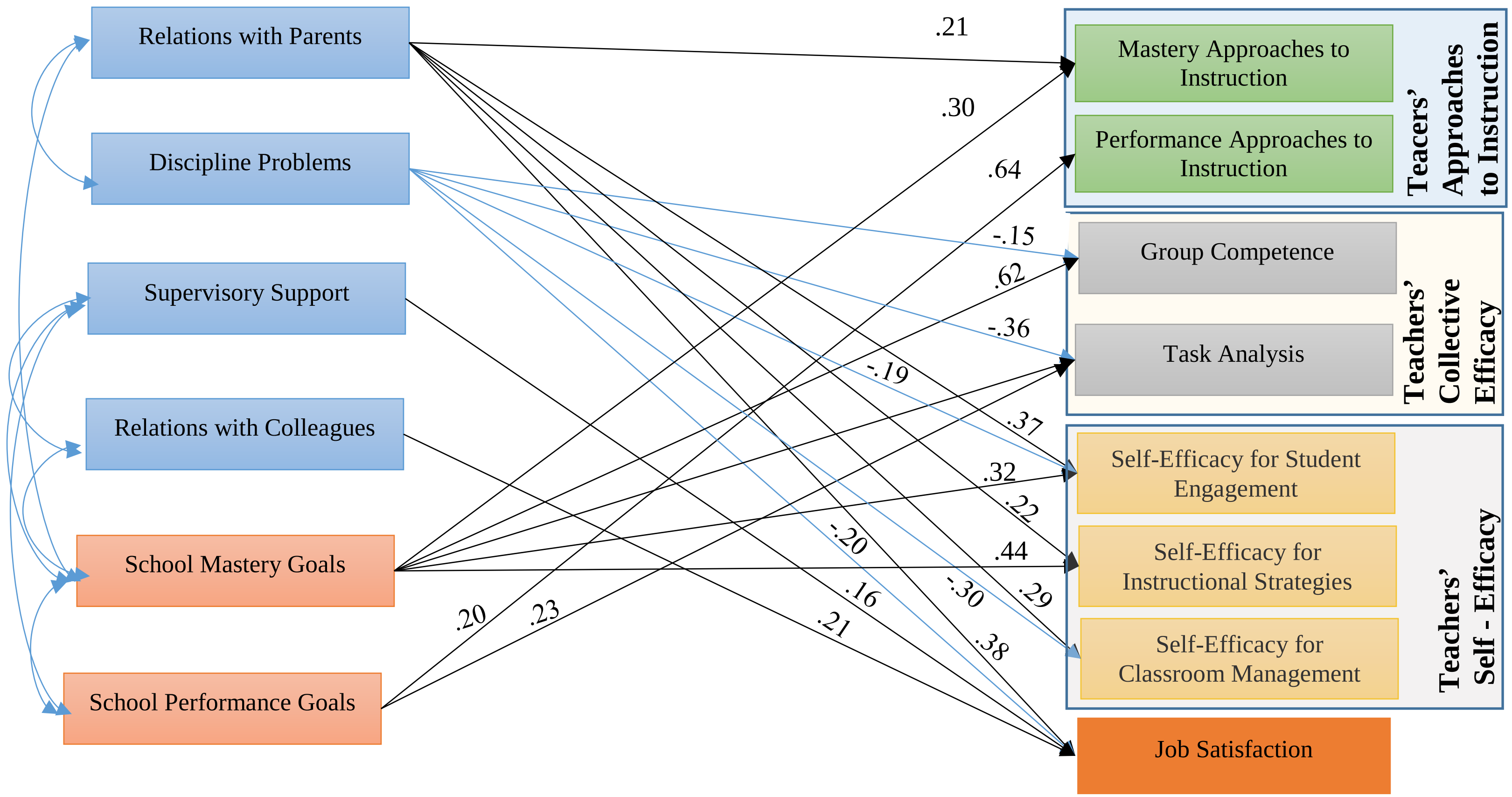


Figure 4.11 Significant paths from School Environment variables to Teacher Motivation and Job Satisfaction Variables

Blue lines indicate significant negative relationships.

Table 4.58 Standardized Path Coefficients of Direct Effects on Teacher Motivation and Job Satisfaction

Effect	*Direct Effects*	*Standard Errors of the Estimates*	*t*	R^2
On Mastery Approaches to Instruction				
of Relations with Parents	.21*	.06	2.46	
of Discipline Problems	.14	.04	-1.68	
of Supervisory Support	.09	.05	1.05	.23
of School Mastery Goals	.30*	.09	2.94	
Of School Performance Goals	-.01	.10	-.06	
On Performance Approaches to Instruction				
of Supervisory Support	.04	.05	.47	
of School Mastery Goals	-.13	.10	-1.44	.34
of School Performance Goals	.64*	.10	7.07	
On Group Competence				
of Relations with Parents	.04	.06	.51	
of Discipline Problems	-.15*	.04	-2.00	
of Supervisory Support	.10	.05	-1.26	
of Relations with Colleagues	.11	.06	1.46	.39
of School Mastery Goals	.62*	.10	6.62	
of School Performance Goals	-.12	.10	-1.31	
On Task Analysis				
of Relations with Parents	.12	.09	1.45	
of Discipline Problems	-.36*	.06	-4.63	
of Supervisory Support	.02	.07	.25	.33
of School Mastery Goals	.20*	.15	2.16	
of School Performance Goals	.23*	.15	2.45	
On Teacher Efficacy for Student Engagement				
of Relations with Parents	.37*	.08	4.93	
of Discipline Problems	-.19*	.06	-.260	
of supervisory support	-.01	.07	-.17	.39
of School Mastery Goals	.32*	.14	3.51	
of School Performance Goals	.02	.14	.18	

Table 4.58 Standardized Path Coefficients of Direct Effects on Teacher (Continued)

On Teacher Efficacy for Instructional				
of Relations with Parents	.22*	.08	2.77	
of Discipline Problems	.12	.06	-1.53	
of Supervisory Support	.03	.07	-.35	.33
of School Mastery Goals	.44*	.13	4.60	
of School Performance Goals	.02	.13	20	
On Teacher Efficacy for Classroom Management				
of Relations with Parents	.29*	.09	.52	
of Discipline Problems	-.30*	.07	-3.82	
of Supervisory Support	.03	.08	.32	.29
of School Mastery Goals	.18	.15	1.80	
of School Performance Goals	-.02	.15	-.16	
On Job Satisfaction				
of Relations with Parents	.38*	.08	4.95	
of Discipline Problems	-.20*	.06	-2.72	
of Supervisory Support	.16*	.07	2.15	.37
of Relations with Colleagues	.21*	.08	2.71	
of School Mastery Goals	-.01	.12	-.19	

**Significant paths*

4.4 Summary of Findings

The main purpose of this study was to investigate the relationships among science teachers' motivation, job satisfaction, and students' motivation, engagement, and science achievement. Additionally, the influence of school context variables and school goal structure on teachers' motivation and job satisfaction was also examined. Accordingly, a series of HLM analyses were conducted to reveal the relationships between teacher level variables (motivation and job satisfaction) and students' motivation, engagement, and science achievement. Then, a path model was conducted to be able to reveal the relationships among school context variables, school goal structures, teacher motivation, and teacher job satisfaction.

Firstly, results of HLM analyses revealed that students' self-efficacy was positively associated to by teachers' mastery approaches to instruction and negatively associated to teachers' efficacy for instructional strategies. For engagement dimensions, results revealed different predictors. Students' agentic and behavioral engagement in science was positively associated to students' self-efficacy, mastery approach goals, mastery avoidance goals, and performance approach goals. None of the teacher level variables included in the current study were able to predict both student agentic and behavioral engagement. Different from the agentic and behavioral engagement, cognitive engagement linked to students' performance avoidance goals positively in addition to self-efficacy, mastery approach and mastery avoidance goals. Moreover, teachers' efficacy for student engagement associated negatively with students' cognitive engagement and positively moderated the relationship between students' performance avoidance goals and cognitive engagement. Lastly, teachers' job satisfaction positively moderated the relationship between mastery approach goals and cognitive engagement. For emotional engagement, students' self-efficacy, mastery approach and avoidance goals, and performance approach goals were found as positively associated. Regarding teacher level predictors, teachers' mastery approaches to instruction associated positively with emotional engagement and teachers' efficacy for student engagement predicted it negatively. Teachers' collective efficacy dimensions moderated the relationships between student level predictors and emotional engagement. Particularly, teacher' collective efficacy for task analysis moderated the relationship between students' self-efficacy and emotional engagement and teachers' collective efficacy for group competence moderated the relationship between students' mastery approach goals and emotional engagement positively.

For students' achievement goals, students' self-efficacy in science classes correlated positively with all four dimensions of achievement goals, namely, mastery approach goals, mastery avoidance goals, performance approach goals, and performance avoidance goals. In terms of teacher level predictors and moderation effects, results revealed that mastery approach goals associated positively with teachers’ efficacy for classroom management, mastery avoidance goals associated negatively with teachers’ job satisfaction, and performance avoidance goals associated negatively with teachers’ collective efficacy for task analysis. For moderation effects, HLM analyses results indicated that teachers’ efficacy for instructional strategies moderated the relationship between self-efficacy and performance avoidance goals and the relationship between performance approach goals and self-efficacy was moderated negatively by teachers’ job satisfaction.

For students’ science achievement, HLM analysis indicated that the strongest positive student level predictor was behavioral engagement, followed by self-efficacy and mastery approach goals with the same magnitude. Moreover, students’ science achievement associated negatively with students’ cognitive engagement, mastery avoidance goals and performance avoidance goals. Regarding teacher motivation influences on students’ science achievement, results indicated that teachers’ mastery approaches to instruction was the only significant positive predictor. Other teacher level variables included by the current study were not able to predict students’ science achievement.

Lastly, for the relationships among teachers’ perception of school context variables, school goal structures, teachers’ motivation and job satisfaction, path analysis results indicated that teachers’ mastery approaches to instruction was positively linked to their relationships with parents and school mastery goal structure. Teachers’ performance approaches to instruction, on the other hand, were found to be positively related only to school performance goals. In addition, results demonstrated that teachers’ collective efficacy beliefs were linked to school goal structure (both mastery and performance) positively and to the discipline problems in the classroom negatively. For teachers' self-efficacy, while all three dimensions of teachers' self-efficacy (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management) was positively associated with the relations with parents positively, efficacy for student engagement and efficacy for instructional strategies were also positively related to school mastery goal structure. In addition, efficacy for student engagement and efficacy for classroom management were found to be negatively linked to the discipline problems teachers' suffer in their classrooms Finally, according to the results, teachers' job satisfaction was positively related to relations with parents, supervisory support, and relations with colleagues. Only negative association was found with discipline problems science teachers' suffered in their classrooms.

CHAPTER V

DISCUSSION AND CONCLUSIONS

This chapter, firstly, presents the discussions of the findings obtained in the results section. Next, conclusions, implications, and limitations and recommendations inferred from the current study follow.

5.1 Discussion

In the present study, five main research questions and their related sub questions were tested. For these questions, a number of Hierarchical Linear Models (HLM) including both teacher and student level variables and a path analysis consisting of only teacher variables were conducted. Concerning HLM, 10 one-way random effect ANOVA models, 10 means as outcomes models, 9 random coefficient models, and 8 intercepts and slopes as outcomes models were constructed to be able to address the research questions. Teacher motivation variables of the study were teacher self-efficacy (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management), collective efficacy (group competence and task analysis), and instructional goal orientations (mastery and performance). Teachers' perception of school environment variables were teachers' perceptions of school context variables and school goal structures. Teachers' perception of school context variables included relationships with parents, relationships with colleagues, supervisory support and discipline problems. Teachers' perception of school goal structure variables were school mastery goal structure and school performance goal structure. Lastly, student variables of the study were students engagement (agentic, behavioral, cognitive, and emotional), achievement goals (mastery approach, mastery avoidance, performance approach, and performance avoidance), and students science achievement. The findings for each research question were discussed in the sections below.

5.1.1 R.Q. 1: Predicting Students' Engagements

HLM analysis conducted for predicting students' engagements (agentic, behavioral, cognitive, and emotional) revealed that all of the four dimensions of students' engagements were varying among classes and conducting multilevel analyses were appropriate. The ICC's calculated for agentic, behavioral, cognitive, and emotional engagement dimensions were 5 %, 4 %, 3 %, and 6 %, respectively. These results suggested that while a great majority of students' engagements were within classes, small percent of the variance were between classes and could be explained by teacher level variables. These results are consistent with the limited literature that Uden et al., (2014) reported in their study that Dutch vocational high school students' engagements varied among classes and calculated ICC's for the behavioral, cognitive and emotional engagement were 9.69 %, 13.64 %, and 22.22 %, respectively. Due to the limited number of studies investigating the relationship between teacher level variables and student engagement, findings of the study are not comparable but such ICC values are common in the field of both psychology and motivation research. Although the ICC's for Dutch high-schoolers were higher than the participants of the present study, such consistency is important that engagement data enabled construction of HLM models. Lastly, Uden et al., (2014) did not include agentic engagement in their research and results are incomparable for agentic engagement.

Predicting Agentic Engagement

For agentic engagement, HLM analysis suggested that none of the teacher level variables predicted students' agentic engagement. In other words, while One-Way Random Coefficients ANOVA model suggested an existence of level two variance component for Agentic Engagement, the specified teacher variables were not able to capture any portion of this variability between classes. The limited number of studies investigating the upper level predicted effects on student engagement did not include agentic engagement in their studies. Therefore, the findings of the current study could not be compared with any previously conducted studies. It is recommended that more research is needed investigating these relationships with similar samples to be able to make subtle discussions and interpretations.

Random Coefficients Model for agentic engagement indicated that, students' agentic engagement in science classes was predicted by students' self-efficacy beliefs ($\gamma = .358$), mastery approach goals ($\gamma = .122$), mastery avoidance goals ($\gamma = .093$), and performance approach goals ($\gamma = .062$). These findings indicated that students who have high self-efficacy in science, setting more mastery approach, mastery avoidance and performance approach goals tend to be more agentic engaged in science classes. Among these predictors, self-efficacy had the strongest relationship ($\gamma = .358$) with agentic engagement. This coefficient means that, when other predictor effects are held constant, a one point standard deviation increase in students' self-efficacy belief leads to a .358 increase in students' agentic engagement. Similarly, one point standard deviation increase in mastery approach goals, mastery avoidance goals and performance approach goals lead to .122, .093, and .062 point standard deviation increase in students' agentic engagement, respectively. Moreover, 22.4 % of the within class variance in agentic engagement was explained by self-efficacy, mastery approach goals, mastery avoidance goals, and performance approach goals. These results are in line with the previous research in general. For example, Hıdıroğlu (2014) reported a strong positive relationship between students' self-efficacy and agentic engagement in science in a path model with seventh grade students. Additionally, Hıdıroğlu and Sungur (2015) found that mastery approach goals make a significant contribution to the prediction of students' agentic engagement in science. This means that students who are willing to learn and master the material are expressing their preferences and manipulate the flow of the course according to their learning style. Students' mastery avoidance goals and performance approach goals also correlated positively with students' agentic engagement. This means that students who are avoiding not learning and not mastering and students who strive for besting others and getting the top grades in normative scoring are more likely to express their ideas and do not hesitate to manipulate the flow of the course. At this point, it is worth mentioning that since agentic engagement is a relatively new dimension for student engagement (Reeve & Tseng, 2011), studies investigating the relationships between achievement goals and agentic engagement are rare. Accordingly, there is a limited available study to compare results of current study in terms of the relationship between achievement goals and agentic engagement. Thus, dearth of studies regarding agentic engagement necessitates further research to make detailed interpretations and comparisons.

Predicting Behavioral Engagement

Concerning behavioral engagement dimension of students' engagement in science class, relationship between teacher level predictors, student level predictors, and their interactions for behavioral engagement, intercepts and slopes as outcomes model was constructed. The final model suggested that none of the teacher level variables predicted behavioral engagement of the students in science class. Similar to agentic engagement, the null model of HLM for behavioral engagement suggested a portion of variance existed among classes and it could be explained by teacher level variables. Nevertheless, teacher level variables covered in the present study could not capture any of this variability among classes. It indicated that other teacher level variables can be influential in explaining the class level differences for students' behavioral engagement in science classes. Another inference from this finding was that a great majority of the variance lied within classes for behavioral engagement. This finding was surprising because a recent study conducted by Uden et al., (2014) reported significant teacher level predictors for behavioral engagement. According to Uden et al., (2014), teacher proximity and influence explained 29 % of the variance in students' behavioral engagement at the group level. There were also other teacher level motivation variables (altruistic, intrinsic, and extrinsic motivation), beliefs about teacher knowledge (subject-matter knowledge, pedagogical knowledge, and didactic knowledge), and teacher self-efficacy and they were not found as associated with students' behavioral engagement. However, it should be mentioned that Uden et al., (2014) studied with students from vocational school and they were all high-school students. Moreover, the ICC in their study (9.69 %) for behavioral engagement was larger than the present study (4 %). Thus, further research is needed in terms of behavioral engagement and teacher level predictors in Turkey to be able to make better comparisons and deep interpretations.

For student level predictors of behavioral engagement, HLM analysis results showed that students' self-efficacy beliefs in science (γ = .338), mastery approach goals (γ = .368), mastery avoidance goals (γ = .043), and performance approach goals (γ = .064) positively correlated with their behavioral engagement. These findings indicated that students who have high self-efficacy in science class, setting more mastery approach, mastery avoidance, and performance approach goals tend to be more behaviorally engaged in science classes. While students' mastery goal orientation was the strongest (γ = .368) student level predictor for behavioral engagement, for agentic engagement, students' self-efficacy beliefs (γ = .358) were the strongest predictor. Students' self-efficacy beliefs, mastery approach goal orientations, mastery avoidance goal orientations and performance approach goal orientations explained almost half (% 43) of the variability within classes for students' behavioral engagement.

Concerning the relationship between students' self-efficacy and behavioral engagement, the findings of the study were in line with the previous studies (Bandura, 1997; Caraway et al., 2003; Hıdıroğlu, 2014; Ryan & Pintrich, 1997). In addition to theoretical assertions, previous studies verified the predictive power of self-efficacy on students' behavioral engagement. For example, Hıdıroğlu (2014) reported that seventh grade students' science self-efficacy beliefs associated positively with students' behavioral engagement in science class. In another study, Caraway et al., (2003) found that high school-students with high self-efficacy indicated more school engagement (behavioral engagement). Additionally, this study supported the findings of Warwick (2008). In mathematics, Warwick (2008) found that students' mathematics self-efficacy predicted students' behavioral, cognitive, and motivational engagement.

With regard to the relationship between students' behavioral engagement and achievement goals, the present study suggested that students' mastery and performance approach and mastery avoidance goals positively predicted students' behavioral engagement. At first glance, the relationship between mastery approach goals and behavioral engagement seems logical because a mastery oriented student value learning and try to master on a task for the sake of learning. Hence, results complied with the previously conducted research for mastery approach goals. For instance, Miller et al., (1996) reported that students with mastery approach goals exert extra effort in the classroom. Moreover, Patrick et al., (2007) found that students who set mastery approach goals engage in constructive discussions related to schoolwork with other students around. Studies presented above did not make a distinction between mastery approach and mastery avoidance goals. Therefore, it is not possible at the moment to discuss findings of this study regarding mastery avoidance goals. Although findings of the current study indicated a positive relationship between mastery avoidance goals and behavioral engagement (γ = .043), it is relatively low in comparison with the relationship between mastery approach goals and behavioral engagement (γ = .338). On the other hand, previous results suggested that performance goals associate with maladaptive patterns of behavior. Indeed, Ryan and Pintrich (1997) found that students with performance approach goals indicated maladaptive patterns of behavioral engagement such as avoiding help-seeking. In another study, Ryan and Patrick (2001) reported that students with performance approach goals display discipline distracting actions in the classroom. Goal theorists posited that (see Schunk, 2012) students may have multi-goals at the same time. Therefore, students may have both performance and mastery approach goals at the same time and their goals may lead them to behaviorally engage in science classes. Thus, positive relationship between various achievement goals and behavioral engagement is not surprising though.

Predicting Cognitive Engagement

HLM analysis conducted for cognitive engagement sub dimension of students' engagements in science classes suggested that in the teacher level, only teachers' Efficacy for Student Engagement associated negatively (γ = -.034) with students' cognitive engagement. This means that, students taught by teachers who are less confident in engaging students' in science class were found to be more cognitively engaged in science classes. Remaining teacher level variables were not found as significant predictors of students' cognitive engagement in science class. This finding is somehow contrasts with the limited literature on the relationships between teacher variables and students' cognitive engagement. Uden et al., (2014) reported a positive relationship between teacher self-efficacy and students' cognitive engagement. However, in their hierarchical linear modeling analysis, they entered their teacher level variables in a cumulative order and they found that significant effect of teacher self-efficacy on students' cognitive engagement waned when they entered teachers' interpersonal relationships variables (i.e. influence and proximity) in the analysis. In the current study, the items measuring cognitive engagement generally focused on cognitive strategies students' use while they are studying for science classes; not the strategies they use while they were in the science class (e.g. "When doing schoolwork, I try to relate what I'm learning to what I already know", When I'm working on my schoolwork, I stop once in a while and go over what I have been doing"). Therefore, if highly efficacious teachers cover all the aspects of the science topic of the day engaging their students, then students may use cognitive strategies less while studying for science class. Another explanation for this finding may be that according to Raudenbush et al. (1992) what teachers' believe concerning their confidence may not be compatible with how they perform teaching in the classroom. Similarly, what students perceive regarding the practices of their teachers may not be the same as theachers' beleifs about their practices. Nevertheless, such explanations are not more than speculation and further research is needed related to relationship between teacher beliefs and students' engagement. To be able to reach more tenable conclusions, more research is needed both in national and international context.

With regard to student level predictors, HLM analysis suggested that students' science self-efficacy (γ = .410), mastery approach goals (γ = .231), mastery avoidance goals (γ = .113), and performance avoidance goals (γ = .091), were positively linked with cognitive engagement. These results mean that students possessing high levels of self-efficacy in science, setting mastery approach, mastery avoidance, and performance avoidance goals tend to be more cognitively engaged in science classes. Moreover, these student level predictors explain a considerable amount of variance (38.5 %) in cognitive engagement.

These results are partly consistent with the previously conducted studies. For the relationship between students' self-efficacy and cognitive engagement, science education research has a number of studies to compare with. For instance, in Turkey, Hıdıroğlu (2014) reported a positive relationship. She stated that students who are confident in learning science topics are eager to associate their new learnings to what they already know and establish links between what they covered in science class and what they study further. Moreover, findings of the present study comply with the international findings. For example, in an early study, Anderman and Young (1994) examined the relationship between motivation and cognitive strategy use in sixth and seventh grade science classes. Researchers determined self-efficacy, learning goal orientations, expectancy-value and self-concept as the motivation constructs and cognitive strategy use as the engagement constructs. Their findings suggested that sixth and seventh graders who are learning oriented use deep learning strategies more. Moreover, students with high self-efficacy in science use deep learning strategies (cognitive engagement) in science.

In the current study, HLM analysis for the relationship between achievement goals (mastery approach, mastery avoidance, performance approach, and performance avoidance) suggested that mastery approach goals, mastery avoidance goals, and performance avoidance goals were positively correlated with cognitive engagement. There was not a significant relationship between cognitive engagement and performance approach goals of students in science classes. These findings suggested that students setting more mastery approach, mastery avoidance and performance avoidance goals tend to be more cognitively engaged in science classes. These findings partly support the findings of previous studies because the relationships between achievement goals and cognitive engagement have been investigated for three decades but a consensus on these relationships was not reached by the scholars. Early researchers did not make a distinction between approach and avoidance distinction of student goals and examined the relationships under the names of task (mastery) and ego (performance) goals (Meece et al., 1988; Nolen, 2003; Anderman & Young, 1994). Additionally, their research suggested mixed results. According to Greene (2015), science education research is rich in terms of the studies investigating relationships between achievement goals and cognitive engagement. Researchers have often used students' cognitive strategy use as an indication of students' cognitive engagement (Meece et al., 1988; Nolen, 2003; Anderman & Young, 1994). Thus, such a substitution enabled cognitive engagement research as one of the richest domains of engagement research. In one of these studies, Meece, Blumenfeld and Hayle (1988) investigated the relationships between task mastery goals and cognitive strategy use in six different science activities. Their results showed that students setting high levels of task mastery goals were more cognitively engaged in science activities. In another study, Nolen (2003) examined the relationships among high school students' perceptions of science learning environments, variables of motivation, learning strategies, and achievement. The results indicated that both task (mastery approach) orientation and ego orientation (performance approach) correlated positively with deep strategy use but the correlation was stronger between deep strategy use and task orientation. Moreover, Anderman and Young (1994) found that students setting more mastery (approach) goals were more cognitively engaged in science classes. Overall, these findings both contradict and support the findings of the present study in terms of approach dimension of achievement goals. For the avoidance goals, present study suggested that both mastery and performance avoidance goals correlate positively with cognitive engagement. This means that students who are avoiding misunderstanding and trying not to look incompetent are more cognitively engaged. These findings are reasonable from the perspective of competitive and examination oriented learning environments. Accordingly, Turkish educational system was defined as such an education system (Sungur & Şenler, 2009). Indeed, King and McInerney (2014) stated that in collectivist societies avoidance goals may yield adaptive outcomes if there is more competition oriented learning environments. In Turkey, students are subject to a series of examinations for placement of high schools and then for universities. Therefore, such norm-referenced ranking examinations may motivate students to use more cognitive strategies to avoid not learning and not looking dumb in the eyes of other students in science classes. Moreover, researchers from Iran, Rastegar, Jahromi, Haghighi and Akbari (2010), reported a positive relationship between Persian students' cognitive strategy use and performance avoidance goals in a non-Western society. Moreover, a related construct, metacognition was found to have positive associations with avoidance goals in previously conducted studies in Turkey (see Kıran, 2010; Kahraman, 2011). For example, in a path model with 1932 8^{th} grade students, Kıran (2010) investigated whether achievement goals predicted students' metacognition and effort regulation in science. Results indicated that mastery and performance avoidance goals correlated positively but weakly with metacognition. Kahraman (2011) also found that students' avoidance goal orientations (both mastery and performance) correlated positively with students' metacognitive strategy use in science. Although international studies proposed negative and mixed relationships between avoidance goal orientations and adaptive outcomes, Turkish students' avoidance goals also correlate positively with cognitive engagement. However, literature is limited though. Therefore, more research is needed to be able to make deep interpretations.

Predicting Emotional Engagement

For the last dimension of students' engagement, HLM analysis suggested that students' emotional engagement correlated positively with teachers' mastery approaches to instruction (γ = .040). This means that students in classes of teachers who perceive themselves to use mastery oriented instructional approaches at higher levels in science teaching were more likely to be emotionally engaged. Explicitly, these students feel that science class is fun and they love learning science in classes of teachers who pay attention on teaching science for the sake of teaching, not to make students compete with each other. This finding is reasonable and supported previous findings regarding the influence of teachers' mastery instructional approaches on students' emotional engagement (Anderman & Patrick, 2012). For instance, Wolters (2004) reported that students' perceiving their classrooms as mastery oriented put forth greater effort, did not delay starting their math works, persisted on aversive situations, were more likely to choose additional mathematics classes, and used more cognitive strategies. Students perceiving their teachers' instructional approach in science classes as mastery oriented generally displayed positive emotional engagement patterns. For example, these students displayed positive school-related affections (Ames & Archer, 1988; Kaplan & Midgley, 1997), feelings of belonging to school (Anderman & Anderman, 1999). To sum up, seventh grade students of present study showed more emotionally engaged patterns of behavior when their science teachers used mastery oriented instructional approaches in science classes.

Concerning the relationship between teachers' self-efficacy and students' emotional engagement, unlike the expected positive relationship, emotional engagement significantly but negatively associated with teachers' efficacy for student engagement ($\gamma = -.055$). This means that in classes where teachers feel more confident in engaging students to science classes, students feel less emotionally engaged. Students' love and sympathy to science classes decrease in the presence of high teacher confidence for engaging them in science classes. This finding was not supported by the literature because in a general sense, teachers' self-efficacy may enhance student's sense of efficacy, motivating engagement in class activities, and regulating their efforts in face of low success and challenging tasks (Ross, 1998; Ross, Hogaboam-Gray, & Hannay, 2004). Accordingly, Pianta, La Paro, Payne, and Bradley (2002), found that when students are taught by responsible and efficacious teachers, their academic engagement increases. In a recent study, Uden et al., (2014) reported that teacher self-efficacy associated positively but weakly with students' emotional engagement. The same group of researchers reported another significant positive relationship between teacher self-efficacy and student emotional engagement when student emotional engagement was measured from the teachers' perspective. Despite these counter findings in the literature, the negative relationship between students' emotional engagement and teachers' efficacy for student engagement could be reasonable. Turkish teachers generally use teacher centered instruction and students are accustomed to receiving information passively (Gökçe, 2006; Kozandağı, 2001; Özmen, 2003). Teaching learning process in Turkey may be summarized as transmitting knowledge from the source (teacher) to the receiver (students). On the contrary, in a learning environment where students are active and teachers are striving to engage students in science class, Turkish students may not feel comfortable. They may feel that they may not succeed. Therefore, in student centered learning environments students may feel anxiety and may not emotionally engage in science classes because of their teacher centered instruction background. Another explanation for the unexpected finding may be that what teachers believe they are capable of and what they perform in the classroom may not be the same and students' perceptions of these performances may not be the same as teachers' feelings about their performances (Raudenbush et al. 1992). However, these explanations are not more than speculations and more research is needed in Turkish context with different samples to shed more light on this relationship.

For students' emotional engagement in science classes, HLM analysis of intercepts and slopes as outcomes model suggested that self-efficacy ($\gamma = .335$), mastery approach goals ($\gamma = .292$), mastery avoidance goals ($\gamma = .067$), and performance approach goals ($\gamma = .039$) were found as positively correlated with emotional engagement. These four student level variables accounted for approximately 35 % of variance in students' emotional engagement in science class. Explicitly put, these findings suggested that students who have high self-efficacy in science were more emotionally engaged. In a similar way, students setting more mastery approach, mastery avoidance and performance approach goals were found to be more emotionally engaged in science classes. For the relationship between students' science self-efficacy and emotional engagement, findings of the present study was supported by the literature as the other dimensions of engagement. Self-efficacy was found to be associated positively with all dimensions of students' engagement. This means that students' self-efficacy was a prominent predictor of students' engagement in a general sense. Indeed, previous research support these findings for self-efficacy. For example, Schunk and Mullen (2012) stated that self-efficacy correlates positively with behavioral, emotional, and cognitive aspects of engagement. Caraway et al., (2003) found that students' self-efficacy correlated positively with students' emotional engagement. For achievement goals, the present study found that students' mastery approach, mastery avoidance and performance approach goals positively associated with students' emotional engagement. For mastery and performance approach goals, findings of the present study supported the studies conducted previously. Roeser, Midgley and Urdan (1996) examined the relationship between 8th grade middle school students' achievement goals and feelings of belonging to school (emotional engagement). They found that students possessing task goals (mastery approach) have the feeling of belonging to school. In another study, Murayama and Elliot (2009) investigated whether performance and mastery goals correlate significantly with intrinsic motivation and academic self-concept (intrinsic motivation and academic self-concept were considered as emotional engagement). They found that while mastery and performance approach goals correlated positively with students' emotional engagement, performance avoidance goals correlated negatively. Current study included performance avoidance goals in relation to students' emotional engagement but there was not a significant relationship. Additionally, students' mastery avoidance goals correlated positively with emotional engagement. However, the strength of the relationship was relatively low (γ = .067). As stated in previous sections, studies investigating the relationships between achievement goals with using approach avoidance distinctions and engagement constructs are rare. Though not the same but in Turkey, previous researchers reported positive relationships between avoidance goals and adaptive patterns of behavior (see Kıran, 2010; Kahraman, 2011). Thus, avoidance goals might correlate positively with adaptive outcomes in Turkish context. More research is needed regarding the relationships between the avoidance dimensions of achievement goals and motivational and engagement constructs to be able to make deeper interpretations.

Different from the other dimensions of engagement, teacher level variables moderated the relationships between student level predictors and emotional engagement. The relationship between students' self-efficacy and emotional engagement was moderated by teachers' collective efficacy for task analysis (γ = .031) and the relationship between mastery approach goals and emotional engagement was moderated by teachers' collective efficacy for group competence (γ = .042). These moderation effects mean that the relationship between students' self-efficacy and emotional engagement was stronger in classes where teachers have high collective efficacy in analysis of teaching tasks. Similarly, the relationship between students' mastery approach goals and emotional engagement was stronger in classes where teachers' collective efficacy for group competence is higher. These findings are reasonable because theoretically, student outcomes of teachers' collective efficacy were stated as student achievement, school dropout/attendance, college attendance, and student course selection (Goddard, Hoy, & Woolfolk-Hoy, 2004). Thus, expecting a direct relationship or a moderation effect of teachers' collective efficacy on student outcomes is not illogical. Indeed, this study suggested moderation effects for teachers' collective efficacy on the relationships between student self-efficacy and emotional engagement and mastery approach goals and emotional engagement. Despite theoretical assertions, collective efficacy lacks studies in terms of examining the relationships between teachers' collective efficacy and student outcomes other than student achievement. More research is needed to make better explanations and talk about possible relations of teachers' collective efficacy to student outcomes. Moreover, qualitative studies may reveal the origin of interrelationships between teachers' collective efficacy and student level outcomes such as emotional engagement.

5.1.2 R.Q. 2: Predicting Students' Achievement Goals

In the fourth research question of the present study, Turkish seventh grade students' achievement goal orientations (mastery approach, mastery avoidance, performance approach, and performance avoidance) in science class were predicted by teacher level variables (level two) and students' science self-efficacy. To be able to model the possible relationships between teacher level variables and achievement goals, an empty model HLM was run. Empty (or null) model provides a critical ICC coefficient that reveals the variance partition. If there is a significant amount of variance in the teacher level, then HLM modeling is possible. For each dimension of achievement goals of students', four separate empty HLM models were tested. The results suggested that there were some amount of variance in the teacher level for each dimension of achievement goals. Explicitly, 5 % of the variance of mastery approach goals, 3 % of the variance for mastery avoidance goals, 3 % of the variance for performance approach goals, and lastly 3 % of the variance for performance avoidance goals were in the teachers' level. Thus, conducting further HLM models to predict achievement goals with teacher level predictors was plausible. Preliminary interpretations of the results of empty model suggested that great majority of the variance in students' achievement goals in science was within classes and the teacher level variance of the mastery approach goals was the largest one varying among classes. Recently, similar analyses with achievement goals were conducted by Yerdelen (2013) and Pamuk (2014) in Turkey. The findings of the present study supported their findings in terms of the ICC coefficients for achievement goals in science. For example, Yerdelen (2013) found 6 %, 3 %, 4 %, and 5 % ICCs for mastery approach, mastery avoidance, performance approach, and performance avoidance goals, respectively. Similarly, Pamuk (2014) reported that 8 %, 4 %, 4 %, and 5 % of ICCs for mastery approach, mastery avoidance, performance approach, and performance avoidance goals, respectively. Thus, variations of achievement goals are in close ranges for the three studies. For all three studies, mastery approach goals had the largest teacher level variability. The other dimensions of achievement goals had similar variability as well.

HLM analysis for the predictors of achievement goals in the student level included only student self-efficacy in science. Results of intercepts and slopes as outcomes model suggested that self-efficacy associated positively with all dimensions of achievement goals. This means that students who feel themselves more confident in science classes are likely to study in science classes for the reasons of mastering course material, besting others, getting the best grades as well as avoiding misunderstanding and looking incompetent in the eyes of others. Put it explicitly, while the strongest association was between self-efficacy and mastery approach goals ($\gamma = .405$), the smallest one was between self-efficacy and mastery avoidance goals ($\gamma = .063$). For performance goals, the regression coefficient between self-efficacy and performance approach goals was $\gamma = .303$ and for self-efficacy and performance avoidance goals was $\gamma = .150$. These findings implied that while students' self-efficacy beliefs predicted approach goals more strongly, avoidance goals were predicted by self-efficacy relatively weakly. These results are partly supported by the literature because research on the relationship between self-efficacy and achievement goals suggested mixed results. For example, Pajares, Britner, and

Valiente (2000) investigated the relationship between self-efficacy and achievement goals. They found that while self-efficacy correlated positively with mastery approach goals, it correlated negatively with performance avoidance goals. In a similar study, Anderman and Midgley (1992) reported positive relationships between mastery goals and students' self-efficacy. However, Pajares' (2006) caution concerning the influence of context on motivational constructs should be kept in mind. Indeed, competitive learning environments and exam oriented instruction in classrooms may lead students with high self-efficacy to adopt mastery avoidance goals (King & McInerney, 2014). A recent study conducted in Turkey by Kıran and Sungur (2012) found that students' self-efficacy in science associated positively with students' mastery approach, performance approach and mastery avoidance goals in science. The relationship between self-efficacy and performance avoidance goals was not significant. Similarly, Bezci (2016) found that self-efficacy associated positively with students' mastery avoidance goals in science. Moreover, in the current study, it was found that self-efficacy positively associated to students' performance avoidance goals as well. These findings for performance avoidance goals may be inspiring results for future researchers to investigate deeply such unexpected relationships. Moreover, qualitative investigations may enable researchers to dig deeply on students' achievement goals and their relationships with other motivational constructs.

Concerning the teacher level predictors of achievement goals, intercepts and slopes as outcomes model suggested that students' mastery approach goals were predicted by teachers' efficacy for classroom management (γ = .042). Approximately 6 % of the between class variance in students' mastery approach goals was explained by the teachers' efficacy for classroom management. This result suggested that students tend to set mastery approach goals when their teachers had high self-efficacy in classroom management. This finding complies with theoretical assertions regarding teacher self-efficacy (Woolfolk-

Hoy & Davis, 2006; Tschanennen Moran- Woolfolk-Hoy, 2004). Indeed, Woolfolk & Hoy (1990) stated that teachers with high sense of self-efficacy have a humanistic approach in classroom management strategies. In such an environment, it is not surprising to expect positive relationships between efficacy for classroom management and students' mastery approach goals. However, studies conducted on national context did not find a relationship between teachers' self-efficacy and students' mastery approach goals (see Yerdelen, 2013; Pamuk; 2014). Research on the relationships between teacher and student variables are relatively new in Turkey. Therefore, more research is needed to make better comparisons.

For mastery avoidance goals, HLM results of Means and Slopes as outcomes model suggested that teachers' job satisfaction associated negatively with students' mastery avoidance goals (γ = -.042). This relationship is not surprising because it is reasonable to expect low levels of mastery avoidant student goals in classes of teachers who are satisfied with being in teaching profession. Students may be avoiding misunderstanding or afraid of not learning in classes of teachers with low satisfaction from being in the teaching profession. Teachers' job satisfaction may positively influence the teaching behaviors of teachers and therefore, may be less likely to create learning environments promoting adoption of avoidance goals.

For performance approach goals, HLM analysis suggested that while none of the teacher level variables predicted students' performance approach goals in science classes, the relationship between students' self-efficacy and performance approach goals was moderated negatively by teachers' job satisfaction (γ = -.034). This means that the relationship between students' self-efficacy and performance approach goals in science class was weaker in classes of teachers who are satisfied from their profession. On the contrary, self-efficacy-performance approach relationship was stronger in classes of teachers with low job satisfaction. The reason for this finding may be that dissatisfied teachers may fail to promote cooperation among students and create a positive learning environment. Rather, in the classes of teacher with less job satisfaction, competition may arise among students for better learning. However, this explanation is speculative and warrants further investigation.

For performance avoidance goals, HLM analysis of means and slopes as outcomes model suggested that teachers' collective efficacy for task analysis negatively associated with students' performance avoidance goals ($\gamma = -.041$). This means that students set more performance avoidance goals in classes of science teachers who have low levels of collective efficacy for analysis of teaching tasks. This relationship is reasonable because performance avoidant students strive not to look dumb or not incompetent. Therefore, their goal is just to do a little to save themselves from being incompetent in the eyes of other students. Such a maladaptive behavioral pattern may likely occur in classes of teachers who have low levels of confidence in analysis of teaching task because when teachers have high levels of collective efficacy for analysis of teaching task, they are aware of the required sources and limitations of school facilities to elicit successful teaching (Goddard, Hoy, & Woolfolk-Hoy, 2000). In addition to teacher level predictor of performance avoidance goals, a cross-level interaction was found. Teachers' efficacy for instructional strategies negatively moderated the relationship between students' self-efficacy in science and performance avoidance goals ($\gamma = -.043$). This is to say that the relationship between students' self-efficacy in science and performance avoidance goals gets stronger in classes of teachers who have low self-efficacy in implementing instructional strategies. This finding is reasonable from theoretical perspective of teacher self-efficacy because teachers with high self-efficacy take students' needs into consideration and create more student-centered classrooms that emphasize non-competitive classrooms (Tschannen-Moran & Woolfolk Hoy, 2007; Woolfolk-Hoy & Davis, 2006). When teachers have low self-efficacy in their competence for instructional strategies, it is possible that students orient themselves to performance avoidance goals. Items in teachers' efficacy for instructional strategies ask "To what extent can you provide an alternative explanation or example, when students are confused?" or "How much can you use a variety of assessment strategies". High efficacy in such kind of situations may result in a classroom environment where students' with high self-efficacy decrease their tendency towards setting performance avoidance goals and in students with lower self-efficacy the tendency towards having performance avoidance goals may increase. However, research investigating the relationships between teacher variables and students' outcomes are limited to make better interpretations and comparisons. More empirical research are needed which tests the theoretical assertions in different contexts regarding teacher self-efficacy and students' achievement goals.

5.1.3 R.Q. 3: Predicting Students' Science Self-Efficacy

The third research question of the present study concerned seventh grade students' self-efficacy and its predictors on the teacher level. Since the data were in a nested structure, HLM analysis was used. Seventh grade students' self-efficacy in science class was measured by the Self-Efficacy dimension of Motivated Strategies for Learning Questionnaire. Descriptive statistics for the self-efficacy scale suggested that seventh grade Turkish students feel themselves fairly efficacious (M = 5.46, SD = 1.29, 7 point Likert) in science classes. The means of the all eight items of the scale were above the scale midpoint. Individual item mean scores indicated that while students feel most confident in doing well in science class (M = 5.74), they feel least confident in understanding the most difficult reading material in science classes (M = 4.91). Relatively less confident, anyway, they can be considered as highly efficacious about understanding reading materials. In a similar item level analysis study, Bezci (2016) reported parallel results with the present study. The same items had the highest and lowest item means in her study as well. Such a result could be associated with the PISA (Program for International Student Assessment) reading comprehension results because Turkish 15 year-olds were below the OECD average in reading comprehension tests. This means that Turkish adolescents have difficulties in comprehending what they read in their mother tongue. Overall, while Turkish students have a high general positive belief in their capabilities to do well in science class or an expectation to do well, their belief in their capabilities to grasp the most difficult material is relatively low.

Concerning HLM analysis for seventh grade students' self-efficacy beliefs in science class, a one-way random effects ANOVA model and Means as Outcomes models were conducted. One way Random Effects ANOVA (empty or null model) was conducted to detect whether the variance of students' science self-efficacy beliefs varied among classes. Empty model does not include any predictors from both level one and level two and only provides critical information regarding the variance components. After obtaining variance components, the proportion of between classes variance to the total variance yields the critical ICC coefficient which indicates how much of the total variability lies between classes. Related analysis revealed that there was a statistically significant variation among the classes concerning students' self-efficacy. Thus, it indicated that conducting HLM analysis was appropriate for this dataset. To find out the partition of variance between teacher and student levels, Intraclass Correlation Coefficient (ICC) was calculated. The ICC indicated that while 4 % of the variance was at the teacher (class) level, namely between classes, 96 % of the variance of students' self-efficacy was within classes. In other words, teacher level variables may explain 4 % of the total variability and student level variables may explain 96 % of the variability in students' self-efficacy in science. According to Hox (2010), in educational and organizational research, ICC of .05 is regarded as small, .10 as medium, and .15 as large values. According to this scale, ICC for self-efficacy in this study was low. Although the ICC was low in the present study, it was not a surprising result in the research on psychological constructs. For example, Pamuk (2014) found that, the ICC for students' science self-efficacy was around 6 % in a similar study conducted with a sample recruited from Ankara. Previously conducted research indicated similar values for such motivational and psychological constructs. For example, Peters (2013) found that the ICC for math self-efficacy was around 7 %. In Turkey, recently two studies yielded relatively higher ICC values for science self-efficacy. Yerdelen (2013) found in a nationwide study that the ICC for students' science self-efficacy was around 11 % and Yıldırım (2012) reported 17 % of ICC for math self-efficacy in a nationwide study conducted by using PISA 2003 Turkey data. The ICC values for self-efficacy fluctuates but it is clear that nationwide data inflates the ICC values. This may be caused by the large sample recruited from a wide range of students. However, Pamuk's (2014) study and present study were both conducted in Ankara and yielded similar ICC values for the students' residing in a similar region. Overall, for psychological constructs, such low values are not surprising.

To be able to predict which teacher level variables were influential in students' science self-efficacy beliefs, a means as outcomes model was tested. At the teacher level, teachers' *Mastery Approaches to Instruction* (γ = .062) was found as positively associated and teachers' *Efficacy for Instructional Strategies* (γ = -.055) was found as negatively associated with students' science *Self-Efficacy* beliefs. These results suggested that students who were in classes of teachers who perceived themselves as implementing science instruction based on mastery approaches at higher levels felt more self-efficacious in science. The relationship between teachers' instructional goal structures and students' self-efficacy has rarely been studied in the literature. Limited number of studies suggested somehow inconsistent results. For example, Wolters (2004) investigated the influence of classroom goal structure on high school students' math self-efficacy by using HLM analysis. Wolters (2004) found that students in classrooms where performance goal structure was emphasized reported a higher level of self-efficacy in mathematics. However, in another study, Urdan (2004) reported a positive relationship between high school students' self-efficacy in English class and classroom level mastery goal structure. Moreover, Gutman (2006) found that students who perceived more mastery-oriented classroom goals in 9^{th} grade experiences more positive change in their mathematics self-efficacy from 8^{th} to 9^{th} grades. Although literature presents positive relationships for both (mastery and performance) of the teacher instructional goals, in the current study there was not a significant relationship between teachers' performance approaches to instruction and student' self-efficacy in science. At this point, it is important to note that, previous studies mostly evaluated classroom goal structures from the students' perspective rather than teachers' self-reported instructional goal orientations. In other words, studies to date commonly evaluated teachers' instructional practices in terms of students' perceived classroom goal structures (Wolters, 2004; Urdan, 2004; Gutman, 2006). Ciani et al., (2008) criticizes the limited number of studies investigating the goal structure created in the classrooms by teachers through their instructional practices. Although there existed both student and teacher surveys in PALS (Patterns of Adaptive Learning Survey) booklet measuring goal structures in the classroom, number of studies is relatively low. Moreover, empirical research examining the influence of teachers' instructional goal structures on student outcomes is less in number (Miller & Murdock, 2007). In the current study, limited number of studies (despite available survey resources (e.g. PALS)) and the gap in the literature regarding the relationship between teachers' self-reported instructional goal structures and student outcomes were taken into consideration and teachers' instructional goals were investigated to strengthen the current research. Different from the available literature, findings indicated that students' self-efficacy and teachers' performance instructional goals did not associate. Abovementioned justifications may be the potential reasons for this non-relationship. Future research may investigate the reasons for this distinction in detail. Therefore, this study differs from previously conducted studies in this respect.

The second predictor of students' science self-efficacy in the teacher level was teachers' *Efficacy for Instructional Strategies.* Results of means as outcomes model suggested that students' self-efficacy in science class was negatively associated with teachers' efficacy for instructional strategies. More specifically, students who are taught by teachers having high levels of self-efficacy in implementing instructional strategies have relatively low levels of self-efficacy in science classes. Although this result is a contradiction with theoretical assertions by Woolfolk and Davis (2006), it has consistencies with empirical studies conducted both in national and international context. International and national studies did not present consistent results as well (see Kurien, 2011; Studart, 2006). For example, a recent study conducted in Turkey by Yerdelen (2013) did not report any significant direct association with three dimensions of science teachers' self-efficacy and students' science self-efficacy beliefs. Moreover, Pamuk (2014) reported a negative relationship between teachers' efficacy for classroom management and students' science self-efficacy in science while teacher efficacy for instructional strategies and teacher efficacy for student engagement had no relationship with students' science self-efficacy. In the current study, the negative relation found between efficacy for instructional strategies and students' science self-efficacy can be explained as follows: In turkey science teachers use mainly teacher centered instructional strategies. Science teachers mostly undertake the teaching and learning process personally and have their classes in a knowledge-transfer fashion. In such a circumstance in the science classrooms, students are passive receivers of scientific knowledge and students are not provided opportunities to actively participate in the construction of their own comprehension of knowledge (Gökçe, 2006; Kozandağı, 2001; Özmen, 2003). Thus, students are used to be in such teacher-centered learning environments. When teachers use various strategies including student-centered strategies, this may lead to a decrease in their self-efficacy. For example, Sungur and Tekkaya (2006) found that implementation of PBL as a student centered instructional strategy diminished students' self-efficacy in biology.

In addition, in a personal communication, Usher (E. Usher, personal communication, October 12, 2015) stated that self-efficacy is simply the answer to the question "*Can I do this?*". So, considering the teacher self-efficacy and student self-efficacy relationship from this perspective, teachers' answer to the question *"Can I implement instructional strategies effectively?"* may not be clearly related to the answer student give to the question *"Can I do well in science?"*. Nevertheless, such propositions regarding this negative relationship is not more than a speculation and more research is needed that investigates the relationship between science teachers' self-efficacy for instructional strategies and students' self-efficacy in science.

5.1.4 R.Q. 4: Predicting Students' Science Achievement

The fifth research question addressed the science achievement differences among the classes and their possible predictors in student and teacher level. The interaction effect of teacher level variables on the relationship between student level variables and students science achievement was also tested in the scope of this question. For the specified purpose, a series of HLM analyses were conducted due to the nested structure of the collected data.

To be able to examine whether there were class level differences or not, an empty model (One-Way Random effects ANOVA) was conducted. Results of one-way random effects ANOVA suggested that 29 % of the total variability in science achievement lied between classes. Accordingly, 71 % of the variance existed within classes. Similar findings were reported by studies conducted recently in Turkey (Pamuk, 2014; Taş, 2013; Yerdelen, 2013). For example, Yerdelen (2013) reported 30 % of ICC in students' science achievement and Pamuk (2014) and Tas (2013) reported 37 % of ICC in students' science achievement. Based on Hox's (2012) criteria, the ICC of 29 % can be labeled as a large value. Based on the findings of both current study and cited studies above, it can be said that in Turkey, students' science achievement varies among classes and this variability can be predicted by teacher level variables. Moreover, the variance in the teacher level was generally around 30 to 40 percent. Majority of the variance lied within classes which can be predicted by student level predictors.

After having evidence of teacher level variability for students' science achievement, means as outcomes, random coefficients and lastly intercepts and slopes as outcomes models were constructed via HLM software to be able to find teacher and student level predictors of science achievement and interactions between teacher and student level variables. Similar to the discussions of previously tested engagement and achievement goals, results of intercepts and slopes as outcomes model was taken into consideration because this last model includes previously conducted means as outcomes and random coefficient models. Accordingly, results suggested that teachers' mastery approaches to instruction predicted students' science achievement in science class. Teachers' mastery approaches to instruction variable accounted for 6.2 % of the between class variance in science achievement. Remaining 93.8 % of the between class variance was accounted for by other teacher or class level variables which were not included in this study. For the total variability of science achievement, approximately 2 % (6.2 * 29 %) of the variance was accounted for by the teachers' mastery approaches to instruction. However, it can be said that the predictive power of teachers' mastery approaches to instruction on students' science achievement was very low. Despite such a low explained variance, the findings of the present study regarding the relationship between teachers' mastery approaches to instruction and students' science achievement was supported by the literature. For example, Wolters (2004) found that mathematics achievement of middle school students was predicted by their perceptions of classroom mastery goal structures. Similarly, for fifth grade students, mathematics achievement was predicted by classroom mastery goal structure. Moreover, Urdan (2004) reported that at high school level, students' academic achievement in English was predicted by their perceptions of classroom mastery goal structure. On the other hand, despite inclusion of teachers' performance approaches to instruction, no relationship was found between students' science achievement. Literature presented mixed results in terms of the relationship between teachers' performance approaches to instruction and students achievement. While Ee et al., (2003) reported a positive relationship between teachers' performance approaches to instruction, Gutman (2006) reported no association for this relationship. In Turkey, however, literature is limited regarding the relationship between teachers' goal structure and student achievement. While the relationship between teachers' mastery approaches to instruction and students' science achievement was in the expected direction, it was hard to discuss results for the performance approaches to instruction. Therefore, more research is needed in this area and qualitative investigations may provide thick descriptions for the teachers' instructional goals and their influence on student outcomes.

Previous research has indicated that teachers' collective efficacy had a positive associations with student academic achievement (Caprara et al., 2006; Goddard et al., 2000) but in the current study, there was not a significant relationship between teachers' collective efficacy and science achievement. The reason for this unexpected finding may be that, in the current study, the data were collected from public schools In Turkey, science teachers in private school appears to have in better collaborative relationships with each other. On the other hand, in public schools collaboration among science teachers is not so apperant. Thus, the items used in the present study to assess collective efficacy may not be fully relevant for the teachers in public schools. So, to be able to provide better explanations for the the non-significant assocation between collective efficacy and science achievement, qualtitative data collection preocudres should be used and context should be examined deeply. Similar to teachers' collective efficacy, teachers' job satisfaction was not found as a significant predictor of students' science achievement. Despite the positive assocations documented between different levels of teachers' job satisfaction (low, medium, high) and students acacdemic achievement (low, medium, and high), by TIMMS report for Turkey (Yıldırım, Yıldırım, Ceylan, & Yetişir, 2013; Büyüköztürk, Çakan, Tan, & Atar, 2014), current study was unable to find a positive association. However, at this point it is import to note that, in the current study, the analyses were not conducted for different levels of job satisfaction and achievement separately. Instead, all data were analyzed totally as a single dataset. A categorization in dataset may reveal significant relationships between teachers' job satisfaction and student achievement but in the current study there was not a significant relationship.

Results of the HLM analysis regarding the relationships between student level predictors and students' science achievement were all in the expected direction except for cognitive engagement. Explicitly, results of intercepts and slopes as outcomes model suggested that while students' self-efficacy (γ = .114), behavioral engagement (γ = .180), and mastery approach goals (γ = .114), positively predicted students' science achievement; cognitive engagement (γ = -.051), mastery avoidance goals (γ = -.047), and performance avoidance goals (γ = -.074), predicted students' science achievement negatively. These six student level variables accounted for approximately 16 % of the within class variance in students' science achievement. Approximately 84 % of the variance lied within classes was explained by other student level variables which were not examined in this study. As stated before, 71 % of the variance was within classes and predictor student level variables accounted for about 11.4 % (16 x 71 %) of the total variability within classes in science achievement. These findings, suggested by HLM analysis were in line with the previous findings regarding the relationships with motivational and engagement constructs with students' achievement. In the following sections these significant relationships are discussed with previous findings from the literature.

Students' self-efficacy was found to have positive association with students' science achievement. Explained in other words, students holding high levels of "I can do it" feeling for science class scored higher in the science achievement test. This finding complied with the previous findings in the literature. Self-efficacy research is rich in terms of studies investigating the relationship between academic achievement and students' self-efficacy (Britner & Pajares, 2006; Linnenbrink & Pintrich, 2002; Hampton & Mason, 2003; Klassen, 2004; Pajares, 2006; Yildirim, 2012). In an early study, a meta-analysis concerning the relationship between academic achievement and self-efficacy was conducted by Multon, Brown, and Lent (1991). They examined 36 studies conducted between 1981 and 1988. They found that self-efficacy correlated with achievement with a moderate effect size and explained 14 % of the variance in students' academic achievement. For science education research, the literature reported consistent positive relationship between students' science achievement and student science self-efficacy as the present study did. For example, in a recent study Bergey et al., (2015) found that prior scientific inquiry self-efficacy predicted achievement on science achievement. In another study, Sun et al., (2012) examined the same relationship for Hong-Kong adolescents with the PISA 2006 data. The analysis of nation-wide data supplied by PISA revealed that students' with high self-efficacy in science were found more successful in science. Lastly, Yerdelen (2013) found students' self-efficacy as the strongest predictor of science achievement. To sum up, findings of the present study complied with the previous findings but self-efficacy was not the strongest predictor of students' science achievement.

For the relationships between students' engagements and science achievement, HLM analysis suggested that while behavioral engagement was the strongest positive predictor (γ = .180), cognitive engagement negatively predicted students' science achievement (γ = -.051). Additionally, agentic and emotional engagements did not associate with students' science achievement. These findings were to say that students who are behaviorally engaged in science class were more successful. However, cognitively engaging in science work had a negative association with students' achievement in science. Engagement literature provided mixed results in terms of the relations of engagement variables with students' achievement. For instance while Mo (2008) found positive links between science achievement and emotional and cognitive engagement, behavioral engagement was found to be negatively related to science achievement. A recent study conducted by Sedaghat, Abedin, Hejazi, and Hassanabadi (2011) in Iran reported that while students' shallow cognitive strategies negatively predicted science achievement, deep cognitive strategy use positively predicted science achievement. In another study Reeve (2013) found that emotional and cognitive engagement did not predict students' science achievement. However, he found positive associations for behavioral and agentic engagement. As summarized above, international literature regarding the relationship between students' engagement and science achievement yielded inconsistent results. In national context, Hıdıroğlu (2014) examined the relationships between four engagement dimensions (agentic, behavioral, cognitive, and emotional) and science achievement using a path analysis. She collected her data from Gaziantep (Turkey) and found that while behavioral, cognitive and emotional engagement predicted seventh grade students' science achievement, agentic engagement did not. Similar to Hıdıroğlu's (2014) in this study agentic engagement did not predict students' science achievement. The nature of agentic engagement offers active participation of students in the teachers' teaching processes and speak about the covering of topics. However, in Turkey, teachers are bounded by the national curriculum and it is not easy even for teachers to reshape the classes in accordance with students' desires (Ozmen, 2003; Gokce, 2006). Moreover, nationwide high school placement examinations restrict the autonomy of students. In Turkey, teachers would not design their classes in accordance with their students' needs. Thus, a non-significant relationship between agentic engagement and students' science achievement in science is not surprising. For cognitive and emotional engagement, while findings of the present study contradicts with Hıdıroğlu (2014), who found positive associations with science achievement, Reeve (2013), consistent with current findings, reported negative relationships for cognitive engagement and no relationship for emotional engagement. The qualitative study conducted by Romainville (1994) can provide an explanation for the negative association found between cognitive engagement and science achievement: In the study, Romainville (1994) examined the relationship between university students' metacognition and their performance in terms of exploring the potential relationship between students' performance and their capacity to talk about, describe and criticize their cognitive strategies. Romainville (1994) found that high achievers were unable to identify what their cognitive learning strategies were. This means that successful students do automatically whatever is needed to succeed but they cannot name their efforts and cognitive strategies when asked by the researcher. In other words, they do whatever is needed but they are not aware of the strategies they use. The findings of the Romainville (1994) study cannot be inferred from the current study due to methodological differences but a possible reason of negative relationship between cognitive engagement and science achievement could be attributed to such kind of characteristic of students. Despite there exists support from the international literature, national literature in a similar context yielded counter results (see Hıdıroğlu, 2014). A possible reason may be negative suppression effect (Tabachnick & Fidell, 2013). This occurs when the sign of zero order correlations and multilevel analysis contradicts with each other. In this relationship, such a situation was obtained. The zero order correlation between cognitive engagement and science achievement was r = .13 and multilevel regression coefficient was $\gamma = -.051$. Since there exists such a contradiction, the researchers are advised to use cautioun in interpretation.

Lastly, for the relationships between students' achievement goals in science class and science achievement, HLM analysis suggested that while mastery approach goals associated positively with students' science achievement, mastery and performance avoidance goals correlated negatively. Additionally, performance approach goals were found to have no relationship with students' science achievement. These results are partly consistent with both the international and national literature. For example, the most consistent finding has been for the relationship between mastery approach goals and achievement. Most of the studies investigating this relationship reported consistent positive relationship. For example, in a comprehensive review Linnenbrink-Gracia, et al., (2008) found that while 40 % of the reviewed studies reported significant positive relationship between mastery approach goals and achievement, only two studies found negative relationship. Recently, Chen and Wong (2014) found that mastery approach goals correlated positively with student achievement. Similarly, Chen (2015), later, found a consistent positive relationship between mastery approach goals and student achievement. Such a positive relationship is plausible because mastery approach oriented students set goals for learning and mastering the task, they work for grasping the content (Ames & Archer, 1988; Dweck & Legett, 1988; Elliot, 2010; Pintrich & Schunk, 2002). Indeed, in Turkish context, a series of studies regarding the relationship between students' achievement goals and science achievement yielded consistent positive relationship between mastery approach goals and science achievement. For instance, Taş (2008) studied with 1950 7^{th} grade students and found that students' who set more mastery goals were found more successful than their counterparts. In her second study Taş (2013) studied with a nation-wide data and used HLM software for analysis. She replicated her findings in the first study and found that mastery approach goals positively predicted science achievement. In another study conducted in Turkey with a nationwide dataset, Yerdelen (2013) used HLM analysis and found that mastery approach goals correlated positively with students' science achievement. Research in Turkish context mostly complied with the findings of international context and found consistent positive relationships between mastery approach goals and students science achievement. As expected, the findings of the present study supported previous findings both in national and international contexts.

The findings of the study regarding the relationship between performance approach goals and students' science achievement did not reveal a significant association. This finding is partly inconsistent with international literature but studies conducted in Turkey reported similar findings. As cited above for mastery approach goals, review of Linnenbrink-Garcia et al., (2008) also examined the relationship between performance approach goals and student achievement. They found that 40% of the studies for performance approach goals and academic achievement relationship resulted in a positive correlation. The rest of the studies examined reported non-significant results, except 6% reported negative correlations. Similarly, Chen and Wong (2014) and Chen (2015) reported positive relationships for performance approach goals. Based on the theoretical assertions and empirical support for performance approach goals, it is not illogical to expect positive relationships between performance goals and achievement. Students with performance approach goals strive for outperform others and get the best grades. Thus, a positive correlation is expected between these two variables. However, a consistent no significant relationship was reported in Turkish context. Taş (2008; 2013) and Yerdelen

(2013) reported no relationship between performance approach goals and science achievement. Although inconsistent with the international literature, the findings of the current study supported the findings of the national studies and found no relationship. In sum, it can be concluded that Turkish students' performance approach goals appears not to be related to their science achievement. Further research may take the findings of the recently conducted studies into consideration and examine deeply why Turkish adolescents' performance approach goals are not linked to their science achievement. Qualitatively designed studies may be of help in reaching deep investigations.

With regard to avoidance dimensions of mastery and performance goals, findings of the present study reported negative relationship with students' science achievement. Although mastery and performance avoidance goals associated unexpectedly positively with adaptive outcomes such as self-efficacy and engagement, their relationship with academic achievement was in line with the theoretical assertions and empirical studies (Elliot & McGregor, 2001; Skaalvik, 1997; 2002; Yerdelen, 2013). For performance avoidance goals, these findings were expected because students' with performance avoidance goals try not to look incompetent. Their desire is not to be seen as poorest and they try to avoid looking stupid (Elliot & Harackiewicz, 1996; Middleton & Midgley 1997; Skaalvik, 1997; Elliot & McGregor, 2001). It is reasonable to expect low academic achievement for these students. International and national studies support the findings of the present study. In Turkey, Yerdelen (2013) reported a negative correlation between seventh grade Turkish students' performance avoidance goals and science achievement. Moreover, Elliot and McGregor (2001), in their presentation of 2x2 achievement goal framework study, reported that while performance avoidance goals correlated negatively with academic achievement, mastery avoidance goals did not associate with students' achievement. Similarly, Skaalvik (1997; 2002) consistently reported negative relationships between self-defeating ego goals (performance avoidance goals) and student academic achievement in his subsequent studies. These studies (Elliot & McGregor, 2001; Skaalvik, 1997; 2002) also found that there was not a significant relationship between mastery avoidance goals and student academic achievement. In national context, Yerdelen (2013) reported no relationship between mastery avoidance goals and students' science achievement. However, in the present study, it was found that students' mastery avoidance goals in science class negatively predicted their science achievement. Although there is a significant negative relationship, the regression coefficient of the relationship between mastery avoidance goals and science achievement ($\gamma = -.047$) is trivial according to Cohen's (1988) criterion ($d \leq .20$). A negative relationship between mastery avoidance goals and academic achievement is reasonable because avoiding learning the material because of the fear that one would not learn the whole material may lead to incomplete learnings and thus may lead to decrease of academic achievement. Nevertheless, such an explanation is not more than a speculation and more research is needed in Turkish context for mastery avoidance goals because *avoidance* seems like a negative concept at the first glance. Further research will shed more light on mastery avoidance goals and more comprehensive explanations and interpretations will be plausible for mastery avoidance goals.

5.1.5 R.Q. 5: Relationships among Teachers' Perceived School Environment Variables and Teacher Motivation

The last research question was for investigating the relationships among teachers' perception of school environment variables (i.e. relations with parents, discipline problems, supervisory support, relations with colleagues, school mastery goal structure, and school performance goal structure) and teachers' motivation variables (teachers' mastery and performance approaches to instruction, teachers' collective efficacy, teachers' self-efficacy, and job satisfaction). A path model was constructed and analyzed with LISREL 8.80

statistical software package. In this path model, school context variables were placed as predictors and teacher motivation variables were placed as outcomes. In the following sections, the relationships between predictors and outcomes are discussed for each outcome.

Results of path analysis showed that while teachers' mastery approaches to instruction was predicted by school mastery goal structure and teachers' relations with parents, teachers' performance approaches to instruction was predicted only by school performance goal structure. Teachers' relations with parents and school mastery goal structure accounted for 23 % of the variance in teachers' mastery approaches to instruction. The only predictor of teachers' performance approaches to instruction, school performance goal structure accounted for 34 % of its variance. These findings implied that science teachers who have positive relationships with parents of their students, and perceiving their school's goal structure as mastery oriented were likely endorse mastery approaches to their science instruction. On the other hand, teachers who perceive their school's goal structure as performance oriented endorse performance instructional goals in their science instruction. These findings are supported by the limited literature regarding school goal structures. Ciani, Summers, and Easter (2008) stated that less is known about how teachers' perception of school goal structures influence their motivational beliefs, instructional practices, and student related outcomes. Although school goal structure research has been influential in motivation literature, studies assessing school goal structure from the perspective of teachers are rare. Researchers prefer to evaluate school goal structures and their effects from the perspective of students. Nevertheless, few studies have measured school goal structures and their influences on teacher outcomes. For example, Ciani et al., (2008) found that teachers' of a school communicating more performance goal structure were found to use more performance oriented instruction. Similarly, Deemer (2004) reported that teachers' perception of school performance goal structure was positively related to their performance oriented instruction. Cho and Shim (2013) studied with 211 primary and secondary school teachers from the US and found that mastery school goal structures predicted teachers' mastery approaches to instruction and perceived school performance goal structures predicted teachers' performance approaches to instruction. For school mastery goal structures, Retelsdorf, Butler, Streblow, and Sciefele (2010) found that mastery oriented teachers in Germany used mastery instructional practices. Moreover, Skaalvik and Skaalvik (2010) stated that work climate and relations with the environment is critical for teachers. While negative relations cause negative feelings about teaching profession, low teacher self-efficacy and burnout, positive relationships with student parents lead teachers to strive for teaching better and earn respect from parents. Indeed, the findings of the current study were in line with the international literature that while performance school goal structure positively predicted teachers' performance instructional approaches, perceptions of mastery school goal structure and relationships with parents associated positively with mastery instructional approaches. In Turkish context, there were not available studies investigating teachers' perceptions of school goal structures and their relationships with teacher outcomes. More empirical studies are needed to enrich research in this field. Not only in domain teachers like science teachers of this study, but also teachers from various domains may be recruited in further studies to reveal these relationships.

Dimensions of teachers' collective efficacy were predicted by school goal structures and discipline problems. More specifically, teachers' collective efficacy for group competence was positively predicted by school mastery goals and negatively predicted by discipline problems. Explicitly put, in schools where learning and mastering for the value of learning teachers feel more competent as a group. On the other hand, when teachers heave discipline problems in their classrooms their perception of competence as a group decreases. Additionally, for teachers' collective efficacy for analysis of teaching task, both school mastery and performance goals predicted positively, but similar to group competence, when discipline problems increase in classrooms teachers' collective efficacy for analysis of teaching task decreases. Previous research have not documented studies investigating the relationships between school goal structures and teachers' collective efficacy. However, the findings of the present study are plausible. Previous research on discipline problems suggested that teachers' having discipline problems in their classrooms live high levels of burnout and work-related problems (Hakanen, Bakker, & Schaufeli, 2006; Kokkinos, 2007). Thus, it is reasonable to say that high levels of discipline problems would decrease teachers' collective efficacy as a group in terms of both group competence and analysis of teaching tasks.

Results of path analysis suggested that dimensions of teachers' self-efficacy was predicted mainly by school mastery goal structure, discipline problems and teachers' relations with parents. Particularly, while relations with parents and school mastery goal structure positively predicted teachers' efficacy for student engagement, discipline problems predicted negatively. This means that in mastery goal oriented schools teachers feel more confident in engaging students to science classes. Similarly, when teachers had good relationships with parents of the students they feel more efficacious in engaging students to science classes. On the other hand, as expected, the increase of discipline problems in their classes diminish their efficacy in engaging students to science class. Regarding teachers' efficacy for instructional strategies, results indicated that teachers' relations with parents and school mastery goal structure positively predicted teachers' efficacy for instructional strategies. These results showed that when teachers are supported by parents and work in schools where learning and mastering the material is important is emphasized, teachers' efficacy for instructional strategies increased. Lastly, for teachers' efficacy for classroom management dimension, path analysis results suggested that while relations with parents positively predicted, discipline problems predicted it negatively.

As for the other dimensions of teacher self-efficacy, positive relationships with parents and receiving support from them made teachers believe in themselves to manage their classrooms better. One of the most salient negative relationships in this analysis was between discipline problems and teachers' efficacy for classroom management. As expected, discipline problems negatively predicted teachers' efficacy for classroom management. Teachers' efficacy for managing classroom and creating a peaceful classroom environment decreased when they had disruptive students who interrupt their classes. These results are in line with the limited literature related to the relationships between school context variables and teacher self-efficacy. For teachers self-efficacy as a composite measure, Marachi, Gheen, & Midgley (2000) and Midgley et al., (1995) reported that in school environments where mastery goals were salient, teachers were found to have more self-efficacy. Similarly, Ciani et al., (2008) examined the zero order correlations between three dimensions of teachers' self-efficacy (efficacy for student engagement, efficacy for instructional strategies, and efficacy for classroom management) and school goal structures (mastery and performance goal structures). They found that school mastery goal structure significantly correlated with teachers' efficacy for student engagement and efficacy for instructional strategies but it did not correlate with teachers' efficacy for classroom management. On the other hand, school performance goal structure did not correlate with none of the teacher self-efficacy dimensions. Previous findings regarding school goal structures suggested that when teacher self-efficacy was measured on a single composite measure, it was positively predicted by school mastery goal structure but not by school performance goal structure (Midgley et al., 1995). However, for beginning teachers, Devos, Dupriex and Paquay (2012) found that while school mastery goal structure positively predicted beginning teachers' self-efficacy, school performance goal structure predicted it negatively. Separate dimensions of self-efficacy varied in terms of the relationships with school goal structures. Although Ciani et al., (2008) examined only zero order correlations, their findings complied with the findings of the current study. School mastery goal structure positively predicted teachers' efficacy for student engagement and instructional strategies but not classroom management. More research is needed on the relationships between school goal structures and teacher self-efficacy but it is reasonable to say that school mastery goal structure plays an important role in teachers' feeling of confidence for engaging students in classes and applying instructional strategies properly.

For teachers' self-efficacy, school context variables were also found as influential. Findings of the current study indicated that relations with parents positively predicted all dimensions of teachers' self-efficacy beliefs. These findings are supported by both theoretical assertions and empirical findings. Skaalvik and Skaalvik (2009; 2010) stated that parent trust and support is critical for teachers. Feeling of distrust by the parents and avoiding cooperation with them may result serious strain on teachers such as low self-efficacy, increased anxiety, and low work morale. Indeed, Skaalvik and Skaalvik (2010) found in a path analysis that relationship with parents have strong relationship (β = .46) with teacher self-efficacy. Although Skaalvik and Skaalvik (2010) assessed self-efficacy in a single measure, this study is important for the limited literature. The findings of the current study verified the findings of Skaalvik and Skaalvik (2010) in the Turkish context with Turkish science teachers. It can be inferred that teachers' relationships with parents shape their self and collective efficacy beliefs regarding student engagement, instructional strategies, and group competence. National literature regarding parent relationships with teachers have gaps that need to be researched in the future. More research is needed to explain this phenomenon from the perspective of various domain teachers.

Lastly, results of path analysis indicated that discipline problems negatively predicted teachers' efficacy for student engagement and efficacy for classroom management. Explicitly, when teachers had discipline problems and disruptive student behaviors in their classroom, their efficacy for engaging students in science class and managing the classroom properly decreases. These findings are reasonable because a peaceful teaching and learning environment is a desired place to be able to have classes as planned. As stated before, teachers' who have discipline problems in their classrooms suffer from high levels of burnout and work-related problems (Hakanen, Bakker, & Schaufeli, 2006; Kokkinos, 2007). Thus, increase of discipline problems in science classes is likely to diminish science teachers' efficacy for classroom management and student engagement in science. These findings were expected and path analysis yielded consistent results.

With regard to teachers' job satisfaction, path analysis results suggested that while relations with parents, supervisory support, and relations with colleagues positively predicted, as expected, discipline problems predicted negatively. These findings implied that teachers' positive relationships with their environment make them feel better concerning their occupation. On the other hand, when they suffered discipline problems during teaching, their satisfaction and desire for being in the teaching profession decreases. Findings of the present study were supported both theoretically and empirically. A peaceful social climate and social working environment positively influences teachers' job satisfaction. Skaalvik and Skaalvik (2007) examined school context variables and their relationships with teachers' motivational variables and job satisfaction. They worked with 2569 Norwegian teachers from various domains of teaching. They found that teachers' relationships with parents positively predicted job satisfaction. The support teachers' receive and relationships with colleagues also positively predicted job satisfaction over teachers' feeling of school belonging. Moreover, discipline problems were found indirectly but negatively related to job satisfaction over emotional exhaustion dimension of teachers' burnout. In another study, Skaalvik and Skaalvik (2009) examined the influence of school context variables on teacher burnout and job satisfaction. They collected data from 563 Norwegian elementary and middle school teachers and analyzed the data via path analysis. Their results indicated that for Norwegian teachers' supervisory support and parent relationships were positively but indirectly related to job satisfaction over dimensions of burnout. Overall, it was clear from the findings of the present study that teachers' jobs satisfaction was influenced by school environment variables (i.e. supervisory support, relations with colleagues, and relations with parents) and in-class student discipline problems. These four predictors accounted for 37 % of the variance in job satisfaction of teachers. In Turkey, research on the predictors of job satisfaction for science teachers are rare. Yerdelen, Sungur, and Klassen (2016) investigated the contribution of class size, years of teaching experience and weekly course hours, and demographic characteristics such as gender, graduated faculty, marital status, and having children on science teachers' job satisfaction. They found that as class size and weekly hours increase, teachers' job satisfaction decreases. Moreover teaching experience and job satisfaction had a positive relationship and female teachers' were more satisfied than their male counterparts from being in teaching profession in Turkey. Nevertheless, more research is needed for domain teachers in terms of work related beliefs. There may be domain-related dissatisfaction of teachers. Therefore, for more deep investigations, qualitative research designs may be more useful for revealing such differences in teachers' job satisfaction levels.

5.2 Conclusions

This study investigated the role of teacher motivation variables in seventh grade students' motivation, engagement, and achievement in science and the relation of teacher perceptions of school context variables' to the teachers' motivation variables. For this purpose, data were collected from science teachers and their students from public schools located in two district of Ankara. Data were analyzed by using two statistical software, namely HLM 6.0 and LISREL 8.80. HLM 6.0 was used to analyze the nested data, which were collected from both teachers and their students. With the use of HLM, the influence of teacher level variables on the student level outcomes were investigated without aggregating or disaggregating the data. LISREL 8.80 was used to analyze the data collected to examine the relationships between teacher perceptions of school context variables and teacher motivation variables.

Results of the several HLM models revealed several important findings which can be summarized as follows: As one of the student variables, students' *self-efficacy* was found to be predicted by teachers' mastery approaches to instruction and teachers' efficacy for instructional strategies. Findings concerning *students' engagements* revealed that dimensions of student engagement in science class were mainly predicted by student level variables rather than teacher level predictors. For example, while students' self-efficacy and mastery approach goals were best predictors for all dimensions of engagement, teachers' efficacy for engagement and mastery approaches to instruction predicted students emotional and cognitive engagement. Additionally, *students' achievement goals* in science classes were all predicted by students' self-efficacy in science. Of the teacher level variables, efficacy for classroom management predicted mastery approach goals. Moreover, job satisfaction negatively predicted mastery avoidance goals and it negatively moderated the relationship between self-efficacy and performance approach goals. Performance avoidance goals were predicted by teachers' collective efficacy for task analysis and the relationship between self-efficacy and performance avoidance goals was moderated negatively by teachers' efficacy for instructional strategies. Concerning students' academic achievement in science classes, students' behavioral engagement was the strongest predictor followed by mastery approach goals and students' self-efficacy. Surprisingly, students' cognitive engagement negatively predicted students' science achievement. Negative relationships were also found for the relationships between both mastery and performance avoidance goals and students’ science achievement. Among the eight teacher level predictors, only significant positive predictor of science achievement was teachers’ mastery approaches to instruction. In science classes, science teachers’ mastery approaches to instruction positively associated with student science achievement. The emphasis in instruction on learning and mastering rather than competition or besting others contributed positively to the science achievement of Turkish seventh grade students. It can be concluded that for seventh graders, the contribution of intrapersonal variables were more salient than teacher level predictors.

With regard to the relationship among teachers’ perception of school context variables and teacher motivation variables, school mastery goal structures associated positively with all teacher motivational variables except job satisfaction. Another finding was that teachers’ performance instructional approaches was predicted only by their perception of a school performance goal structure. Additionally, when teachers perceived discipline problems in their classrooms, all of their motivational variables tended to decrease. For the teachers’ job satisfaction variable, it was found that all school context variables were influential except for school goal structures. Thus, it can be concluded that teachers’ job satisfaction was free from the goal structure of the school and basically relies on the relationships in the school working environment and discipline problems in the classroom.

5.3 Implications

This study examined the role of teacher motivation and job satisfaction in seventh grade students’ motivation, engagement, and achievement in science and the relation of teacher perceptions of school environment variables to the teachers' motivation and job satisfaction.

In predicting science achievement with teacher level variables, only significant predictor was found to be teachers' mastery approaches to instruction. This finding implied that when science teachers focus on students' learning and mastering course material and their individual progress, students' achievement in science is likely to increase. Therefore, it is suggested that science teachers emphasize the importance of learning and improving oneself in their classes. Additionally, regarding the relations of student level variables with science achievement, findings suggested that students' behavioral engagement, mastery approach goals, self-efficacy in science were the best predictors of students' achievement in science. Accordingly, in order to improve students' science achievement, science teachers are advised to help students to be more behaviorally engaged, be more self-efficacious, and adopt mastery approach goals in science classes. In order to improve students' behavioral engagement, Dunleavy and Milton (2009) suggested that science teachers may design activities that require high level of student participation and teachers may provide ample time for students' in-depth work on designed science activities. Moreover, science teachers may encourage students to be curious, ask questions and perceive mistakes as a part of learning. Moreover, in order to enhance student self-efficacy which was another student level variable found to be significantly linked to science achievement as well engagement and achievement goals in the current study, efficacy and confidence building activities may be organized so that students experience the feeling of "I can do it". At this point, teacher contribution is critical because as Bandura (1997) stated, diminishing self-efficacy is easier than building it. Therefore, teachers must be careful about assigning science works and homework aligned with students' capabilities. A failure in an unbalanced science work may leave deep marks which may have an irreversible impact on students' science self-efficacy.

Bandura (1997) suggested four sources of self-efficacy, namely mastery experiences (past accomplishments), vicarious experiences (learning from the models), verbal persuasions, and emotional arousal (stress, fatigue, anxiety, etc.). Previous research indicated that mastery experiences are the most powerful source of self-efficacy beliefs. Verbal persuasions from respected others also contribute to students' efficacy building processes. Teachers, families, and respected adults are all influential in this process. Teachers may foster students' self-efficacy beliefs by making students experience success through activities which are designed as beginning from simple activities ranging through tough ones. Thus, it becomes easier for students to have the feeling of "I can do it!". Moreover, encouraging comments from teachers regarding students' schoolwork and homework may increase their efficacy beliefs. Similarly, families and respected adults from the relatives may contribute to students' efficacy building processes by supporting students' efforts and being an inspiring role model. Modeling (vicarious experience) is another important source of students' self-efficacy. Students watching capable others whom are similar in terms of skills may gain confidence in their abilities in accomplishing science learning tasks. Thus, science teachers' may organize learning centers and hands on activities conducted in groups where students can work together and foster their self-efficacy in science through watching their peers. Moreover, the last source of self-efficacy is physiological states that include fatigue, stress and anxiety that influence students' self-efficacy in a negative way. Therefore, teachers must be careful about not making students feel anxious by assigning heavy school work and exams out of the topics not covered in class. Such negative experiences would work counter in improving students' self-efficacy beliefs. On point needs to be clarified that abovementioned student centered activities may contribute to increasing students' self-efficacy and engagement in science but as mentioned before, students in Turkey are more accustomed to teacher centered instruction. Therefore, students should be instructed through student centered education system from their early grades. An immediate change in their education system from teacher centered instruction to a student centered one may diminish their self-efficacy beliefs towards science. Indeed, current study found that as science teachers' efficacy for student engagement increased students self-efficacy in science decreased. Thus, researchers must use caution in such kind of situations. Considering current findings regarding the significant contribution of self-efficacy to students' science achievement as well as engagement and achievement goals in science, fostering students' self-efficacy is crucial in schooling endeavors.

Additionally, students' mastery goals were found to be positively associated with students' science achievement. This means that students' setting goals that focus on learning and mastering the task are more successful. In order to orient students' goals on mastery approaches TARGET model may be used in science classrooms. TARGET is an acronym for task, authority, recognition, grouping, evaluation, and timing (Ames, 1992). Task refers to the characteristics of learning activities which are variety, challenge, organization, and interest level. Authority is having opportunities to be responsible for own learning, making decisions freely, and undertake a leader role. Recognition concerns incentives and rewards that are granted for individual effort, personal improvement and accomplishments. Grouping is cooperation among students in heterogeneously formed groups. Evaluation is related to various forms of student assessments that evaluate student individual progress and mastery. And lastly timing refers to planning schedules and optimizing time for completing assignments. In a learning environment designed in TARGET fashion may help to foster students' adopting of mastery approach goals because TARGET framework relies on self-regulation and monitoring one's own improvement. Accordingly, learning cycle and problem-based learning strategies can be implemented in science classes. In both strategies students feel autonomous while working on challenging and interesting tasks. They work in small groups and they schedule their time to complete their tasks. In addition, during their engagement in the tasks they find opportunity to realize their own learning progress. Moreover, science teachers may pay attention on hands-on science experiments in which students may keep up with the time, work cooperatively with classmates, and even students may feel recognition and rewarded after accomplishing a science experiment. Additionally, students actively perform an experiment and it provides teachers and alternative assessment opportunity such as performance assessment.

Current findings, also, revealed that teachers' self-efficacy is associated with students' mastery approach goals, cognitive engagement and emotional engagement. Moreover, teachers' collective efficacy was associated with performance avoidance goals and it moderated the relationships between students' self-efficacy and emotional engagement and the relationship between mastery approach goals and emotional engagement. Lastly, teachers' job satisfaction was found to be associated negatively with mastery avoidance goals, and it moderated the relationship between mastery approach goals and cognitive engagement. Overall, according to current findings, teacher motivation variables were found to have associations with various student outcomes. The path analysis conducted for revealing how school environment variables influenced teacher motivation variables yielded valuable findings for enhancing such student outcomes.

The findings of the path analysis indicated that school mastery goal structure, teachers' relations with student parents, and discipline problems teachers had in their classrooms played an important role in teachers' motivation and job satisfaction. Based on the results of path analysis for teacher variables, findings of the study pointed out prominent factors that help to shape teachers' motivation. Firstly, school may endorse and emphasize mastery goal structures to make their teachers more motivated in teaching science in terms of improving teachers' use of more mastery oriented instructional strategies, subtle belief in their own teaching as a group and also personal efficacy beliefs in student engagement and instructional strategies. Rather than a competitive and exam scores-oriented school environment, schools emphasizing the virtues of learning and mastering the task may create more inspiring environments for teachers and teaching. In turn, according to the current HLM findings, creating such an environment, may enhance student outcomes at the school level in the expected direction. Moreover, the findings indicated that positive relations with parents of the students implied that teacher support and trust provided by the parents increases teacher motivation. Therefore, close relationships between parents and teachers may make teachers more aware about the socio-demographic structure of their students. Such knowledge increase student understanding in the way that teacher will be more aware about the needs and interests of their students. Additionally, a related finding of the present study was the negative relationship between discipline problems in the classrooms and teacher motivation. Taking teachers relationships with parents and discipline problems together, this study implies that disruptive students' problems may be solved by teachers' initiatives for learning more about students' parents. As stated above, obtaining detailed information about student and parents may be an advantage for teachers to take action in the face of disruptive student behaviors. Personal and psychological problems may cause students to behave inappropriately in the classroom and such issues may be handled by positive relations with students' parents. Additionally, teachers' job satisfaction is influenced by school context variables. The strongest predictor of science teachers' job satisfaction was teachers' relations with students' parents. In addition to obtaining critical information related to students, having good relationships with students' parents make teachers' feel more satisfied from being in the teaching profession. Thus, schools may make organizations to keep teachers and student parents in touch. For example regular teacher-parent meetings may be organized in a strict schedule. In these meetings, teachers may, for instance, inform parents about students' portfolios that include a wide range of student products students prepared during their education period. Moreover, students may also be invited to these teacher-parent meetings and they may make presentations regarding their works in science classes.

In summary, this study mainly suggested that teachers' mastery instructional approaches were related to students' academic achievement in science. Moreover, other teacher motivational variables were related to students' self-efficacy, achievement goals, and engagement in science classes. According to the results of the current study, as educators if we want to improve these student outcomes, we may try to strengthen teacher-parent relationships, take precautions to minimize student discipline problems and emphasize schools to endorse a mastery goal structure.

5.4 Limitations and Recommendations

There are some limitations of this study and they must be stated here. Firstly, this study was based on a cross-sectional data and was not capable of providing casual relationships. For gaining stronger evidences regarding the influence of school environment on teachers' motivation and the influence of teachers' motivation on student outcomes, experimental or longitudinal design studies are recommended for the interested researchers. Moreover, the data were collected from both teachers and students with self-report questionnaires. Self-report questionnaires may fall short to grasp, for example, the actual teacher and student motivation thoroughly. Therefore, qualitative data collection methods such as observations and video-recording during classes may be more useful to examine the variables of interest.

In this study, two dimensions of school context variables, which were autonomy and time pressure, were not included in the HLM and path analysis due to their low reliability values. Therefore, they were excluded from the main study. Future researchers are advised to use these subscales with caution. Both sub scales had three items. Future researchers may use additional items assessing both constructs to increase the scale reliabilities. Additionally, this study used Teacher Collective Efficacy Scale (TCES). In its original form, the scale was designed as comprising of a single factor but in the present study, two factors emerged and the scale was used as a two dimensional scale. Although there are studies supporting two-factor structure of the scale (McCoach & Colbert, 2010), most of the studies conducted in the countries other than USA used the single factor structure version of collective efficacy scale (i.e. Molenaar, Sleegers, & Daly, 2012; Ross et al., 2004). Thus, researchers in the field are advised to examine the factor structure and other psychometric properties of the scale in detail. Moreover, future researchers are advised to examine different versions of teacher collective efficacy scale and use the appropriate one in accordance with their studies because most of the studies conducted out of US used a single factor structure versions of collective efficacy scale.

This study only focused on science domain teachers, seventh grade students, and their science related outcomes. Future researchers may enrich such kind of multilevel studies with different age groups and different domain teachers. The literature is limited, especially in Turkey, regarding multilevel analysis studies. In order to grasp a better understanding regarding the influence of upper hierarchical structures (e.g. teachers, classes, schools, etc.) on student level outcomes, multilevel studies provide subtle findings without losing important data. Therefore, few studies in Turkey conducted by using HLM analysis restricted deeper interpretations for the findings of the current study. Moreover, in the current study, a two-level HLM analysis was conducted. Based on the data collected from teachers regrding their perceptions of school environment, a three level HLM analysis was possible (student data - level 1, teacher motivtion and job satisfaction data – level 2, and school environment data – level 3). Such a three level HLM model was not preferred due to sample size limitations (number of teachers per school was not sufficient to conduct a three level HLM model). Thus, current study was limited to a two-level HLM model. Future researchers may collect data based on requirements of a three level HLM model and conduct more comprehensive studies including school environment variables in addition to teacher and student data.

In the current study, the science achievement was operationally defined as the scores students obtained from a 14-items multipli choice science achievement test. In this test items mostly focused on physics and biology domains. Items from other topics such as chemistry, earth and space science were not covered in this achievement test. Moreover, items mostly assessed low level taxonomic skills as knowledge, comprehension, and application. In order to assess students' science achievement better, future researchers may increase the number of items in the test and include a wide array of topics for items. Moreover, future researchers may use items from international student assessments such as PISA and open ended items may be of help in reaching better insights regarding students' science understanding. The low number of items may cause high measurement errors and high number of items can provide a better measure for students' science achievement. In the current study, time limitations in the classes hindered measurement of science achievement with more than 14 items. In addition, in the teachers' measures part, job satisfaction was measured by three items. Although, reliability of the scale was sufficiently high to conduct further analyses, future researchers may increase the number of items by using items from TIMMS examinations.

Lastly, there may be suppression effect because of the contrasting signs of multivariate analysis and bivariate correlations. Researchers should be careful about interpreting such inconsistencies. Thus, erroneous interpretations are eliminated for future researchers who are interested in studying in the field.

REFERENCES

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short- and long-term consequences for school performance. *Child Development*, *64*, 801–814.

Allinder, R. M. (1994).The relationship between efficacy and the instructional practices of special education teachers and consultants. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *17*(2), 86–95. http://doi.org/10.1177/088840649401700203

Ames, C. (1984). Competitive, cooperative, and individualistic goal structures: A cognitive-motivational analysis. In R. Ames & C. Ames (Eds.), *Research on motivation in education: Vol. 1. Student motivation* (pp. 177–207). Orlando, FL: Academic Press.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*. http://doi.org/10.1037/0022-0663.84.3.261

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, *80*(3), 260–267. http://doi.org/10.1037/0022-0663.80.3.260

Anderman, L. H., & Anderman, E. M. (1999). Social predictors of changes in students' achievement goal orientations. *Contemporary Educational Psychology*, *25*, 21–37. http://doi.org/10.1006/ceps.1998.0978

Anderman, E.M., & Johnston, J. (1998). TV news in the classroom: What are adolescents learning? *Journal of Adolescent Research, 13,* 73-100.

Anderman, E. M., & Maehr, M. L. (1994). Motivation and Schooling in the Middle Grades. *Review of Educational Research*, *64*(2), 287–309. http://doi.org/10.3102/00346543064002287

Anderman, E. M., & Midgley, C. (1997). Changes in achievement goal orientations, perceived academic competence, and grades across the transition to middle-level schools. *Contemporary Educational Psychology*, *22*(3), 269–298.

Anderman, E. M., & Patrick, H. (2012). Achievement goal theory, conceptualization of ability/intelligence, and classroom climate. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 173–92). New York, NY: Springer. http://dx. doi.org/10.1007/978-1-4614-2018-7_8

Anderman, E. M., & Young, A. J. (1994). Motivation and strategy use in science: Individual differences and classroom effects. *Journal of Research in Science Teaching, 31,* 811–831.

Anderman, E. M., Griesinger, T., & Westerfield, G. (1998). Motivation and cheating during early adolescence. *Journal of Educational Psychology*, *90*(1), 84-93.

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools, 45,* 369–386.

Archambault, I., Janosz, M., Morizot, J., & Pagani, L. (2009). Adolescent behavioral, affective, and cognitive engagement in school: Relationship to dropout. *Journal of school Health*, *79*(9), 408-415.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: W.H. Freeman.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, *52*(1), 1-26.

Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science, 1,* 164-180.

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67*, 1206–1222.

Bandura, A., Caprara, G. V., Barbaranelli, C., Pastorelli, C., & Regali, C. (2001). Sociocognitive self-regulatory mechanisms governing transgressive behavior. *Journal of Personality and Social Psychology, 80*, 125–135. doi:10.1037/0022-3514 .80.1.125

Benbow, R. Y. (2006). *A nexus between teacher efficacy and the English language arts achievement of third grade students in selected elementary schools in South Carolina* (Unpublished doctoral dissertation). South Carolina State University, Orangeburg, SC.

Bentler, P. M., & Bonnet, D. C. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588-606.

Bergey, B. W., Ketelhut, D. J., Liang, S., Natarajan, U., & Karakus, M. (2015). Scientific Inquiry Self-Efficacy and Computer Game Self-Efficacy as Predictors and Outcomes of Middle School Boys' and Girls' Performance in a Science Assessment in a Virtual Environment. *Journal of Science Education and Technology,* 696–708. http://doi.org/10.1007/s10956-015-9558-4

Bezci, F. (2016). *The interplay among elementary students' implicit theories of ability, epistemological beliefs, motivational beliefs, achievement goals, learning strategies, procrastination and science achievement* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Bouffard-Bouchard, T., Parent, S., & Parivee, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high-school age students. *International Journal of Behavioral Development, 14,* 153-164.

Britner, S. L. (2008). Motivation in high school science students: A comparison of gender differences in life, physical, and earth science classes. *Journal of Research in Science Teaching, 45*(8), 955–970. http://doi.org/10.1002/tea.20249

Britner, S. L., & Pajares, F. (2001). Self-efficacy beliefs, race, and gender in middle school science. *Journal of Women and Minorities in Science and Engineering, 7,* 271–285

Britner, S. L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching*, *43*(5), 485–499. http://doi.org/10.1002/tea.20131

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage Publications.

Buhs, E. S., & Ladd, G. W. (2001). Peer rejection as an antecedent of young children's school adjustment: An examination of mediating process. *Developmental Psychology, 37*, 550–560.

Butler, R. (2007). Teachers' achievement goal orientations and associations with teachers' help seeking: Examination of a novel approach to teacher motivation. *Journal of Educational Psychology*, *99*(2), 241.

Butler, R. (2012). Striving to connect: Extending an achievement goal approach to teacher motivation to include relational goals for teaching. *Journal of Educational Psychology*, *104*(3), 726.

Buyukgoze-Kavas, A., Duffy, R. D., Güneri, O. Y., & Autin, K. L. (2013). Job satisfaction among Turkish teachers: Exploring differences by school level. *Journal of Career Assessment*, 1069072713493980.

Büyüköztürk, Ş., Çakan, M., Tan, Ş., & Atar, H. Y. (2014). *TIMSS 2011 Ulusal Matematik ve Fen Raporu 8. Sınıflar.* Retrieved from http://timss.meb.gov.tr/wp-content/uploads/TIMSS-2011-8-Sinif.pdf

Calik, T., Sezgin, F., Kavgaci, H., & Cagatay Kilinc, A. (2012). Examination of Relationships between Instructional Leadership of School Principals and Self-Efficacy of Teachers and Collective Teacher Efficacy. *Educational Sciences: Theory and Practice*, *12*(4), 2498-2504.

Caprara, G. V., Barbaranelli, C., Steca, P., & Malone, P. S. (2006). Teachers' self-efficacy beliefs as determinants of job satisfaction and students' academic achievement: A study at the school level. *Journal of School Psychology*, *44*(6), 473–490. http://doi.org/10.1016/j.jsp.2006.09.001

Caprara, G. V., Barbaranelli, C., Borgogni, L., Petitta, L., & Rubinacci, A. (2003). Teachers', school staff's and parents' efficacy beliefs as determinants of attitudes toward school. *European Journal of Psychology of Education*, *18*(1), 15–31. http://doi.org/10.1007/BF03173601

Caraway, K., Tucker, C. M., Reinke, W. M., & Hall, C. (2003). Self-efficacy, goal orientation, and fear of failure as predictors of school engagement in high school students. *Psychology in the Schools*, *40*(4), 417–427. http://doi.org/10.1002/pits.10092

Chacón, C. T. (2005). Teachers' perceived efficacy among English as a foreign language teachers in middle schools in Venezuela. *Teaching and Teacher Education*, *21*(3), 257–272. http://doi.org/10.1016/j.tate.2005.01.001

Chen, W. W. (2015). The relations between perceived parenting styles and academic achievement in Hong Kong: The mediating role of students' goal orientations. *Learning and Individual Differences*, *37*, 48–54. http://doi.org/10.1016/j.lindif.2014.11.021

Chen, J. A., & Usher, E. L. (2013). Profiles of the sources of science self-efficacy. *Learning and Individual Differences*, *24*, 11–21. http://doi.org/10.1016/j.lindif.2012.11.002

Chen, W. W., & Wong, Y. L. (2014). The relationship between goal orientation and academic achievement in Hong Kong: the role of context. *Asia-Pacific Education Researcher*, *24*(1), 169–176. http://doi.org/10.1007/s40299-013-0169-7

Chester, M. D., & Beaudin, B. Q. (1996). Efficacy beliefs of newly hired teachers in urban schools. *American Educational Research Journal, 33,* 233–257.

Cho, Y., & Shim, S. S. (2013). Predicting teachers' achievement goals for teaching: The role of perceived school goal structure and teachers' sense of efficacy. *Teaching and Teacher Education*, *32*, 12–21. http://doi.org/10.1016/j.tate.2012.12.003

Christenson , S. L., Reschly, A. L., Appleton, J. J., Berman, S., Spanjers, D., & Varro, P. (2008). Best practices in fostering student engagement. In A. Thomas, & J. Grimes (Eds.), *Best practices in school psychology* (5th ed.). Bethesda, MD: National Association of School Psychologists.

Christenson, S. L., Reschly, A. L., & Wylie, C. (Eds.). (2012). *Handbook of research on student engagement*. Springer Science & Business Media.

Ciani, K. D., Summers, J. J., & Easter, M. A. (2008). A "top-down" analysis of high school teacher motivation. *Contemporary Educational Psychology, 33*(4), 533–560. http://doi.org/10.1016/j.cedpsych.2007.04.002

Cleary, T. J., & Zimmerman, B. J. (2012). A cyclical self-regulatory account of student engagement: Theoretical foundations and applications. In S. L. Christenson, A. L. Reschly, & C.Wylie (Eds.), *Handbook of research on student engagement* (pp. 237–257). New York, NY: Springer.

Cockburn, A. D., & Haydn, T. (2004). *Recruiting and retaining teachers: Understanding why teachers teach.* London, England: RoutledgeFalmer.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences. 2nd ed.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. R. Gunnar & L. A. Sroufe (Eds.), *Self-process and development: The Minnesota symposia on child development* (Vol. 23, pp. 43–77). Hillsdale, NJ: Erlbaum.

Connell, J. P., Spencer, M. B., & Aber, J. L. (1994). Educational risk and resilience in African-American youth: context, self, action, and outcomes in school. *Child Development*, *65*(2 Spec No), 493–506. http://doi.org/http://dx.doi.org/10.2307/1131398

Cousins, J., & Walker, C. (1995). *Personal teacher efficacy as a predictor of teachers' attitudes toward applied educational research.* Paper presented at the annual meeting of the Canadian Association for the Study of Educational Administration, Montreal.

Covington, M. V. (1992). *Making the grade: A self-worth perspective on motivation and school reform.* New York: Cambridge Univ. Press.

Czerniak, C. M., & Schriver, M. L. (1994). An examination of preservice science teachers’ beliefs and behaviors as related to self-efficacy. *Journal of Science Teacher Education, 5*(3), 77-86.

Çapa, Y., Çakıroğlu, J., & Sarıkaya, H. (2005). The development and validation of a Turkish version of teachers’ sense of efficacy scale. *Education and Science, 30*(137), 74-81.

Day, C., Sammons, P., Stobard, G., Kington, A., & Gu, Q. (2007). *Teachers matter: Connecting work, lives and effectiveness*. Berkshire, England: Open University Press

Deemer, S. (2004). Classroom goal orientation in high school classrooms: revealing links between teacher beliefs and classroom environments. *Educational Research, 46*(1), 73–90. http://doi.org/10.1080/0013188042000178836

Demirtas, Z. (2010). Teachers’ job satisfaction levels. *Procedia Social and Behavioral Sciences, 9*, 1069-1073.

Devos, C., Dupriez, V., & Paquay, L. (2012). Does the social working environment predict beginning teachers’ self-efficacy and feelings of depression?. *Teaching and Teacher Education, 28*(2), 206-217.

Diseth, Å. (2011). Self-efficacy, goal orientations and learning strategies as mediators between preceding and subsequent academic achievement. *Learning and Individual Differences, 21,* 191–195. doi: 10.1016/j.lindif.2011.01.003

Dunleavy, J., & Milton, P. (2009). What did you do in school today? Exploring the concept of student engagement and its implications for teaching and learning in Canada. *Canadian Education Association (CEA),* 1-22.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41,* 1040-1048.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review, 95*(2), 256.

Ebel, R. L. (1965). *Measuring educational achievement*. Englewood Cliffs.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives* (pp. 75–146). San Francisco: W.H. Freemen.

Eccles, J. S., Midgley, C., Wigfield, A., Buchana, C. M., Reuman, D., Flanagan, C., et al. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist, 48,* 90–101.

Ee, J., Moore, P., & Atputhsamy, L. (2001). The relationship between teachers' goal orientations and strategy-based instruction and low-achieving students' goal orientations, self-regulation, and achievement, *Asia-Pacific Journal of Teacher Education & Development* , *4*(2), 115-135 .

Ee, J., Moore, P. J., & Atputhasamy, L. (2003). High-achieving Students: their motivational goals, self-regulation and achievement and relationships to their teachers' goals and strategy-based instruction. *High Ability Studies, 14*, 23 – 39

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals, epistemological beliefs and need for closure. *British Journal of Educational Psychology, 76*, 535–551.

Elliot, A. J. (2010). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, *34*(July 2015), 169–189. http://doi.org/10.1207/s15326985ep3403

Elliot, A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, *72*(1), 218–232. http://doi.org/10.1037//0022-3514.72.1.218

Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology*, *70*(3), 461–475. http://doi.org/10.1037/0022-3514.70.3.461

Elliot, A. J., & McGregor, H. (2001). A 2x2 achievement goal framework. *Journal of Personality and Social Psychology, 80*, 501–519.

Elliot, A. J., & Reis, H. T. (2003). Attachment and exploration in adulthood. *Journal of Personality and Social Psychology, 85*, 317–331.

Enochs, L. G., Scharmann, L. C., & Riggs, I. M. (1995). The relationship of pupil control to preservice elementary science teacher self–efficacy and outcome expectancy. *Science Education*, *79*(1), 63-75.

Entwisle, D. R., & Alexander, K. L. (1993). Entry into school: The beginning school transition and educational stratification in the United States. *Annual review of sociology*, 401-423.

Evans, L. (2001). Delving deeper into morale, job satisfaction, and motivation among education professionals. *Educational Management and Administration, 29*, 291–306.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London: Sage.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59,* 117–142.

Finn, J. D. (2006). *The adult lives of at-risk students: The roles of attainment and engagement in high school* (NCES 2006–328). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Fives, H., & Buehl, M. M. (2016). Teacher motivation: Self-efficacy and goal orientation. In K.R. Wentzel & D.B. Miele (Eds.), *Handbook of Motivation at School* (pp 340-361). New York: Routledge

Fraenkel, J. R., & Wallen, N. E. (2006). How to design and evaluate research in education. New York, USA: McGrawhill, Inc.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59–109. http://doi.org/10.3102/00346543074001059

Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2007). Achievement goals, efficacy beliefs and coping strategies in mathematics: The roles of perceived parent and teacher goal emphases. *Contemporary Educational Psychology*, *32*(3), 434–458. http://doi.org/10.1016/j.cedpsych.2006.10.009

Furlong, M. J., Whipple, A. D., St. Jean, G., Simental, J., Soliz, A., & Punthuna, S. (2003). Multiple contexts of school engagement: Moving toward a unifying framework for educational research and practice. *California School Psychologist, 8,* 99–114.

George, D., & Mallery, P. (2003). *SPSS for windows step by step. A simple guide and reference*. Boston: Pearson Education.

Gibson, S., & Dembo, M. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology, 76,* 569-582.

Goddard, R. D. (2001). Collective efficacy: A neglected construct in the study of schools and student achievement. *Journal of Educational Psychology*, *93*(3), 467–476. http://doi.org/10.1037/0022-0663.93.3.467

Goddard, R. D., & Goddard, Y. L. (2001). A multilevel analysis of the relationship between teacher and collective efficacy in urban schools. *Teaching and Teacher Education*, *17*(7), 807–818. http://doi.org/10.1016/s0742-051x(01)00032-4

Goddard, R. D., Hoy, W. K., & Hoy, A. W. (2000). Collective teacher efficacy: Its meaning, measure, and impact on student achievement. *American Educational Research Journal*, *37*(2), 479–507. http://doi.org/10.3102/00028312037002479

Goddard, R. D., Hoy, W. K., & LoGerfo, L. (2003). Collective efficacy and student achievement in public high schools: A path analysis. In *annual meeting of the American Educational Research Association, Chicago*.

Gonida, E. N., Voulala, K., & Kiosseoglou, G. (2009). Students' achievement goal orientations and their behavioral and emotional engagement: Co-examining the role of perceived school goal structures and parent goals during adolescence. *Learning and Individual differences*, *19*(1), 53-60.

Gökçe, İ. (2006). *Fen ve teknoloji dersi programı ile öğretmen kılavuzunun içsel olarak değerlendirilmesi ve uygulamada karşılaşılan sorunlar (Balıkesir Örneği)* (Unpublished master's thesis). Balıkesir Universitiy, Balıkesir, Turkey.

Graham, J. M., Guthrie, A. C., & Thompson, B. (2003). Consequences of not interpreting structure coefficients in published CFA research: A reminder. *Structural Equation Modeling*, *10*(1), 142–153.

Gravetter, F. J., & Wallnau, L. B. (2013). *Statistics for the behavioral sciences*. Belmont, CA: Cengage Learning.

Greene, B. A. (2015). Measuring cognitive engagement with self-report scales: reflections from over 20 years of research. *Educational Psychologist*, (August), 1–17. http://doi.org/10.1080/00461520.2014.989230

Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L., & Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology*, *29*(4), 462–482.

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching and Teacher Education*, *4*(1), 63–69. http://doi.org/10.1016/0742-051X(88)90025-X

Gutman, L. M. (2006). How student and parent goal orientations and classroom goal structures influence the math achievement of African Americans during the high school transition. *Contemporary Educational Psychology*, *31*(1), 44–63. http://doi.org/10.1016/j.cedpsych.2005.01.004

Gürçay, D., Yilmaz, M., & Ekici, G. (2009). Öğretmen kolektif yeterlik inancını yordayan faktörler. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *36*(36).

Hakanen, J. J., Bakker, A. B., & Schaufeli, W. B. (2006). Burnout and work engagement among teachers. *Journal of School Psychology*, *43*(6), 495–513. http://doi.org/10.1016/j.jsp.2005.11.001

Hampton, N. Z., & Mason, E. (2003). Learning Disabilities, Gender, Sources of Efficacy, Self-Efficacy Beliefs, and Academic Achievement in High School Students. *Journal of School Psychology*, *41*(2), 101–112. http://doi.org/10.1016/S0022-4405(03)00028-1

Heddy, B. C., & Sinatra, G. M. (2013). Transforming misconceptions: Using transformative experience to promote positive affect and conceptual change in students learning about biological evolution. *Science Education*, *97*, 725–744.

Hıdıroğlu, F. M. (2014). *The role of perceıved classroom goal structures, self-efficacy, and the student engagement ın seventh grade students'scıence* *achıevement* (Unpublished master's thesis). Middle East Technical University, Ankara, Turkey.

Hıdıroğlu, M., & Sungur, S. (2015). Predicting seventh grade students' engagement in science by their achievement goals. *Asia-Pacific Forum on Science Learning and Teaching, 16*(2), 1-17.

Ho, C. L., & Au, W. T. (2006). Teaching satisfaction scale measuring job satisfaction of teachers. *Educational and psychological Measurement*, *66*(1), 172-185.

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications (2nd ed.).* New York, NY: Routledge.

Hoy, A. W. (2004, April). *What do teachers need to know about self-efficacy?* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Hoy, W. K., & Woolfolk, A. E. (1993). Teachers' sense of efficacy and the organizational health of schools. *The elementary school journal*, 355-372.

Høigaard, R., Kovač, V. B., Øverby, N. C., & Haugen, T. (2015). Academic self-efficacy mediates the effects of school psychological climate on academic achievement. *School Psychology Quarterly, 30*(1), 64.

Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit ındexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Ingersoll, R. (2001). Teacher turnover and teacher shortage. *American Educational Research Journal, 38*, 499–534.

Jimerson, S. J., Campos, E., & Greif, J. L. (2003). Towards an understanding of definitions and measures of school engagement and related terms. *The California School Psychologist, 8*, 7–27.

Johnson, S. M., Kraft, M. A., & Papay, J. P. (2011). *How context matters in high-need schools: The effects of teachers' working conditions on their professional satisfac- tion and their students' achievement* (Project on the next generation of teachers working paper). Cambridge, MA: Harvard Graduate School of Education. Retrieved from http:// www.gse.harvard.edu/wngt/papers.htm on 14 July, 2016

Jordan, A., Kircaali-Iftar, G., & Diamond, C. T. P. (1993). Who has a problem, the student or the teacher? Differences in teachers' beliefs about their work with at-risk and integrated exceptional students. *International Journal of Disability, Development and Education*, *40*(1), 45–62. http://doi.org/10.1080/0156655930400104

Joreskog, K. G., & Sorbom, D. (1993). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*, Scientific Software International, Chicago, IL.

Kahraman, N. (2011). *Antecedents and consequences of achievement goals* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Kahraman, N., & Sungur, S. (2013). Antecedents and consequences of middle school students' achievement goals in science. *The Asia-Pacific Education Researcher*, *22*(1), 45-60.

Kaplan, A., & Maehr, M. L. (1997). School cultures. In H. Walberg & G. Haertel (Eds.), *Psychology and educational practice* (Chapter 16, pp. 342–355). Berkeley, CA: McCutchan.

Kaplan, A., & Maehr, M. (1999). Achievement goals and student well-being. *Con- temporary Educational Psychology, 24,* 330-358.

Kaplan, A., & Midgley, C. (1997). The Effect of Achievement Goals: Does Level of Perceived Academic Competence Make a Difference? *Contemporary Educational Psychology*, *22*(4), 415–35. http://doi.org/10.1006/ceps.1997.0943

Kaplan, A., Gheen, M., & Midgley, C. (2002). Classroom goal structure and student disruptive behaviour. *The British Journal of Educational Psychology*, *72*(October), 191–211. http://doi.org/10.1348/000709902158847

Kaplan, A., Middleton, M. J., Urdan, T., & Midgley, C. (2002). Achievement goals and goal structures. In *Goals, Goal Structures, and Patterns of Adaptive Learning*, Ed. C. Midgley, pp. 21–55. Hillsdale, NJ: Erlbaum

Karabenick, S. A. (2004). Perceived achievement goal structure and college student help seeking. *Journal of Educational Psychology, 96,* 569–581.

Klassen, R. (2004). A cross-cultural investigation of the efficacy beliefs of South Asian immigrant and Anglo non-immigrant early adolescents, *Journal of Educational Psychology, 96,* 731-742.

Koustelios, A., Karabatzaki, D., & Kouisteliou, I. (2004). Autonomy and job satisfaction for a sample of Greek teachers. *Psychological Reports, 95*, 883–886.

King, R. B., & McInerney, D. M. (2014). Culture's consequences on student motivation: Capturing cross-cultural universality and variability through personal investment theory. *Educational Psychologist*, *49*(3), 175-198.

Kingir, S., Tas, Y., Gok, G., & Vural, S. S. (2013). Relationships among constructivist learning environment perceptions, motivational beliefs, self-regulation and science achievement. *Research in Science & Technological Education*, *31*(3), 205-226.

Kıran, D. (2010). *A study on sources and consequences of elementary students' self-efficacy beliefs in science and technology course* (Unpublished master's thesis). Middle East Technical University, Ankara, Turkey.

Kıran, D., & Sungur, S. (2012). Middle school students' science self-efficacy and its sources: Examination of gender difference. *Journal of Science Education and Technology*, *21*(5), 619-630.

Klassen, R. M., & Chiu, M. M. (2010). Effects on teachers' self-efficacy and job satisfaction: Teacher gender, years of experience, and job stress. *Journal of Educational Psychology, 102*(3), 741–756. http://doi.org/10.1037/a0019237

Klassen, R. M., Tze, V. C., Betts, S. M., & Gordon, K. A. (2011). Teacher efficacy research 1998–2009: Signs of progress or unfulfilled promise? *Educational Psychology Research, 23*, 21-43.

Kline, R. B. (2011). *Principles and practice of structural equation modeling (3rd ed.).* New York, NY: Guilford Press

Klusmann, U., Kunter, M., Trautwein, U., Lüdtke, O., & Baumert, J. (2008). Engagement and emotional exhaustion in teachers: Does the school context make a difference? *Applied Psychology*, *57*(SUPPL. 1), 127–151. http://doi.org/10.1111/j.1464-0597.2008.00358.x

Kokkinos, C. M. (2007). Job stressors, personality and burnout in primary school teachers. *The British Journal of Educational Psychology*, *77*(Pt 1), 229–43. http://doi.org/10.1348/000709905X90344

Korevaar, G. (1990). *Secondary school teachers' courses of action in relation to experience and sense of self- efficacy.* Paper presented at the annual meeting of the American Educational Research Association, Boston.

Kozandağı, İ. (2001). *Öğretmen Görüşlerine Göre İlköğretim Okulları 4. ve 5. Sınıf Fen Bilgisi Öğretim Programlarında Karşılaşılan Sorunlar ve Çözüm Önerileri* (Unpublished master's thesis). Dokuz Eylül University, İzmir, Turkey.

Krug, S. E. (1989). Leadership and learning: A measurement-based approach for analyzing school effectiveness and developing effective school leaders. In M. L. Maehr & C. Ames (Eds.), *Advances in motivation and achievement: Motivation enhancing environments* (Vol. 6. pp. 248–274). Greenwich, CT: JAI Press Inc.

Kurien, S. A. (2011). *The relation between teachers' personal teaching efficacy and students' academic efficacy for science and inquiry science* (Unpublished doctoral dissertation). University of Nebraska, Lincoln.

Kurt, T. (2012). Öğretmenlerin öz yeterlik ve kolektif yeterlik algilari. *Journal of Turkish Educational Sciences*, *10*(2), 195 – 227.

Lau, S., & Nie, Y. (2008). Interplay between personal goals and classroom goal structures in predicting student outcomes: A multilevel analysis of person-context interactions. *Journal of Educational Psychology, 100*(1), 15–29. http://doi.org/10.1037/0022-0663.100.1.15

Licht, B. G., & Kistner, J. A. (1986). Motivational problems of learning-disabled children: Individual differences and their implications for treatment. *Psychological and educational perspectives on learning disabilities*, 225-255.

Linnenbrink, E. A. (2005). The Dilemma of Performance-Approach Goals: The Use of Multiple Goal Contexts to Promote Students' Motivation and Learning. *Journal of Educational Psychology*, *97*(2), 197–213. http://doi.org/10.1037/0022-0663.97.2.197

Linnenbrink, E.A., & Pintrich, P.R. (2002). Motivation as an enabler for academic success. *School Psychology Review, 31*, 313-327.

Linnenbrink-Garcia, L., Tyson, D. F., & Patall, E. A. (2008). When are achievement goal orientations beneficial for academic achievement? A closer look at main effects and moderating factors. *Revue internationale de psychologie sociale, 21*(1), 19-70.

Liu, X. S., & Ramsey, J. (2008). Teachers’ job satisfaction: Analyses of the teacher follow-up survey in the United States for 2000-2001. *Teaching and Teacher Education*, *24*, 1173-1184. doi:10.1016/j.tate.2006.11.010

MacCallum, R.C., Browne, M.W., & Sugawara, H., M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*(2), 130-49.

Maehr, M. L. (1991). The ‘‘psychological environment’’ of the school: A focus for school leadership. In P. Thurston&P. Zodhiates (Eds.), *Advances in educational administration*, (Vol. 2, pp. 51–81). Greenwich, CT: JAI Press Inc.

Maehr, M. L., & Fyans, L. J. (1989). School culture, motivation, and achievement. In M. L. Maehr & C. Ames (Eds.), *Advances in motivation and achievement: Motivation enhancing environments* (Vol. 6, pp. 215–247). Greenwich, CT: JAI Press Inc.

Maehr, M. L., & Anderman, E. M. (1993). Reinventing schools for early adolescents: Emphasizing task goals. *Elementary School Journal*, *93*, 593-610.

Maehr, M., & Midgley, C. (1991). Enhancing Student Motivation: A Schoolwide Approach. *Educational Psychologist*. http://doi.org/10.1080/00461520.1991.9653140

Maehr, M. L., & Zusho, A. (2009). Achievement goal theory: The past, present, and future. In K. R. Wentzel & A. Wigfield (Eds.), *Handbook of motivation at school*, (pp. 77–104). New York: Routledge.

Maehr, M. L., & Midgley, C., & Colleagues (1996). *Transforming school cultures*. Boulder, CO: Westview Press.

Marachi, R., Gheen, M. H., & Midgley, C. (2000). *Elementary, middle, and high school teachers' beliefs and approaches to instruction using a goal theory framework*. Manuscript submitted for publication.

Marks, H. M. (2000). Student engagement in instructional activity: Patterns in the elementary, middle, and high school years. *American Educational Research Journal, 39*(1), 153–184. http://doi.org/10.3102/00028312037001153

McCoach, D. B., & Colbert, R. D. (2010). Factors Underlying the Collective Teacher Efficacy Scale and Their Mediating Role in the Effect of Socioeconomic Status on Academic Achievement at the School Level. *Measurement and Evaluation in Counseling and Development, 43*(1), 31–47. http://doi.org/10.1177/0748175610362368

Meece, J. L. (1991). The classroom context and students' motivational goals. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 7). Greenwich, CT: JAI Press.

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation, and academic achievement. *Annual Review of Psychology, 57*, 487–503. http://doi.org/10.1146/annurev.psych.56.091103.070258

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Student's goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology, 80*, 514–523.

Meier, D. (1992). Reinventing Teaching. *Teachers College Record*, *93*(4), 594-609.

Mertler, C. A. (2016). Should I Stay or Should I Go? Understanding Teacher Motivation, Job Satisfaction, and Perceptions of Retention among Arizona Teachers. *International Research in Higher Education*, *1*(2), p34.

Michaelowa, K., & Wittmann, E. (2008). The cost, satisfaction, and achievement of primary education- evidence from francophone sub-Saharan Africa. *The Journal of Developing Areas*, *41*(1), 51–78. http://doi.org/10.1353/jda.2008.0028

Midgley, C. (1993). Motivation and middle level schools. In P. R. Pintrich & M. L. Maehr (Eds.), *Advances in motivation and achievement,* Vol. 8: Motivation and adolescent development. Greenwich, CT: JAI Press.

Midgley, C, & Urdan, T. (1995). Predictors of middle school students' use of self-handicapping strategies. *Journal of Early Adolescence, 15*, 389-411.

Midgley, C., & Urdan, T. (2001). Academic self-handicapping and perfor-mance goals: A further examination. *Contemporary Educational Psychology, 26*, 61–75.

Midgley, C., Anderman, E., & Hicks, L. (1995). Differences between elementary and middle School teachers and students: A goal theory approach. *The Journal of Early Adolescence*. http://doi.org/10.1177/0272431695015001006

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E. M., Anderman, L. H., Freeman, K. E., Urdan, T. et al. (2000). *Manual for the Patterns of Adaptive Learning Scales (PALS).* Ann Arbor: University of Michigan.

Miller, R. B., Greene, B. A., Montalvo, G. P., Ravindran, B., & Nicholls, J. D. (1996). Engagement in academic work: The role of learning goals, future consequences, pleasing others, and perceived ability. *Contemporary Educational Psychology, 21,* 388–442.

Miller, A. D., & Murdock, T. B. (2007). Modeling latent true scores to determine the utility of aggregate student perceptions as classroom indicators in HLM: The case of classroom goal structures. *Contemporary Educational Psychology,32*(1), 83-104.

Ministry of National Education [MONE], (2011). TIMMS national report. Retrieved on December 22, 2015 from http://timss.meb.gov.tr/?page_id=25

Miserandino, M. (1996). Children who do well in school: Individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology, 88,* 203–214.

Mo, Y. (2008) *Opportunity to Learn, Engagement, and Science Achievement: Evidence form TIMSS 2003 Data* (Unpublished doctoral dissertation). State University, Virginia.

Moolenaar, N. M., Sleegers, P. J. C., & Daly, A. J. (2012). Teaming up: Linking collaboration networks, collective efficacy, and student achievement. *Teaching and Teacher Education, 28*(2), 251–262. http://doi.org/10.1016/j.tate.2011.10.001

Morrison, G., Walker, D., Wakefield, P., & Solberg, S. (1994). Teacher preferences for collaborative relationships: Relationship to efficacy for teaching in prevention-related domains. *Psychology in the Schools, 31,* 221–231.

Mosher, R., & McGowan, B. (1985). Assessing student engagement in secondary schools: Alternative conceptions, strategies of assessing, and instruments. University of Wisconsin, Research and Development Center. (ERIC Document Reproduction Service No. ED 272812).

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, *38*(1), 30–38. http://doi.org/10.1037/0022-0167.38.1.30

Murayama, K., & Elliot, A. J. (2009). The joint influence of personal achievement goals and classroom goal structures on achievement-relevant outcomes. *Journal of Educational Psychology, 101,* 432–447.

Murdock, T. B., Miller, A., & Kohlhardt, J. (2004). Effects of classroom context variables on high school students' judgments of the acceptability and likelihood of cheating. *Journal of Educational Psychology*, *96*, 765-777. doi:10.1037/0022-0663.96.4.765

National Research Council, Institute of Medicine of the National Academies. (2004). *Engaging schools: Fostering high school students' motivation to learn.* Washington, DC: The National Academies Press. Newmann, Natriello, G. (1984). Problems in the evaluation of students and student from secondary schools. *Journal of Research and Development in Education, 17,* 14–24.

Newmann, F. M. (1981). Reducing student alienation in high schools: Implications of theory. *Harvard Educational Review, 51*, 546–564.

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91,* 328-346.

Nolen, S. B. (1988). Reasons for Studying: Motivational Orientations and Study Strategies. *Cognition and Instruction, 5*(4), 269–287. http://doi.org/10.1207/s1532690xci0504_2

Nolen, S. B. (2003). Learning environment, motivation, and achievement in high school science. *Journal of Research in Science Teaching, 40,* 347 – 368. http://dx.doi.org/10.1002/tea.10080

Olobatuyi, M. E. (2006). *A user's guide to path analysis.* Lanham, MD: University Press of America, Inc.

Ololube, N. P. (2006). Teachers job satisfaction and motivation for school effectiveness: an assessment. *Essays in Education, 18,* (1-19).

Özmen, Ş. G. (2003). *Fen bilgisi öğretmenlerinin yapılandırmacı öğrenme yaklaşımına ilişkin görüşlerinin incelenmesi* (Unpublished master's thesis). Hacettepe University, Ankara, Turkey.

Pajares, F. (1996). Self-Efficacy Beliefs in Academic Settings. *Review of Educational Research, 66*(4), 543–578. http://doi.org/10.3102/00346543066004543

Pajares, F. (1997). Current directions in self-efficacy research. In M. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 10, pp. 1-49). Greenwich, CT: JAI Press.

Pajares, F. (2002). *Overview of social cognitive theory and of self-efficacy*. Retrieved March 23, 2016, from https://www.uky.edu/~eushe2/Pajares/eff.html

Pajares, F. (2006). Self-efficacy during childhood and adolescence. In F. Pajares, & T. C. Urdan (Eds.), *Self-efficacy Beliefs of Adolescents,* (pp. 339-367). Connecticut, US, IAP.

Pajares, F., & Schunk, D. H. (2002). Self and self-belief in psychology and education: A historical perspective. *Improving academic achievement: Impact of psychological factors on education*, 3-21.

Pajares, F., Britner, S. L., & Valiante, G. (2000). Writing and science achievement goals of middle school students. *Contemporary Educational Psychology, 25*, 4067422.

Pamuk, S. (2014). *Multilevel analysis of students' science achievement in relation to constructivist learning environment perceptions, epistemological beliefs, self-regulation and science teachers' characteristics* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Patrick, H., Ryan, A. M., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology, 99*(1), 83−98.

Patrick, H., Turner, J. C., Meyer, D. K., & Midgley, C. (2003). How teachers establish psychological environments during the first days of school: Associations with avoidance in mathematics. *Teachers College Record, 105,* 1521–1558.

Pianta, R. C., La Paro, K. M., Payne, C., Cox, M., & Bradley, R. (2002). The relation of kindergarten classroom environment to teacher, family, and school characteristics and child outcomes. *The Elementary School Journal, 102*(3), 225–238.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation*, (pp. 451-502). San Diego, CA, US, Academic Press.

Pintrich, P.R., & DeGroot, E.V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*, 33–40.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, Research, and Applications.* Second Edition, Merrill Prentice Hall, Columbus, Ohio.

Pintrich, P. R., Smith, D.A.F., Garcia, T., & Mckeachie, W.J. (1993) Reliability and predictive validity of the motivated strategies for learning questionnaire. *Educational and Psychological Measurement 53,* 810-813

Podell, D. M., & Soodak, L. C. (1993). Teacher Efficacy and Bias in Special Education Referrals. *The Journal of Educational Research*, *86*(4), 247–253. http://doi.org/10.1080/00220671.1993.9941836

Pugh, K. J. (2002). Teaching for idea-based, transformative experiences in science: An investigation of the effectiveness of two instructional elements. *Teachers College Record, 104,* 1101–1137.

Pugh, K. J., Linnenbrink-Garcia, L., Koskey, K. L. K., Stewart, V. C., & Manzey, C. (2010). Motivation, learning, and transformative experience: A study of deep engagement in science. *Science Education*, *94*(1), 1–28. http://doi.org/10.1002/sce.20344

Rastegar, A., Jahromi, R. G., Haghighi, A. S., & Akbari, A. R. (2010). The relation of epistemological beliefs and mathematics achievement: the mediating role of achievement goals, mathematics self-efficacy, and cognitive engagement. *Procedia-Social and Behavioral Sciences*, *5*, 791-797.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). Sage.

Raudenbush, S. W., Rowan, B., & Cheong, Y. (1992). Contextual effects on the self- perceived efficacy of high school teachers. *Sociology of Education, 65*, 150-167.

Raudenbush, S. W., Bryk, A., Cheong, Y. F., Congdon, R., & Du Toit, M. (2011). *Hierarchical linear and nonlinear modeling (HLM7)*. Lincolnwood, IL: Scientific Software International

Raykov, T., & Marcoulides, G. A. (2006). On multilevel model reliability estimation from the perspective of structural equation modeling. *Structural Equation Modeling*, *13*(1), 130-141.

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology*, *105*(3), 579–595. http://doi.org/10.1037/a0032690

Reeve, J., & Tseng, C. M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, *36*(4), 257–267. http://doi.org/10.1016/j.cedpsych.2011.05.002

Retelsdorf, J., & Günther, C. (2011). Achievement goals for teaching and teachers' reference norms: Relations with instructional practices. *Teaching and Teacher Education*, *27*(7), 1111–1119. http://doi.org/10.1016/j.tate.2011.05.007

Retelsdorf, J., Butler, R., Streblow, L., & Schiefele, U. (2010). Teachers' goal orientations for teaching: Associations with instructional practices, interest in teaching, and burnout. *Learning and Instruction*, *20*(1), 30–46. http://doi.org/10.1016/j.learninstruc.2009.01.001

Roeser, R. W., & Eccles, J. S. (1998). Adolescents' perceptions of middle school: Relation to longitudinal changes in academic and psychological adjustment. *Journal of Research on Adolescence*. http://doi.org/10.1207/s15327795jra0801_6

Roeser, R. W., Midgley, C., & Urdan, T. C. (1996). Perceptions of the school psychological environment and early adolescents' psychological and behavioral functioning in school: The mediating role of goals and belonging. *Journal of Educational Psychology*, *88*(3), 408–422. http://doi.org/10.1037/0022-0663.88.3.408

Romainville, M. (1994). Awareness of cognitive strategies: The relationship between university students' metacognition and their performance. *Studies in Higher Education*, *19*(3), 359-366.

Ross, J. A. (1992). Teacher Efficacy and the Effects of Coaching on Student Achievement. *Canadian Journal of Education / Revue Canadienne de L'éducation*, *17*(1), 51. http://doi.org/10.2307/1495395

Ross, J. A. (1998). The antecedents and consequences of teacher efficacy. *Advances in research on teaching*, *7*, 49-74.

Ross, J. A., Hogaboam-Gray, A., & Gray, P. (2004). Prior Student Achievement, Collaborative School Processes, and Collective Teacher Efficacy. *Leadership and Policy in Schools*, *3*(3), 163–188. http://doi.org/10.1080/15700760490503689

Ross, J. A., Hogaboam-Gray, A., & Hannay, L. (2001). Effects of Teacher Efficacy on Computer Skills and Computer Cognitions of Canadian Students in Grades K-3. *The Elementary School Journal*, *102*(2), 141. http://doi.org/10.1086/499697

Russell, V. J., Ainley, M., & Frydenberg, E. (2005). *Schooling issues digest: Student motivation and engagement.* Retrieved July 9, 2016, from http:// www.dest.gov.au/sectors/schooleducation/publicationsresources/ schooling issues digest/schooling issues

Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *American Educational Research Journal, 38,* 437–460.

Ryan, A. M., & Pintrich, P. R. (1997). "Should I ask for help?": Adolescent perceptions of costs and benefits of help-seeking in math class. *Journal of Educational Psychology, 89,* 329-341.

Ryan, A. M., Gheen, M. H., & Midgley, C. (1998). Why do some students avoid asking for help? An examination of the interplay among students' academic efficacy, teachers' social–emotional role, and the classroom goal structure. *Journal of Educational Psychology*, *90*(3), 528–535. http://doi.org/10.1037/0022-0663.90.3.528

Scheopner, A. (2010). Irreconcilable differences: teacher attrition in public and catholic schools. *Educational Research Review*, *5*, 261-277.

Schumacker, R.E., & Lomax, R.G. (2004). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum.

Schunk, D. H. (1995). Self-efficacy and education and instruction. In J. Maddux (Ed.), *Self-efficacy, adaption, and adjustment: Theory, research, and application* (pp. 281–303). New York: Plenum Press.

Schunk, D. H. (2001). *Self-regulation through goal setting*. ERIC Clearinghouse on Counseling and Student Service, University of North Carolina at Greensboro.

Schunk, D. H. (2012). *Learning theories: An educational perspective*. Boston: Pearson.

Schunk, D. H., & Mullen, C. A. (2012). Self-efficacy as an engaged learner. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 219–236). New York, NY: Springer. http://dx.doi.org/10.1007/978-1-4614-2018-7_10

Schunk, D. H., & Pajares, F. (2005). Competence beliefs in academic functioning. In A. J. Elliot & C. Dweck (Eds.), *Handbook of competence and motivation* (pp. 85–104). New York: Guilford Press.

Schunk, D. H., & Pajares, F. (2009). Self-efficacy theory. In K. R. Wentzel & A. Wigfi eld (Eds.), *Handbook of motivation at school* (pp. 35–53). New York: Routledge.

Schunk, D. H., Meece, J. R., & Pintrich, P. R. (2012). *Motivation in education: Theory, research, and applications*. Michigan, Merrill.

Schunk, D. H., Sinatra, G. M., Heddy, B. C., & Lombardi, D. (2015). The Challenges of Defining and Measuring Student Engagement in Science. *Educational Psychologist*, *50*(1), 1–13. http://doi.org/10.1080/00461520.2014.1002924

Scott, C., Stone, B., & Dinham, S. (2001). “I love teaching but..” International patterns of teaching discontent. *Education Policy Analysis Archives, 9*(28), 1-18, Available at http://epaa.asu.edu/epaa/v9n28.html

Sedaghat, M., Abedin, A., Hejazi, E., & Hassanabadi, H. (2011). Motivation, cognitive engagement, and academic achievement. *Procedia-Social and Behavioral Sciences, 15*, 2406-2410.

Senler, B. & Sungur, S. (2007). Parental influences on students' self-concept, task value beliefs, and achievement in science. *The Spanish Journal of Psychology, 12*, 106-117.

Sharma, S., Mukherjee, S., Kumar, A., & Dillon, W. R. (2005). A simulation study to investigate the use of cutoff values for assessing model fit in covariance structure models. *Journal of Business Research, 58*(7), 935-943.

Skaalvik, E. M., & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology*, *99*(3), 611–625. http://doi.org/10.1037/0022-0663.99.3.611

Skaalvik, E. M., & Skaalvik, S. (2009). Does school context matter? Relations with teacher burnout and job satisfaction. *Teaching and Teacher Education*, *25*(3), 518–524. http://doi.org/10.1016/j.tate.2008.12.006

Skaalvik, E. M., & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education*, *26*(4), 1059–1069. http://doi.org/10.1016/j.tate.2009.11.001

Skaalvik, E. M., & Skaalvik, S. (2011). Teachers' feeling of belonging, exhaustion, and job satisfaction: the role of school goal structure and value consonance. *Anxiety, Stress, and Coping*, *24*(4), 369–385. http://doi.org/10.1080/10615806.2010.544300

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85,* 571–581.

Somech, A., & Drach-Zahavy, A. (2000). Understanding extra-role behavior in schools: the relationships between job satisfaction, sense of efficacy, and teachers' extra-role behavior. *Teaching and Teacher Education*, *16*(5–6), 649–659. http://doi.org/10.1016/S0742-051X(00)00012-3

Stipek, D. J., & Daniels, D. H. (1988). Declining perceptions of competence: A consequence of changes in the child or in the educational environment? *Journal of Educational Psychology*, *80*, 352–356

Stuart, S. (2006). *Efficacy transfer: the roles of parent participation, parent efficacy, and teacher efficacy on student efficacy* (Unpublished doctoral dissertation). The University of San Francisco, San Francisco, CA.

Sun, L., Bradley, K. D., & Akers, K. (2012). A Multilevel Modelling Approach to Investigating Factors Impacting Science Achievement for Secondary School Students: PISA Hong Kong Sample. *International Journal of Science Education*, *34*(14), 2107–2125. http://doi.org/10.1080/09500693.2012.708063

Sungur, S. (2004). *An implementation of problem based learning in high school biology courses* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Sungur, S., & Senler, B. (2009). An analysis of Turkish high school students' metacognition and motivation. *Educational Research and Evaluation*, *15*(1), 45-62.

Sungur, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *The journal of educational research*, *99*(5), 307-320.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics, 5th edition.* Boston: Pearson Education.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics, 6th edition.* Boston: Pearson Education.

Taş, Y. (2008). *The interplay of students' perceptions of classroom goal structures, personal goal orientations and learning related variables* (Unpublished master's thesis). Middle East Technical University, Ankara, Turkey.

Tas, Y. (2013). *An investigation of students' homework self-regulation and teachers' homework practices* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Taylor, D. L., & Tashakkori, A. (1995). Decision participation and school climate as predictors of job satisfaction and teachers' sense of efficacy. *The Journal of experimental education*, *63*(3), 217-230.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC, US: American Psychological Association.

Tobin, T. J., Muller, R. O., & Turner, L. M. (2006). Organizational learning and climate as predictors of self-efficacy. *Social Psychology of Education*, *9*(3), 301-319.

Tobin, K., Tippin, D. J., & Gallard, A. J. (1994). Research on instructional strategies for teaching science. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning, national science teachers Association*. New York

Tschannen-Moran, M., & Barr, M. (2004). Fostering student learning: The relationship of collective teacher efficacy and student achievement. *Leadership and Policy in Schools, 3*(3), 189-209.

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education*, *17*(7), 783–805. http://doi.org/10.1016/S0742-051X(01)00036-1

Tschannen-Moran, M., & Hoy, A. W. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and teacher Education, 23*(6), 944-956.

Tschannen-Moran, M., Hoy, A. W., & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of educational research*, *68*(2), 202-248.

Tytler, R., & Osborne, J. (2012). Student attitudes and aspirations towards science. In B. J. Fraser, K. Tobin, & C. J. McRobbie (Eds.), *Second international handbook of science education* (pp. 597–625). New York, NY: Springer International.

Urdan, T. (2004). Using multiple methods to assess students' perceptions of classroom goal structures. *European Psychologist*, *9*(4), 222–231. http://doi.org/10.1027/1016-9040.9.4.222

Urdan, T., & Midgley, C. (2003). Changes in the perceived classroom goal structure and pattern of adaptive learning during early adolescence. *Contemporary Educational Psychology*, *28*(4), 524–551. http://doi.org/10.1016/S0361-476X(02)00060-7

Urdan, T. C., & Roeser, R.W. (1993, April). *The relations among adolescents' social cognitions, affect, and academic self-schemas.* Paper presented at the Annual Meeting of the American Educational Research Association, Atlanta.

Urdan, T., Midgley, C., & Anderman, E. (1998). The role of classroom goal structure in students' use of self-handicapping strategies. *American Educational Research Journal, 35,* 101–122.

Urdan, T., Wood, S., & Midgley, C. (1995). Special issues in reforming middle level schools. *Journal of Early Adolescence, 15,* 90–113.

US Department of Education. (1997). *Job satisfaction among America's teachers: Effects of workplace conditions, background characteristics, and teacher compensation.* Washington, DC: National Center for Educational Statistics, U.S. Department of Education. Available at: http://nces.ed.gov/pubs/ce/c9749a01.html.

Usher, E. L. (2009). Sources of middle school students' self-efficacy in mathematics: A qualitative investigation. *American Educational Research Journal*, *46*(1), 275-314.

Usher, E. L., & Pajares, F. (2008). Sources of Self-Efficacy in School: Critical Review of the Literature and Future Directions. *Review of Educational Research*, *78*(4), 751–796. http://doi.org/10.3102/0034654308321456

Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology*, *34*(1), 89–101. http://doi.org/10.1016/j.cedpsych.2008.09.002

Valentine, J. C., DuBois, D. L., & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytical review. *Educational Psychologist, 39,* 111–133.

van Uden, J. M., Ritzen, H., & Pieters, J. M. (2014). Engaging students: The role of teacher beliefs and interpersonal teacher behavior in fostering student engagement in vocational education. *Teaching and Teacher Education*, *37*, 21-32.

van Uden, J. M., Ritzen, H., & Pieters, J. M. (2013). I think I can engage my students: Teachers'perceptions of student engagement and their beliefs about being a teacher. *Teaching and Teacher Education, 32,* 43-54.

Voelkl, K. E. (1997). Identification with school. *American Journal of Education*, *105*, 294–318.

Wang, M., & Holcombe, R. (2010). Adolescents' perceptions of school environment, engagement, and academic achievement in middle school. *American Educational Research Journal, 47,* 633–662.

Warner, R. M. (2012). *Applied Statistics: From Bivariate Through Multivariate Techniques: From Bivariate Through Multivariate Techniques*. UK: Sage.

Warwick, J. (2008). Mathematical self-efficacy and student engagement in the mathematics classroom. *MSOR Connections*, *8*(3), 31-37.

Watt, H. M., & Richardson, P. W. (2007). Motivational factors influencing teaching as a career choice: Development and validation of the FIT-Choice Scale. *The Journal of experimental education, 75*(3), 167-202.

Wellborn, J. G. (1991). *Engaged and disaffected action: The conceptualization and measurement of motivation in the academic domain* (Unpublished doctoral dissertation). University of Rochester, Rochester, NY.

Wehlage, G. G., & Smith, G. A. (1992). Building new programs for students at risk. In F. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 92–118). New York, NY: Teachers College Press. Wigfield.

White, A. G. (2009). *Ninth and tenth grade students' mathematics self-efficacy beliefs: the sources and relationships to teacher classroom interpersonal behaviors* (Unpublished doctoral dissertation). The University of Alabama, Tuscaloosa.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology*, *96*(2), 236–250. http://doi.org/10.1037/0022-0663.96.2.236

Woolfolk, A. (2014). *Educational Psychology. Active learning edition (12th Ed.).* Boston, MA: Allyn & Bacon.

Woolfolk, A. E., & Hoy, W. K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology, 82*(1), 81–91. http://doi.org/10.1037/0022-0663.82.1.81

Woolfolk Hoy, A., & Davis, H. A. (2006). Teacher self-efficacy and its influence on the achievement of adolescents. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 1–45). Greenwich, CT: Information Age.

Yerdelen, S. (2013). *Multilevel investigations of students' cognitive and affective learning outcomes and their relationships with perceived classroom learning environment and teacher effectiveness* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Yerdelen, S., Sungur, S., & Klassen, R. M. (2016). Türkiye'deki fen bilgisi öğretmenlerinin mesleki iyilik durumlarının bazı demografik ve kontekst değişkenleri ile ilişkisi: Çok değişkenli analiz. *Eğitim ve Bilim*, *41*(183).

Yıldırım, S. (2012). Teacher support, motivation, learning strategy use, and achievement: A multilevel mediation model. *The Journal of Experimental Education*, *80*(2), 150-172.

Yıldırım, H. H., Yıldırım, S., Ceylan, E., Yetişir, M. İ. (2013, Mayıs). *Türkiye Perspektifinden TIMSS 2011 Sonuçları*. Türk Eğitim Derneği Tedmem Analiz Dizisi I, Ankara

Zeldin, A. L., & Pajares, F. (2000). Against the Odds: Self-Efficacy Beliefs of Women in Mathematical, Scientific, and Technological Careers. *American Educational Research Journal*, *37*(1), 215–246. http://doi.org/10.3102/00028312037001215

Zhu, Y. Q., Chen, L. Y., Chen, H. G., & Chern, C. C. (2011). How does Internet information seeking help academic performance? The moderating and mediating roles of academic self-efficacy. *Computers & Education*, *57,* 2476–2484. doi:10.1016/ j.compedu.2011.07.006

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary educational psychology*, *25*(1), 82-91.

Zimmerman, B.J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. American Educational Research Journal, 31, 845–862.

APPENDICES

Appendix A

Değerli Öğrenciler,
İlköğretim öğrencilerinin Fen bilimleri dersindeki tutum ve davranışlarını belirlemek amacıyla bir araştırma yapılmaktadır. Bu nedenle sizlerin görüşlerinin alınmasına gerek duyulmuştur. Araştırma sonuçları kesinlikle gizli tutulacaktır. Araştırmanın amacının gerçekleşmesi cevaplarınızın içtenliğine ve soruları eksiksiz olarak cevaplamanıza bağlıdır.

Çalışmaya katıldığınız için teşekkür ederim.

Araş. Gör. Dekant Kıran

<u>1.Bölüm:</u> Kişisel Bilgiler: Bu bölümde sizinle ilgili kişisel bilgileri doldurmanız istenmektedir.

1. Cinsiyetiniz nedir? ❑ Kız ❑Erkek 2. Kardeş sayısı: ………… 3. Doğum tarihiniz (Yıl olarak belirtiniz): ………………… 4. Geçen dönemki Fen bilimleri dersi karne notunuz: …………………. 5. Okulunuzun adı:............................ .... 6. Şubeniz : ❑ 7A ❑ 7B ❑7C ❑7D ❑7E ❑7F ❑7G ❑7... 7. Anneniz çalışıyor mu? ❑ Çalışıyor ❑ Çalışmıyor ❑ Düzenli bir işi yok ❑ Emekli 8. Babanız çalışıyor mu? ❑ Çalışıyor ❑ Çalışmıyor ❑ Düzenli bir işi yok ❑ Emekli 9. Ne kadar sıklıkla eve gazete alıyorsunuz? ❑ Hiçbir zaman ❑Bazen ❑Her zaman	Anne ve babanızın eğitim düzeyi nedir? 10. Anne ❑ Hiç okula gitmemiş ❑ ilkokul ❑Ortaokul ❑ Lise ❑ Üniversite ❑ Yüksek Lisans ❑ Doktora 11. Baba ❑ Hiç okula gitmemiş ❑ ilkokul ❑Ortaokul ❑ Lise ❑ Üniversite ❑ Yüksek Lisans 12. Evinizde bir çalışma c ❑ Evet ❑ Hayır 13. Evinizde bilgisayarınız var mı? ❑ Evet ❑ Hayır 14. Bilgisayarınızın internet bağlantısı var mı? ❑ Evet ❑ Hayır 15. Evinizde kaç tane kitap bulunuyor? (Magazin dergileri, gazete ve okul kitapları **dışında**) ❑ Hiç yok ya da çok az (0 - 10) ❑ 11 – 25 tane ❑ 26 – 100 tane ❑ 101 – 200 tane ❑ 200 taneden fazla

2.Bölüm: Bu bölümde Fen bilimleri dersindeki öğrenci tutum ve davranışlarına yönelik bir dizi ifade bulunmaktadır. Bu ifadelere ne ölçüde katıldığınızı belirtmek için uygun rakamı yuvarlak içerisine alınız.

ÖĞRENCİ KATILIMI ANKETİ

1 Kesinlikle katılmıyorum · **2** Katılmıyorum · **3** Katılıyorum · **4** Kesinlikle Katılıyorum	**Kesinlikle katılmıyorum**	**Katılmıyorum**	**Katılıyorum**	**Kesinlikle Katılıyorum**
1) Fen bilimleri dersinde öğretmenime sorular sorarım.	1	2	3	4
2) Dersle ilgili sevdiğim ya da sevmediğim şeyleri Fen bilimleri öğretmenime söylerim.	1	2	3	4
3) Fen bilimleri dersiyle ilgili nelere ilgi duyduğumu öğretmenime söylerim.	1	2	3	4
4) Fen bilimleri dersiyle ilgili tercihlerimi ve düşüncelerimi açıkça ifade ederim.	1	2	3	4
5) Fen bilimleri dersini daha iyi hale getirebilmek için önerilerde bulunurum.	1	2	3	4
6) Fen bilimleri dersini dikkatle dinlerim.	1	2	3	4
7) Fen bilimleri dersine çok çalışırım.	1	2	3	4
8) Fen bilimleri öğretmenimiz yeni bir konuya başladığında, dikkatle dinlerim.	1	2	3	4
9) Fen bilimleri dersinde yeni bir konuya başladığımızda, çok çalışırım.	1	2	3	4
10) Fen bilimleri dersine dikkatimi veririm.	1	2	3	4
11) Fen bilimleri dersinde yeni şeyler öğrenmekten hoşlanırım.	1	2	3	4
12) Fen bilimleri dersinde herhangi bir şey üzerinde çalışmak ilgimi çeker.	1	2	3	4
13) Fen bilimleri dersinde öğrendiklerimize karşı merak duyuyorum.	1	2	3	4
14) Fen bilimleri dersi eğlencelidir.	1	2	3	4
15) Fen bilimleri dersindeki yeni bilgileri eski bilgilerimle ilişkilendirmeye çalışırım.	1	2	3	4
16) Fen bilimleri dersine çalışırken yeni bilgilerle kendi deneyimlerim arasında bağlantı kurmaya çalışırım.	1	2	3	4
17) Fen bilimleri dersine çalışırken tüm farklı fikirleri bir araya getirerek, onları anlamlandırmaya çalışırım.	1	2	3	4
18) Fen bilimleri dersine çalışırken, kendi örneklerimi oluşturarak önemli kavramları anlamaya çalışırım.	1	2	3	4
19) Fen bilimleri dersine çalışmaya başlamadan önce, ulaşmak istediğim hedefi belirlerim.	1	2	3	4
20) Fen bilimleri dersine çalışırken, ara sıra durur, yaptıklarımı gözden geçiririm.	1	2	3	4

21) Fen bilimleri dersine çalışırken, yalnızca doğru cevapları bulup bulamadığıma değil, ne kadar anladığıma da dikkat ederim.	1	2	3	4
22) Eğer bir Fen bilimleri konusunu anlamakta zorlanıyorsam, onu öğrenmek için izlediğim yolu değiştiririm.	1	2	3	4

3. Bölüm: Bu bölüm Fen bilimleri dersindeki hedeflerinizi belirlemek için hazırlanmıştır. Ankette doğru ya da yanlış cevap olmadığını unutmayınız. Yapmanız gereken, düşüncelerinizi en iyi tanımlayan ifadenin bulunduğu rakamı yuvarlak içerisine almaktır.

HEDEF YÖNELİMİ ANKETİ

1 Hiçbir Zaman · **2** Nadiren · **3** Bazen · **4** Çoğunlukla · **5** Her Zaman	**Hiçbir Zaman**	**Nadiren**	**Bazen**	**Çoğunlukla**	**Her Zaman**
1. Fen bilimleri dersinin içeriğini mümkün olduğunca iyi anlamak benim için önemlidir.	1	2	3	4	5
2. Fen bilimleri dersinde amacım sınıftaki diğer öğrencilerden daha kötü performans sergilemekten kaçınmaktır.	1	2	3	4	5
3. Diğer öğrencilerden daha iyisini yapmak benim için önemlidir.	1	2	3	4	5
4. Fen bilimleri dersinden mümkün olduğunca çok şey öğrenmek istiyorum.	1	2	3	4	5
5. Fen bilimleri dersinde beni sıklıkla motive eden şey, diğerlerinden daha kötü performans sergileme korkusudur.	1	2	3	4	5
6. Fen bilimleri dersinde verilen her şeyi tam olarak öğrenmek arzusundayım.	1	2	3	4	5
7. Fen bilimleri dersinde amacım, diğer pek çok öğrenciden daha iyi bir not almaktır.	1	2	3	4	5
8. Fen bilimleri dersinde öğrenebileceğimden daha azını öğrenmekten korkuyorum.	1	2	3	4	5
9. Fen bilimleri dersindeki tek amacım diğerlerinden daha başarısız olmanın önüne geçmektir.	1	2	3	4	5
10. Fen bilimleri dersinde öğrenilecek her şeyi öğrenemeyebileceğimden sıklıkla endişe duyuyorum.	1	2	3	4	5
11. Fen bilimleri dersinde diğerlerine göre daha başarılı olmak benim için önemlidir.	1	2	3	4	5
12. Bazen Fen bilimleri dersinin içeriğini istediğim kadar iyi anlayamayacağımdan korkuyorum.	1	2	3	4	5
13. Fen bilimleri dersinde amacım başarısız olmaktan kaçınmaktır.	1	2	3	4	5
14. Fen bilimleri dersinde beni sıklıkla motive eden şey başarısız olma korkusudur.	1	2	3	4	5
15. Fen bilimleri dersinde sadece başarısız olmaktan kaçınmak istiyorum.	1	2	3	4	5

4. Bölüm: Anketin 8 maddeden oluşan bu kısmı, sizin Fen bilimleri dersine karşı tutumunuza ve motivasyonunuza yönelik maddelerdir. Maddeleri belirtilen yönergeler doğrultusunda doldurunuz.

FEN BİLİMLERİ ÖZYETERLİK ÖLÇEĞİ

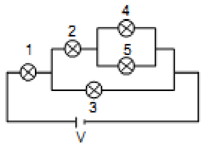
1 --- 2 --- 3 --- 4 --- 5 --- 6 -- 7 **Beni hiç yansıtmıyor** **Beni tam olarak yansıtıyor**	**Beni hiç yansıtmıyor**					**Beni tam olarak yansıtıyor**
1) Fen bilimleri dersinden çok iyi bir not alacağımı düşünüyorum.	1	2	3	4	5	6	7
2) Fen bilimleri dersi ile ilgili okumalarda yer alan en zor konuyu bile anlayabileceğimden eminim.	1	2	3	4	5	6	7
3) Fen bilimleri dersinde öğretilen temel kavramları öğrenebileceğimden eminim	1	2	3	4	5	6	7
4) Fen bilimleri dersinde, öğretmenin anlattığı en karmaşık konuyu anlayabileceğimden eminim.	1	2	3	4	5	6	7
5) Fen bilimleri dersinde verilen sınav ve ödevleri en iyi şekilde yapabileceğimden eminim.	1	2	3	4	5	6	7
6) Fen bilimleri dersinde çok başarılı olacağımı umuyorum.	1	2	3	4	5	6	7
7) Fen bilimleri dersinde öğretilen becerileri iyice öğrenebileceğimden eminim.	1	2	3	4	5	6	7
8) Dersin zorluğu, öğretmen ve benim becerilerim göz önüne alındığında, fen bilimleri dersinde başarılı olacağımı düşünüyorum.	1	2	3	4	5	6	7

Appendix B

FEN VE TEKNOLOJİ TESTİ

Aşağıdaki soruları dikkatli bir şekilde çözerek yanıtlarınızı lütfen optik formun arkasındaki cevap anahtarına işaretleyiniz.

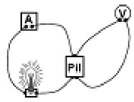
1.

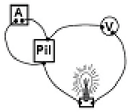


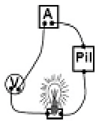
Şekilde verilen elektrik devresindeki eşdeğer ampullerden en az ışık veren iki ampul hangileridir?

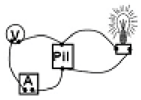
A) 1 ve 3
B) 2 ve 3
C) 3 ve 4
D) 4 ve 5

2. Aşağıdaki devrelerin hangisinde ampermetre ve voltmetrenin bağlantıları doğru gösterilmiştir?

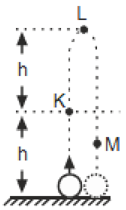
A) 

B) 

C) 

D) 

3.

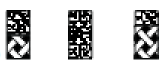


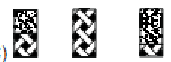
Şekilde düşey doğrultuda yukarı doğru atılan bir topun izlediği yol görülmektedir. **Buna göre; topun K, L, M noktalarındaki potansiyel enerji ve kinetik enerji dağılımları hangisindeki gibi olur?**

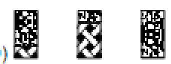
: Potansiyel enerji : Kinetik enerji
Sürtünmeler önemsenmeyecek.

K L M

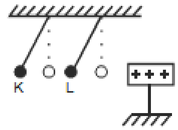
A) 

B) 

C) 

D) 

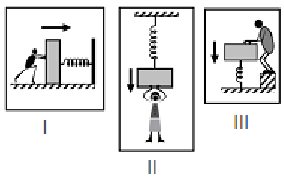
4.



Şekildeki durumun sağlanabilmesi için özdeş K ve L kürelerinin yük durumları hangisinde doğru verilmiştir?

	K	L
A)	+	+
B)	+	Nötr
C)	-	+
D)	-	-

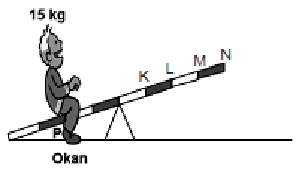
5. Üç öğrenci I, II ve III teki yaylara oklarla gösterilen yönlerdeki kuvvetleri uyguluyorlar.



Yayların bu kişilere uyguladıkları kuvvetlerin yönleri hangi seçenekte doğru olarak verilmiştir?

	I	II	III
A)	→	↓	↓
B)	←	↑	↓
C)	←	↑	↑
D)	→	↓	↑

6.

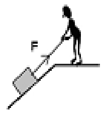


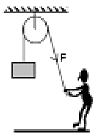
Şekildeki eşit bölmeli tahterevallinin P noktasında oturan 15 kg ağırlığındaki Okan denge konumuna getirilmek istenmektedir.
Buna göre aşağıdakilerin hangisinde denge <u>sağlanmaz</u>?

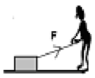
A) K ye 30 kg ağırlığındaki Ziya oturduğunda
B) L ye 15 kg ağırlığındaki Göktuğ oturduğunda
C) M ye 10 kg ağırlığındaki Selim oturduğunda
D) N ye 20 kg ağırlığındaki Hakan oturduğunda

7. Fiziksel anlamda iş yapılabilmesi için;
- Kuvvet uygulanmalı
- Kuvvet etkisindeki cisim yol almalıdır.

buna göre aşağıdakilerden hangisinde <u>kesinlikle iş yapılamaz</u>?

A) 

B) 

C) 

D) 

8. Aşağıdakilerden hangisi burnumuzun görevi <u>değildir</u>?

A) Koku alma
B) Alınan havayı süzme
C) Alınan nemli havayı kurutma
D) Alınan soğuk havayı ısıtma

9. Aşağıdakilerden hangisi diğer iç salgı bezlerinin çalışmasını denetler ve düzenler?

A) Böbrek üstü bezi
B) Hipofiz bezi
C) Tiroit bezi
D)Yumurtalık

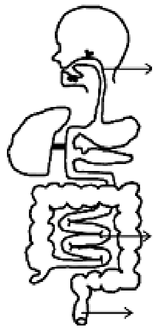
10. Korku, heyecan, mutluluk ve öfke gibi durumlarda vücutta adrenalin hormonu seviyesi artar.
Buna göre, aşağıdaki durumların hangisinde Hülya'nın adrenalin hormonu seviyesinde artma beklenir?

A) Yemek yerken su içtiğinde
B) Ders çalıştıktan sonra uyuduğunda
C) Her gün, ev işlerinde annesine yardım ettiğinde
D) Sınavda başarılı olunca aşırı sevindiğinde

11. Göze gelen ışık ışınları ilk önce aşağıdakilerin hangisinden geçer?

A) Sarı benekten
B) Göz merceğinden
C) İristen
D) Korneadan

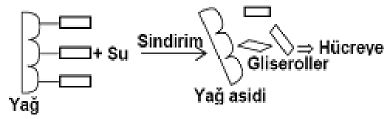
12.



Şekilde sindirim sisteminin bazı organları okla gösterilmiştir.
Aşağıda verilen olaylardan hangisi okla gösterilen organlardan birinin görevi <u>değildir</u>?

A) Atık maddelerin vücuttan uzaklaştırılması
B) Besinlerin ağızdan yemek borusuna iletilmesi
C) Besinlerin bulamaç hâline getirilmesi
D) Besinlerin kana geçirilmesi

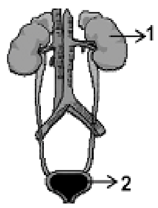
13.



Yağlar, şekilde de görüldüğü gibi sindirim sisteminde sindirilerek yağ asidi ve gliserole ayrılır.
Bu bilgilere göre aşağıdakilerden hangisine <u>ulaşılamaz</u>?

A) Yağların büyük moleküllü olduğuna
B) Yağ asidi ve gliserolün hücre zarından geçebilecek büyüklükte olduğuna
C) Yağların kan yoluyla taşındığına
D) Yağların sindiriminde su kullanıldığına

14. Öğretmen;
Şekildeki boşaltım sisteminde verilen 1 ve 2 numaralı organların isim ve görevlerini söyler misin?



Öğrenci;
1 numaralı organ böbrektir, idrarı depo eder.
2 numaralı organ idrar kesesidir, kanı süzer.
Bu açıklamalara göre öğrenci ile ilgili olarak aşağıdakilerden hangisi söylenebilir?

A) Boşaltım sistemi organlarını bilmiyor.
B) Boşaltım sistemi organlarının şeklini biliyor, ancak görevlerini birbirine karıştırıyor.
C) Boşaltım sistemi organları ile diğer sistemlerin organlarını ayırt edemiyor.
D) Boşaltım sistemi organlarını ve görevlerini çok iyi biliyor.

TEST BİTTİ

...

Appendix C

Sayın Fen Bilimleri öğretmeni,

Bu ankette size öğretmenlik mesleğine karşı tutumlarınıza ve algılarınıza yönelik çeşitli sorular sorulmaktadır. Lütfen her cümleyi dikkatle okuduktan sonra, size uygun gelen seçeneği **mutlaka** işaretleyiniz. Unutmayın Doğru ya da Yanlış cevap yoktur. Sizden hiçbir şekilde kimliğinizi belirten bir bilgi istenmemektedir ve anketlere verdiğiniz cevaplar araştırmacılar tarafından gizli tutulacaktır. Bu nedenle sorulara içtenlikle cevap vermenizi rica ederiz.

Katkılarınızdan dolayı çok teşekkür ederim.

Araş. Gör. Dekant KIRAN
ODTÜ Eğitim Fakültesi İlköğretim Bölümü

KİŞİSEL BİLGİLERİNİZ

1. Cinsiyetiniz: O Kadın O Erkek **2.** Yaşınız:________ **3.** Üniversite eğitimi gördüğünüz fakültenin adı: ______________________________ **4.** Üniversite eğitimi gördüğünüz bölümün adı: ___________________________________ Şu andaki eğitim durumunuz? OLisans O Yüksek lisans ODoktora ODiğer_____________________	**5.** Kaç yıldır öğretmenlik yapıyorsunuz?- ____________ **6.** Girdiğiniz sınıflardaki ortalama öğrenci sayısı:______ **7.** Haftalık ders saatiniz:______ **8.** Evli misiniz? OEvet O Hayır **9.** Çocuğunuz var mı? O Evet O Hayır **10.** Çocuğunuz var ise sayısı: O 1 O 2 O 3 O 4 O 5 O 6 ve üstü

OKUL ORTAMI ALGILARI ANKETİ

Değerli fen bilimleri öğretmenleri,

Bu ankette sizlere **okul ortamı** ve **okuldaki diğer öğretmenlerle olan ilişkilerinizle** ilgili sorular sorulmaktadır. Soruları yanıtlarken size en çok uyan rakamı aşağıdaki ölçeğe göre değerlendirerek **mutlaka** yuvarlak içine alınız. Unutmayın, doğru ya da yanlış cevap yoktur. Sizden hiçbir şekilde kimliğinizi belirten bir bilgi istenmemektedir ve anketlere verdiğiniz cevaplar araştırmacılar tarafından gizli tutulacaktır. Bu nedenle sorulara içtenlikle cevap vermenizi rica ederiz.

Katkılarınızdan dolayı teşekkür ederiz.

1 2 3 4 5 6 **Yanlış** → **Doğru**	**Yanlış**					**Doğru**
1. Ders hazırlığı için kullanılması gereken zamanın çoğunu okuldaki toplantılar, idari işler ve evrak işleri alıyor.	1	2	3	4	5	6
2. Okuldaki yaşantı yorucu ve dinlenip yenilenmek için zaman yok.	1	2	3	4	5	6
3. Çalışma saatleri içerisinde ders anlatımı için hazırlık yapmak genellikle mümkün olmuyor.	1	2	3	4	5	6

4. Derslerimde istediğim öğretim yöntem ve stratejisini seçmekte özgürüm.	1	2	3	4	5	6
5. Derslerimde, içeriğin hangi kısmına odaklanacağıma karar vermekte özgürüm.	1	2	3	4	5	6
6. Çalışma şartlarımı değiştirebileceğimi hissediyorum (ders saatleri ayarlanırken; ya da fen laboratuvarı düzenlenirken söz sahibi olmak, vb.).	1	2	3	4	5	6
7. Velilerin ders anlatımıma ve öğretim tarzıma güvendiklerini hissediyorum.	1	2	3	4	5	6
8. Velilerle işbirliği yapmak kolaydır.	1	2	3	4	5	6
9. Veliler kararlarıma güvenir ve kararlarımı onaylar.	1	2	3	4	5	6
10. Derslerim disiplin sorunu yaşayan öğrenciler tarafından sık sık bölünür.	1	2	3	4	5	6
11. Disiplin sorunu olan bazı öğrenciler dersin planlandığı gibi işlenmesini zorlaştırır.	1	2	3	4	5	6
12. Ders esnasında öğrenci davranışlarını kontrol etmek çaba gerektirir ve çok zaman alır.	1	2	3	4	5	6
13. Mesleki konularda okul yönetiminden daima yardım ve tavsiye isterim.	1	2	3	4	5	6
14. Okul müdürü ile ilişkim karşılıklı güven ve saygı içindedir.	1	2	3	4	5	6
15. Okul yönetimi destekleyicidir ve yapılan iyi işleri över.	1	2	3	4	5	6
16. Mesleki konularda okuldaki diğer öğretmen arkadaşlarımdan daima tatmin edici düzeyde yardım alırım.	1	2	3	4	5	6
17. Bu okulda öğretmenler arasındaki ilişkiler arkadaşlık ve birbirini koruyup gözetme olarak nitelendirilebilir.	1	2	3	4	5	6
18. Bu okuldaki öğretmenler birbirlerine yardım eder ve destek olur.	1	2	3	4	5	6

ÖĞRETİM YAKLAŞIMLARI VE OKUL HEDEF YAPILARI ANKETİ

Değerli fen bilimleri öğretmenleri,
Bu ankette sizlere okulun hedef yapısı ve öğretim yaklaşımlarınızla ilgili sorular sorulmaktadır. Soruları yanıtlarken size en çok uyan rakamı aşağıdaki ölçeğe göre değerlendirerek **mutlaka** yuvarlak içine alınız. Unutmayın, doğru ya da yanlış cevap yoktur. Sizden hiçbir şekilde kimliğinizi belirten bir bilgi istenmemektedir ve anketlere verdiğiniz cevaplar araştırmacılar tarafından gizli tutulacaktır. Bu nedenle sorulara içtenlikle cevap vermenizi rica ederiz. Katkılarınızdan dolayı teşekkür ederiz.

ÖĞRETİM YAKLAŞIMLARI ANKETİ

1 — Hiç Katılmıyorum · **2** · **3** — Biraz Katılıyorum · **4** · **5** — Kesinlikle Katılıyorum	**Hiç Katılmıyorum**		**Biraz Katılıyorum**		**Kesinlikle Katılıyorum**
1. Fen Bilimleri ödevini en güzel yapan öğrencilere özel ayrıcalıklar tanırım.	1	2	3	4	5
2. Sınıf seviyesinin altında olsalar bile, öğrencilerin bireysel gelişimlerini gözlemleyebilmek için özel bir çaba harcarım.	1	2	3	4	5

3. Fen Bilimleri dersinde en yüksek notu alan öğrencinin çalışmasını (ödev/proje/performans, vb.) sınıfa örnek gösteririm	1	2	3	4	5
4. Derslerimde, öğrencilerin arasından seçim yapabileceği değişik etkinlikleri sık sık kullanırım.	1	2	3	4	5
5. Karne notlarını verirken, öğrencilerin Fen Bilimleri dersinde ne kadar gelişim gösterdiklerini göz önünde bulundururum.	1	2	3	4	5
6. Öğrencilerin, Fen Bilimleri dersindeki başarı düzeylerinin sınıftaki diğer öğrencilere göre nasıl olduğunu anlamalarına yardımcı olurum.	1	2	3	4	5
7. Öğrencileri Fen Bilimleri dersinde birbirleriyle yarışmaları için cesaretlendiririm.	1	2	3	4	5
8. Fen Bilimleri dersinde başarılı olan öğrencileri diğer öğrencilere model olarak gösteririm.	1	2	3	4	5
9. Öğrencilerin ihtiyaçlarına ve beceri seviyelerine uygun olarak çok çeşitli ödevler veririm.	1	2	3	4	5

OKUL HEDEF YAPILARI ANKETİ

1 2 3 4 5 **Hiç Katılmıyorum** **Biraz Katılıyorum** **Kesinlikle Katılıyorum**	**Hiç Katılmıyorum**		**Biraz Katılıyorum**		**Kesinlikle Katılıyorum**
1. Bu okulda, çok çalışmanın önemli olduğu öğrencilere açıkça vurgulanır.	1	2	3	4	5
2. Bu okulda, öğrendikleri ve kendilerini geliştirdikleri sürece hata yapmalarının normal olduğu öğrencilere anlatılır.	1	2	3	4	5
3. Bu okulda, hangi öğrencilerin en yüksek notu, hangi öğrencilerin en düşük notu alacağını tahmin etmek kolaydır.	1	2	3	4	5
4. Bu okulda, iyi not alan öğrenciler diğerlerine örnek olarak gösterilir.	1	2	3	4	5
5. Bu okulda, sınavlarda yüksek puan almanın önemi hakkında öğrenciler pek çok şey duyarlar.	1	2	3	4	5
6. Bu okulda, öğrencilerin yaptığı ödev ve proje gibi çalışmaların çoğu özgün ve eğlencelidir.	1	2	3	4	5
7. Bu okulda, notlar ve sınav sonuçları üzerinde fazlaca durulan konulardır.	1	2	3	4	5
8. Bu okulda, öğrenmenin eğlenceli bir uğraş olması gerektiği öğrencilere sık sık söylenir.	1	2	3	4	5
9. Bu okulda, ödev ve proje gibi çalışmaların veriliş amacının konuları ezberletmek değil, konuların daha iyi anlaşılmasını sağlamak olduğu vurgulanır.	1	2	3	4	5
10. Bu okulda, öğrencilerin göstermiş olduğu gelişim ve çaba takdir edilir.	1	2	3	4	5
11. Bu okulda, teşekkür ve takdir alanların arasına girmenin ne denli önemli olduğu öğrencilere çokça vurgulanır.	1	2	3	4	5
12. Bu okulda, öğrencilerin yaptıkları çalışmaların (ödev, proje, vb.) okul dışındaki yaşamlarıyla nasıl ilişkili olduğunu göstermek için büyük bir çaba harcanır.	1	2	3	4	5

13. Bu okulda, öğrenciler okul başarısı için birbirleriyle yarışmaya teşvik edilirler.	1	2	3	4	5

ÖĞRETMEN KOLEKTİF YETERLİK ANKETİ

1 2 3 4 5 6 **Hiç Katılmıyorum** ... **Tamamen Katılıyorum**	**Hiç Katılmıyorum**				**Tamamen Katılıyorum**
1. Bu okuldaki Fen Bilimleri öğretmenleri, sınıflarındaki çalışması zor öğrencilere ulaşmayı başarabilirler.	1	2	3	4	5	6
2. Bu okuldaki Fen Bilimleri öğretmenleri, derslerinde öğrencileri motive edebileceklerinden emindirler.	1	2	3	4	5	6
3. Bu okuldaki Fen Bilimleri öğretmenleri, sınıflarındaki bir öğrenci öğrenmek istemiyorsa fazla uğraş göstermezler.	1	2	3	4	5	6
4. Bu okuldaki Fen Bilimleri öğretmenleri, öğrencilerin Fen Bilimleriyi anlamlı öğrenebilmesi için yeterli becerilere sahip değildirler.	1	2	3	4	5	6
5. Eğer öğrenciler bir konuyu ilk işlendiğinde öğrenmezlerse, bu okuldaki Fen Bilimleri öğretmenleri aynı konuyu öğrencilere başka yollarla öğretmeyi denerler.	1	2	3	4	5	6
6. Bu okuldaki Fen Bilimleri öğretmenleri çeşitli öğretim yöntemlerini uygulama konusunda yeterli donanıma sahiptirler.	1	2	3	4	5	6
7. Bu okuldaki Fen Bilimleri öğretmenleri, öğretmekle yükümlü oldukları konulara yeterince hazırlıklıdırlar.	1	2	3	4	5	6
8. Bu okuldaki Fen Bilimleri öğretmenleri, uygun öğretim yöntemlerini kullanmadıkları için bazı öğrencilere ulaşmakta başarısız olurlar.	1	2	3	4	5	6
9. Bu okuldaki Fen Bilimleri öğretmenleri, öğrencilerin öğrenebilmesi için her türlü çabayı sarf ederler.	1	2	3	4	5	6
10. Bu okulda Fen Bilimleri dersine yönelik öğretim materyalleri ve araç-gereçlerinin eksikliği öğretimi çok zorlaştırmaktadır.	1	2	3	4	5	6
11. Bu okuldaki Fen Bilimleri öğretmenleri, öğrencilerin disiplin problemleriyle başa çıkma becerilerine sahip değildirler.	1	2	3	4	5	6
12. Bu okuldaki Fen Bilimleri öğretmenleri, sınıflarında hiç kimsenin ulaşamayacağı bazı öğrencilerin var olduğunu düşünürler.	1	2	3	4	5	6
13. Bu okuldaki olanaklarının niteliği, Fen Bilimleri dersindeki öğretme ve öğrenme sürecini gerçekten kolaylaştırır.	1	2	3	4	5	6
14. Bu okuldaki öğrenciler (ev yaşamlarından) öyle avantajlarla okula gelirler ki öğrenememeleri elde değil.	1	2	3	4	5	6
15. Bu okuldaki öğrenciler, öğrenmeye hazır bir biçimde okula gelirler.	1	2	3	4	5	6
16. Buradaki öğrenciler öğrenmeye motive değildir.	1	2	3	4	5	6
17. Bu okuldaki Fen Bilimleri öğretmenleri her öğrencinin öğrenebileceğine gönülden inanır.	1	2	3	4	5	6

İŞ DOYUMU ANKETİ

1 Kesinlikle Katılmıyorum · 2 · 3 · 4 · 5 · 6 Kesinlikle Katılıyorum	Kesinlikle Katılmıyorum					Kesinlikle Katılıyorum
1. Fen Bilimleri öğretmenliği yapmayı seviyorum.	1	2	3	4	5	6
2. Her gün okula gitmeye çok istekliyim.	1	2	3	4	5	6
3. Fen Bilimleri öğretmeni olarak çalışmak son derece tatmin edicidir.	1	2	3	4	5	6

ÖĞRETMEN ÖZYETERLİK ANKETİ

1 Yetersiz · 2 · 3 Çok Az Yeterli · 4 · 5 Biraz Yeterli · 6 · 7 Oldukça Yeterl · 8 · 9 Çok Yeterli	Yetersiz		Çok Az Yeterli		Biraz Yeterli		Oldukça Yeterli		Çok Yeterli
1. Sınıfta fen bilimleri dersini olumsuz yönde etkileyen davranışları kontrol etmeyi ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
2. Fen bilimleri dersine az ilgi gösteren öğrencileri motive etmeyi ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
3. Öğrencileri fen bilimleri dersinde başarılı olabileceklerine inandırmayı ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
4.Öğrencilerin fen bilimleri dersini öğrenmeye değer vermelerini ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
5. Fen bilimleri dersinde öğrencilerinizi iyi bir şekilde değerlendirmenize olanak sağlayacak soruları ne ölçüde hazırlayabilirsiniz?	1	2	3	4	5	6	7	8	9
6. Fen bilimleri dersinde öğrencilerin sınıf kurallarına uymalarını ne kadar sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
7. Fen bilimleri dersini olumsuz yönde etkileyen ya da derste gürültü yapan öğrencileri ne kadar yatıştırabilirsiniz?	1	2	3	4	5	6	7	8	9
8. Fen bilimleri derslerinde farklı öğrenci gruplarına uygun sınıf yönetim sistemi ne kadar iyi oluşturabilirsiniz?	1	2	3	4	5	6	7	8	9
9. Fen bilimleri derslerinde farklı değerlendirme yöntemlerini ne kadar kullanabilirsiniz?	1	2	3	4	5	6	7	8	9
10. Fen bilimleri derslerinde öğrencilerin kafası karıştığında ne kadar alternatif açıklama ya da örnek sağlayabilirsiniz?	1	2	3	4	5	6	7	8	9
11. Çocuklarının fen bilimleri dersinde başarılı olmalarına yardımcı olmaları için ailelere ne kadar destek olabilirsiniz?	1	2	3	4	5	6	7	8	9
12. Fen bilimleri derslerinde farklı öğretim yöntemlerini ne kadar iyi uygulayabilirsiniz?	1	2	3	4	5	6	7	8	9

Appendix D

HIERARCHICAL LINEAR MODEL ASSUMPTIONS

D.1 Assumption Tests for the Model with students' Self-Efficacy as Outcomes

The first step in the assumptions of Hierarchical Linear Modeling is comparing the multilevel standard errors and robust standard errors. If there is a major difference between these values, then it is considered that there may be violations in important assumptions. Raudenbush et al. (2011) stated that "If the robust and model-based standard errors are substantively different, it is recommended that the tenability of key assumptions should be investigated further" (p. 35). Thus, robust and model-based standard errors are examined first for each and every final model in the current study.

The differences of standard errors in Table D.1 and D.2 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.1 Final estimation of fixed effects for student Self Efficacy as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_SELFE, γ_{00}	.015	**.023**	.657	.512
ZT_ATIS_M, γ_{01}	.062	**.025**	2.44	.016
ZT_TSE_I, γ_{02}	-.055	**.026**	-2.18	.033

Table D.2 Final estimation of fixed effects (with robust standard errors)for student Self Efficacy as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_SELFE, γ_{00}	.015	**.023**	.664	.507
ZT_ATIS_M, γ_{01}	.062	**.025**	2.47	.015
ZT_TSE_I, γ_{02}	-.055	**.025**	-2.28	.024

D.2 Assumption Tests for the Model with students' Engagement dimensions as Outcomes

D.2.1 Assumption Tests for Agentic Engagement

The differences of standard errors in Table D.3 and D.4 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.3 Final estimation of fixed effects for Agentic Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_AGENT, γ_{00}	.036	**.022**	1.66	.099
ZT_SELFE, γ_{10}	.358	**.017**	21.19	.000
ZT_MASTAP, γ_{20}	.122	**.019**	6.28	.000
ZT_MASTAV, γ_{30}	.093	**.016**	5.92	.000
ZT_PERFAP, γ_{40}	.062	**.018**	3.44	.001

Table D.4 Final estimation of fixed effects (with robust standard errors) for Agentic Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_AGENT, γ_{00}	.036	**.021**	1.67	.098
ZT_SELFE, γ_{10}	.358	**.017**	21.36	.000
ZT_MASTAP, γ_{20}	.122	**.018**	6.68	.000
ZT_MASTAV, γ_{30}	.093	**.016**	6.00	.000
ZT_PERFAP, γ_{40}	.062	**.018**	3.38	.001

D.2.2 Assumption Tests for Behavioral Engagement

The differences of standard errors in Table D.3 and D.4 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.5 Final estimation of fixed effects for Behavioral Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_BEHAV, γ_{00}	.049	**.014**	3.52	.001
ZT_SELFE, γ_{10}	.338	**.016**	20.90	.000
ZT_MASTAP, γ_{20}	.368	**.020**	18.76	.000
ZT_MASTAV, γ_{30}	.043	**.013**	3.34	.001
ZT_PERFAP, γ_{40}	.064	**.016**	4.05	.000

Table D.6 Final estimation of fixed effects (with robust standard errors) for Behavioral Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_BEHAV, γ_{00}	.049	**.014**	3.60	.001
ZT_ATIS_M, γ_{10}	.338	**.016**	21.26	.000
ZT_TSE_I, γ_{20}	.368	**.020**	18.80	.000
ZT_MASTAV, γ_{30}	.043	**.014**	3.15	.001
ZT_PERFAP, γ_{40}	.064	**.015**	4.20	.000

D.2.3 Assumption Tests for Cognitive Engagement

The differences of standard errors in Table D.7 and D.8 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.7 Final estimation of fixed effects for Cognitive Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_COGNI, γ_{00}	.042	**.015**	2.75	.007
ZT_TSE_S, γ_{01}	-.034	**.015**	-2.23	.027
ZT_SELFE, γ_{10}	.41	**.015**	27.63	.000
ZT_MASTAP, γ_{20}	.231	**.018**	12.52	.000
ZT_JOB_S	.040	**.017**	2.38	.019
ZT_MASTAV, γ_{30}	.113	**.016**	6.98	.000
ZT_PERFAV, γ_{40}	.091	**.019**	4.84	.000
ZT_TSE_S, γ_{42}	.032	**.016**	1.99	.049

Table D.8 Final estimation of fixed effects (with robust standard errors) for Cognitive Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_COGNI, γ_{00}	.042	**.015**	2.77	.007
ZT_TSE_S, γ_{01}	-.034	**.013**	-2.73	.008
ZT_SELFE, γ_{10}	.41	**.015**	27.43	.000
ZT_MASTAP, γ_{20}	.231	**.019**	12.48	.000
ZT_JOB_S	.040	**.016**	2.47	.015
ZT_MASTAV, γ_{30}	.113	**.018**	6.37	.000
ZT_PERFAV, γ_{40}	.091	**.018**	4.97	.000
ZT_TSE_S, γ_{42}	.032	**.014**	2.30	.023

D.2.4 Assumption Tests for Emotional Engagement

The differences of standard errors in Table D.9 and D.10 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.9 Final estimation of fixed effects for Emotional Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_EMOTI, γ_{00}	.044	**.018**	2.49	.014
ZT_ATIS_M, γ_{01}	.040	**.019**	2.12	.036
ZT_TSE_S, γ_{02}	-.055	**.019**	-2.81	.006
ZT_SELFE, γ_{10}	.335	**.018**	18.40	.000
ZT_TASKA, γ_{11}	.031	**.015**	2.06	.042
ZT_MASTAP, γ_{20}	.292	**.021**	13.96	.000
ZT_GRCOM, γ_{21}	.042	**.018**	2.33	.021
ZT_MASTAV, γ_{30}	.067	**.014**	4.82	.000
ZT_PERFAV, γ_{40}	.039	**.018**	2.16	.032

Table D.10 Final estimation of fixed effects (with robust standard errors) for Emotional Engagement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_EMOTI, γ_{00}	.044	**.018**	2.52	.013
ZT_ATIS_M, γ_{01}	.040	**.019**	2.17	.032
ZT_TSE_S, γ_{02}	-.055	**.018**	-3.13	.003
ZT_SELFE, γ_{10}	.335	**.018**	18.48	.000
ZT_TASKA, γ_{11}	.031	**.015**	2.04	.043
ZT_MASTAP, γ_{20}	.292	**.021**	13.82	.000
ZT_GRCOM, γ_{21}	.042	**.017**	2.40	.018
ZT_MASTAV, γ_{30}	.067	**.014**	4.85	.000
ZT_PERFAV, γ_{40}	.039	**.018**	2.21	.028

D.3 Assumption Tests for Achievement Goals

D.3.1 Assumption Tests for Mastery Approach Goals

The differences of standard errors in Table D.11 and D.12 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.11 Final estimation of fixed effects for Mastery Approach Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_MASTAP, γ_{00}	.046	**.019**	2.37	.019
ZT_TSE_C, γ_{01}	.032	**.017**	1.82	.070
ZT_SELFE, γ_{10}	.405	**.017**	24.07	.000

Table D.12 Final estimation of fixed effects (with robust standard errors) for Mastery Approach Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_MASTAP, γ_{00}	.046	**.019**	2.40	.018
ZT_TSE_C, γ_{01}	.032	**.015**	2.21	.029
ZT_SELFE, γ_{10}	.405	**.016**	24.90	.000

D.3.2 Assumption Tests for Mastery Avoidance Goals

The differences of standard errors in Table D.13 and D.14 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.13 Final estimation of fixed effects for Mastery Avoidance Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_MASTAVO, γ_{00}	.046	**.019**	1.06	.019
ZT _JOB_S, γ_{01}	-.02	**.020**	-2.11	.037
ZT_SELFE, γ_{10}	.063	**.017**	3.67	.000

Table D.14 Final estimation of fixed effects (with robust standard errors) for Mastery Avoidance Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_MASTAVO, γ_{00}	.046	**.020**	1.07	.289
ZT _JOB_S, γ_{01}	-.02	**.019**	-2.20	.030
ZT_SELFE, γ_{10}	.063	**.018**	3.46	.001

D.3.3 Assumption Tests for Performance Approach Goals

The differences of standard errors in Table D.15 and D.16 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.15 Final estimation of fixed effects for Performance Approach Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_PERFAP, γ_{00}	.043	**.019**	2.37	.019
ZT_SELFE, γ_{10}	.303	**.017**	1.82	.070
ZT_JOB_S, γ_{11}	-.034	**.016**	24.07	.000

Table D.16 Final estimation of fixed effects (with robust standard errors) for Performance Approach Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_PERFAP, γ_{00}	.043	**.019**	2.40	.018
ZT_SELFE, γ_{10}	.303	**.017**	2.21	.029
ZT_JOB_S, γ_{11}	-.034	**.016**	24.90	.000

D.3.4 Assumption Tests for Performance Avoidance Goals

The differences of standard errors in Table D.17 and D.18 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.17 Final estimation of fixed effects for Performance Avoidance Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_PERFAVO, γ_{00}	.024	**.021**	1.11	.269
ZT_TASKA, γ_{01}	-.041	**.021**	-1.95	.053
ZT_SELFE, γ_{10}	.150	**.019**	8.05	.000
ZT_TSE_I, γ_{11}	- .043	**.019**	-2.33	.021

Table D.18 Final estimation of fixed effects (with robust standard errors) for Performance Avoidance Goals as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_PERFAVO, γ_{00}	.024	**.021**	1.12	.265
ZT_TASKA, γ_{01}	-.041	**.019**	-2.16	.033
ZT_SELFE, γ_{10}	.150	**.019**	8.11	.000
ZT_TSE_I, γ_{11}	- .043	**.018**	-2.37	.019

D.4 Assumption Tests for Science Achievement

D.4.1 Assumption Tests for Science Achievement

The differences of standard errors in Table D.19 and D.20 are not large. Therefore there does not exist a series violation of the assumption. There is no need to investigate further assumptions.

Table D.19 Final estimation of fixed effects for Science Achievement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZT_SAT, γ_{00}	.010	**.046**	-.217	.828
ZT_ATIS_M, γ_{01}	.134	**.045**	2.96	.004
ZT_SELFE, γ_{10}	.114	**.020**	5.69	.000
ZT_AGENT, γ_{11}	.002	**.020**	.082	.935
ZT_BEHAV	.180	**.022**	8.05	.000
ZT_COGNI	-.051	**.022**	-2.33	.020
ZT_MASTAP	.147	**.020**	7.50	.000
ZT_MASTAV	.047	**.019**	-2.48	.015
ZT_PERFAV	.074	**.021**	-3.56	.001

Table D.20 Final estimation of fixed effects (with robust standard errors) for Science Achievement as outcome variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean, ZZT_SAT, γ_{00}	.010	**.046**	-.217	.827
ZT_ATIS_M, γ_{01}	.134	**.043**	3.16	.002
ZT_SELFE, γ_{10}	.114	**.021**	5.38	.000
ZT_AGENT, γ_{11}	.002	**.020**	.082	.936
ZT_BEHAV	.180	**.024**	7.35	.000
ZT_COGNI	-.051	**.022**	-2.31	.021
ZT_MASTAP	.147	**.021**	7.02	.000
ZT_MASTAV	.047	**.018**	-2.57	.012
ZT_PERFAV	.074	**.021**	-3.56	.001

Appendix E

TURKISH SUMMARY

ÖĞRENCİ MOTİVASYONU, KATILIMI VE FEN BAŞARISININ ÖĞRETMEN DEĞİŞKENLERİYLE İLİŞKİSİNİN ÇOK DÜZEYLİ İNCELENMESİ

Giriş

Motivasyon araştırmacıları yakın zaman önce kendilerini öğretmen motivasyonu araştırma sayısının öğrenci motivasyonu araştırmalarının sayısına kıyasla daha az olmasından dolayı eleştirmeye başlamışlardır (Butler, 2007; 2012; Mertler; 2016; Retelsdorf, Butler, Streblow, & Schiefele; 2010; Retelsdorf & Günther, 2011). Butler'e (2007) göre öğretmen motivasyonu, öğrenci çıktılarına katkı yapmasının yanı sıra, kendi öz değerinden dolayı da araştırılmayı hak etmektedir. Öyle ki Tobin, Tippins ve Gallard'ın (1994) belirttiği üzere "…sınıfta olan biteni belirleyen faktörler içinde öğretmen inanışları kritik bir bileşendir" (p. 64). Son yıllarda öğretmen motivasyonu çalışmaları eğitim ve motivasyon kuramları kullanılarak araştırılmasıyla hızla artmıştır (Retelsdorf & Günther, 2011). Öğrencilerin nasıl öğrendiğine açıklama getirmek için geliştirilen motivasyon kuramları öğretmen motivasyonu araştırmalarına da aktarılmıştır (Fives & Buehl, 2016). Günümüze değin öğretmen motivasyonu başlıca sosyo-bilişsel kuram, (öz yeterlik, kolektif yeterlik) (Klassen, Tze, Betts, & Gordon, 2011; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998; Goddard, 2001), beklenti-değer kuramı (Watt & Richardson, 2007) ve hedef yönelimi kuramı (Butler, 2007; 2012) çerçeveleri kullanılarak araştırılmıştır. Bu çalışmada ise, öğretmen motivasyonu, öğretmenlerin öğretme öz yeterliği, grup olarak kolektif yeterlik inanışları ve sınıf içi öğretim hedefleri olarak ele alınmıştır. Buna göre, bu çalışmada araştırılan öğretmen motivasyonu değişkenleri öğretmen öz yeterliği (öğrenci katılımı için öğretmen öz yeterliği, öğretim stratejileri öz yeterliği ve sınıf yönetimi öz yeterliği), öğretmen kolektif yeterliği (grup yeteneği ve görev analizi) ve öğretmenlerin sınıf içi öğretim hedef yönelimleridir (ustalık ve performans).

Fives ve Buehl'in (2016) de vurguladığı üzere, öğretmenler de öğrenciler gibi öz inanışlarından etkilenmektedirler. Bu inanışlardan ön plana çıkan ise öz yeterlik kavramıdır. Öğretmen öz yeterliği, öğretmenlik mesleğine karşı tutum, öğrenciye karşı davranışlar, öğrenci başarısı ve motivasyonu gibi etmenlere katkı yapmaktadır (Klassen & Chiu 2010). Öğrtemen öz yeterliği, öğretmenlerin öğrenci öğrenmesini etkileyen becerilerine olan inancını ifade etmektedir (Caprara, Barbaranelli, Steca & Malone, 2006; Klassen & Chiu 2010). Öğretmen öz yeterliği öğrenci öğrenmelerini pek çok yönden etkileyebilmektedir. Örneğin öz yeterliği yüksek öğretmenler öz yeterliği düşük öğretmenlere göre yenilikçi öğretim yöntemlerini daha etkili kullanırlar, etkili bir sınıf yönetimi sergilerler ve öğrencilerin özerk davranabilmelerini geliştirecek uygun öğretim yöntemlerini kullanabilirler (Cousins & Walker, 1995; Guskey, 1988). Ayrıca, öğretmenlerin öz yeterliği öğrencilerin öz yeterliğine, sınıf etkinliklerine katılmalarına, zorlayıcı ödevlerde ve düşük başarı durumlarında çabalarını düzenlemelerine de katkıda bulunabilir (Ross, 1998; Ross, Hogaboam-Gray, & Hannay, 2001). Dahası, öğretmen öz yeterliğinin öğrenci başarısını yordadığını gösteren çalışmalar da alanyazında mevcuttur.

Öğretmen öz yeterliğinin yanı sıra, mesleki algılar, mesleki tatmin, öğretmenler arası işbirliği ve öğretmen veli ilişkileri gibi diğer psiko-sosyal etmenler de öğretmen-öğrenci ilişkilerinde etkilidir (Caprara ve diğ., 2006). Bandura'ya

(1997) göre, büyük ölçüde çalışanlarının işbirlikli çalışma becerisine dayanan sosyal bir sistemin başarısı çalışanların kolektif yeterliğinden önemli şekilde etkilenebilmektedir. Dahası Bandura, insanların çalışma ortamlarında birbirlerinden ayrı olarak çalışmadıklarını ve bunun sonucu olarak da içinde bulundukları grubun kolektif yeterliği hakkında inanışlar geliştirdiğini belirtmektedir. Kolektif yeterlik, "kişilerin sosyal bir sistem (aile, takım, kurum, topluluk, vb.) ve bu sistemin özel çalışma alanlarındaki yetenek seviyesi ve etkililiği hakkında vardıkları yargılardır" (Caprara ve diğ., 2006) (s. 821). Eğitim alanında da okullar, öğretmenlerin kolektif çalıştıkları sosyal sitemlerdir. Bundan dolayı, öğretmenler bireysel öz yeterliğe sahip oldukları gibi, okullarında çalışan meslektaşları ile birlikte kolektif bir yeterlik inancına da sahiptirler. Sosyo-bilişsel kurama göre öğretmenlerin hem kendileri hem de kurumları ile ilgili yeterlik algıları (okul kolektif yeterliği) öğretmenlerin eylemlerini etkilemektedir. Öğretmen öz yeterliği ve kolektif yeterliği birbirinden farklıdır; öz yeterlik bireysel bir yeterlik inanışını ifade ederken kolektif yeterlik okulla ilişkilidir ve okulun bir özelliğidir (Tschannen-Moran & Barr, 2004). Araştırmalar kolektif yeterliğin öğrenci akademik başarısı üzerinde olumlu etkileri olduğunu göstermektedir (Ross, Hogaboam-Gray, & Gray, 2004; Goddard, 2001). Kolektif öğretmen yeterliği öğrenci akademik başarısını öğrencinin derslerle ilgili yapması gerekenler üzerinde ısrarcı olma eğilimine yöneltecek okul ilkeleri ve yaptırımları oluşturarak dolaylı yoldan etkileyebilir (Goddard & Goddard, 2001). Ancak şu ana kadar pek az çalışma öğretmen kolektif yeterliğinin öğrenci motivasyonu ve katılımı üzerinde nasıl bir etkililiği olduğunu araştırmıştır.

Öğrencilerin akademik başarı ile ilgili hedefleri olduğu gibi öğretmenlerin de uyguladıkları eğitim ve öğretim ile ilgili hedefleri vardır (Ames, 1992; Anderman & Maehr, 1994). Alanyazında öğretmenlerin öğretim uygulamalarıyla şekillenen öğretim hedefleri öğretmenlerin ustalık hedefleri ve öğretmenlerin performans hedefleri olarak tanımlanmıştır (Ciani, Summers, &

Easter, 2008; Deemer, 2004; Ryan, Gheen, & Midgley, 1998). Öğretmenlerin öğretime ustalık yaklaşımları öğrenmeye değer verme, derste anlatılanı anlama ve öğrenme ve kişisel gelişimi ifade eder. Ayrıca öğretimleri ustalık yaklaşım hedefi olan öğretmenler öğrencilerinin üstlendikleri görevlerin zorluğuna göre değerlendirir ve notlandırma için sadece sınav sonuçlarına bakmaktansa öğrencilerin kişisel gelişimlerine odaklanırlar (Maehr & Zusho, 2009). Öte yandan, öğretmenlerin öğretime performans yaklaşımı performansa yönelik öğretim, rekabetçi sınıf ortamı ve öğrencileri birbirleriyle kıyaslamayı ifade eder. Performans odaklı öğretim yapan öğretmenlerin sınıflarında öğrenciler yetenekleriyle ve sınav puanları ile birbirleriyle kıyaslanır. Ayrıca öğrenciler birbirleriyle yarışmaya teşvik edilirler ve birbirleriyle kıyaslanarak başarının belirlendiği mormatif sınavlardaki puanları üzerinden değerlendirilir (Anderman & Patrick, 2009). Alanyazında belirtildiği üzere öğretmenlerin öğretim uygulamaları sınıftaki hedef yapısını şekillendirebilir ve bunun sonucunda başarı, motivasyon ve katılım gibi öğrenci çıktılarını etkileyebilir (Ames, 1992; Maehr & Midgley, 1991; Meece, Anderman, & Anderman, 2006).

Öğretmen motivasyonuna ek olarak, öğretmenlerin iş doyumu öğrenci çıktıları ile ilişkilisiyle önemli bir değişken olarak ortaya çıkmaktadır. İş doyumu kişinin işi hakkındaki olumlu ya da olumsuz hisleridir (Skaalvik & Skaalvik, 2010). İş doyumu öğretmenlerin öğretime karşı tutum ve uygulamaları için belirleyici bir etmendir (Caprara ve diğ., 2003). İş doyumu düşük öğretmenler öğretmenlik mesleğine düşük bir aidiyet sergilerler ve mesleği bırakma eğilimi gösterirler (Evans, 2001; Ingersoll, 2001). Öte yandan, öğretmenler iş doyumunu günlük rutin öğretme öğrenme süreci ve öğrenci ile etkileşimlerinden, günlük sınıfiçi etkinliklerden, çocuklarla bir arada olmaktan, öğrencilerin akademik ilerlemelerini izlemekten, destekleyici meslektaşlarla çalışmaktan ve genel okul ikliminden edinirler (Cockburn & Haydn, 2004). İş doyumu yüksek öğretmenler öğrenmeyi destekleyici ortamlar oluşturur ve öğrencilerini motive etmek için elinden geleni yapar (Klusman et al., 2008). Dahası, yüksek iş doyumuna sahip öğretmenler sınıftaki disiplin sorununu bastırmada, zamanı etkili kullanmada, ders işleme hızını tüm öğrencilere göre ayarlamada ve öğrencilerin daha çok öğrenebilmeleri için teşvik edici olmada düşük iş doyumu sahibi öğretmenlere göre daha başarılıdırlar (Klusmann et al., 2008).

Sonuç olarak denebilir ki öğretmen motivasyonu ve iş doyumu çeşitli öğrenci çıktıları ile alakalıdır. Ancak belirtilen pek çok ilişki kuramsaldır ve ampirik çalışmaların sayısı ve uygulanan veri analizi yöntemi son derece kısıtlıdır. Örneğin nicel çalışmalarda verinin gömülü yapısından dolayı çok düzeyli analiz (HLM) uygun istatistiksel yöntemdir. Ne yazık ki bu analiz yöntemini kullanarak veri analizi yapan çalışmalar çok azdır. Genel olarak öğretmen motivasyonu ile ilişkilendirilerek araştırılması öngörülen öğrenci çıktıları katılım, motivasyon ve başarıdır. Ayrıca bu öğrenci çıktılarının birbirleriyle olan ilişkileri de ortam ve kültürden etkilenebildiğinden farklı bağlam ve ülkelerde de incelenmesine ihtiyaç vardır (Pajares, 2006, Klassen ve diğ., 2011). Buna göre, bu çalışma hem öğrenci çıktılarının kendi aralarındaki ilişkileri hem de bu öğrenci çıktılarının öğretmen motivasyonu ve iş doyumundan nasıl etkilendiğini çok düzeyli analiz yöntemiyle incelemeyi amaçlamaktadır.

Bu çalışmanın öğrenci değişkenleri kısmını oluşturan değişkenler arasında bulunan katılım kavramı dört alt başlık altında kavramsallaştırıldıktan sonra araştırmacıların ilgisini çekmiştir. Bu dört alt boyut ajanssal katılım, davranışsal katılım, bilişsel katılım ve duyuşsal katılım olarak tanımlanmaktadır (Reeve & Tseng, 2011). Öğrenci katılımı araştırmaları görece yeni sayılabilecek bir araştırma dalı olup 1980'lerden başlayarak günümüze değin artarak süregelmiştir (Appleton, Christenson, & Furlong, 2008). Zaman içinde katılım araştırmaları eğitim araştırmacılarının da ilgisini çekmiştir çünkü öğrenci katılımı başarı ve okula aidiyet hissetme gibi okulla ilgili olumlu çıktılar üretmiştir (Fredricks, Blumenfeld, & Paris, 2004; Heddy & Sinatra, 2013; Tytler & Osborne, 2012). Öğrenci katılımı Natriello (1984) tarafından genel bir yapı olarak okul tarafından düzenlenen eğitimsel etkinliklerde bulunmak ve bu etkinliklere bizzat katılmak olarak tanımlanmıştır. Öğrenci katılımının dört alt boyutundan biri olan ajanssal katılım öğrencilerin ders esnasında kişisel tercih ve isteklerini öğretmene belirterek dersin işleyişine yön vermek ve dersin gidişatı ile ilgili yorumlarda bulunmak olarak tanımlanabilir. Ajanssal katılım etkin bir katılımla fikirlerini ve kişisel tercihlerini çekince duymadan ifade etmeyi gerektirir (Reeve, 2013; Reeve & Tseng, 2011). Davranışsal katılım öğrencinin okul içi ve dışı etkinliklerinde öz öğrenmesine ve akademik görevlere gayretle, sabırlı ve girişimci bir şekilde etkin katılımıdır. Davranışsal katılım aynı zamanda önceden belirlenmiş okul ve sınıf kurallarına uymak ve okuldan kaçmama gibi olumlu eylemleri de kapsar (Appleton ve diğ., 2008; Fredricks ve diğ., 2004; Reeve, 2013). Bilişsel katılım, öğrencilerin psikolojik olarak öğrenmeye ve öğrenme görevlerinin ötesine geçebilmek için kendilerine üst hedefler koyabilme öz düzenlemesidir (Connell & Wellborn, 1991; Fredricks ve diğ., 2004; Wehlage & Smith, 1992). Örneğin bilişsel katılım bir öğrencinin öğrenme görevini anlamaya bilişsel bir çaba göstermesi, işlem adımlarının önünde gidebilmesi ve kendisini zorlayarak öğrenmeye sevk edecek, yetenek seviyesinin hemen üzerinde etkinlikler seçmesidir (Sinatra, Heddy, & Lombardi, 2015). Son olarak duyuşsal katılım öğrencilerin okula, derslere ve öğretmenlere karşı geliştirdiği olumlu ya da olumsuz hisleri ifade etmektedir (Fredricks ve diğ., 2004). İlgi, değer verme, sıkılganlık, mutluluk, üzgünlük, kaygı, neşe, rahatlama ve aidiyet hissetme gibi duygular öğrencilerin duyuşsal katılımı olarak örnek verilebilir.

Öğrenci katılımının çeşitli boyutları alanyazında başarı ve motivasyon gibi öğrenci çıktılarıyla ilişkilendirilmiştir (Connell & Wellborn, 1991; Connell, Spencer, & Aber, 1994; Greene, Miller, & Crowson, 2004; Marks, 2000; Reeve

& Tseng, 2011). Örneğin Connell ve diğ. (1994) ve Marks (2000) duyuşsal ve davranışsal katılımın öğrencilerin akademik başarısını yordadığını belirtmişlerdir. Benzer bulgular bilişsel katılım ile öğrenci akademik başarısı ve motivasyonu için de bulunmuştur. Temel sayılabilecek bir çalışmada Pintrich ve DeGroot (1990) öğrenci öz yeterliği ve içsel değer vermenin (duyuşsal katılım olarak değerlendirilebilir) bilişsel katılım ile pozitif korelasyon verdiğini bulmuşlardır. Öğrenci katılımının en yeni boyutu olan ajanssal katılım için de araştırmacılar öğrenci başarısı ve motivasyonu ile pozitif korelasyon elde etmişlerdir (Reeve & Tseng, 2011). Belirtilen alanyazın bulguları ışığında, bu çalışmada öğrenci katılımının bütün boyutları ile öğrencilerin fen başarısı arasında pozitif ilişkiler beklenmektedir.

Öğrenci motivasyonu alanında iki ana yapı olarak öğrencilerin başarı hedefleri (Pintrich & Schunk, 2002) ve öz yeterlik inanışları (Bandura, 1997; Pajares, 2002; Pintrich & Schunk, 2002) karşımıza çıkmaktadır. Başarı hedefleri akademik görevleri tamamlamak için veya başarı durumlarına katılabilmek için öğrencilerin sahip olduğu amaçlar olarak tanımlanmaktadır Ames, 1992; Elliot, 1999; Pintrich, 2000; Pintrich & Schunk, 2002). Başarı hedefleri ilk ortaya atıldığında ustalık ve performans olarak iki ana kol şeklinde tanımlanmıştır (Ames, 1992). Ustalık hedefleri öğrenme, derinlemesine anlama, entelektüel anlamda kişinin kendisini geliştirmesini içerirken performans hedefleri başkalarını geçme, en yüksek notu almak için mücadele etme ve başkalarına başarılı olduğunu gösterme çabası içinde olma şeklinde tanımlanmaktadır (Ames, 1992; Meece ve diğ., 2006; Pintrich & Schunk, 2002; Schunk, Meece, & Pintrich, 2012). Daha sonraları, Elliot (1999) bu iki ana kol hedef yönelimini yaklaşma ve kaçınma şeklinde ikiye bölmeyi önermiştir. Böylelikle ikiye iki hedef yönelimleri kuramsal çerçevesi ortaya çıkmıştır. Her iki kol ikiye ayrılarak ustalık yaklaşma-kaçınma ve performans yaklaşma-kaçınma biçiminde sınıflanmıştır. Buradan hareketle ustalık yaklaşım hedefi anlama, öğrenme, uzmanlaşma ifade etmektedir. Ustalık kaçınma ise öğrenememekten kaçınmayı ifade etmektedir. Öte yandan performans yaklaşma en yüksek notu alma ve yaptıklarını başkalarına sergilemeyi ifade ederken performans kaçınma yeteneksiz görünmekten kaçınma ve başkalarının gözünde küçük düşmeyecek kadarını yaparak durumdan kurtulmak olarak tanımlanabilir. İkiye iki şeklinde tanımlanan bu başarı hedef yönelimi kuramı eğitim psikolojisi araştırmacıları tarafından öğrenci çıktıları ile ilişkilendirilerek pek çok çalışmaya araştırma konusu olmuştur. Örneğin akademik başarı (Chen & Wong, 2014; Taş, 2008; Yerdelen, 2013; Bezci, 2016), akademik öz yeterlik ve biliş üstü strateji kullanımı ve çaba düzenlemesi gibi öz düzenleme becerileri (Anderman & Midgley, 1997; Pajares, Britner, & Valiente, 2000; Kahraman, 2011; Kiran & Sungur, 2012) ve öğrenci katılımının değişik boyutları (ajanssal, davranışsal, bilişsel ve duyuşsal) Anderman & Young, 1994; Dweck & Legett, 1988; Midgley & Urdan, 1995; Hıdıroğlu, 2014) öğrencilerin başarı hedefleri ile ilişkilendirilerek araştırılmıştır. Çalışmalardan elde edilen genel bir eğilim olarak ustalık yaklaşım hedefleri adapte edici öğrenci çıktıları ile pozitif bir ilişki verirken performans yaklaşım hedefleri karışık sonuçlar vermiştir. Kaçınma eğilimi için uluslararası alanyazın negatif ilişki ya da ilişkisizlik bulguları sunarken ulusal alanyazında adapte edici davranışlar ve akademik başarı ile pozitif ilişkiler sunmaktadır (Anderman & Young, 1994; Kahraman, 2011; Kıran, 2010; Midgley & Urdan, 1995). Bu koşullar altında bu çalışmada öğrencilerin başarı hedef yönelimlerinin ulusal alanyazına uygun sonuçlar üreteceği beklenmektedir. Daha özel değinmek gerekirse ustalık yaklaşma kaçınma ve performans aklaşma-kaçınma boyutlarının öğrencilerin öz yeterliği ve katılım boyutları ile pozitif ilişkiler vermesi beklenmektedir. Ustalık yaklaşım hedeflerinin öğrencilerin fen başarısı ile pozitif ilişkiler vermesi beklenirken performans yaklaşım-kaçınma ve ustalık kaçınma hedeflerinin öğrenci fen başarısı ile ilişkisiz olacağı ya da negatif bir ilişki sunması beklenmektedir.

Sosyo-bilişsel kurama göre öz yeterlik inanışları belli davranışları sergileme kararlarında en etkin ve kapsamlı etmendir. Bu etkin ve kapsamlı inanış Bandura (1997) tarafından belirli bir sonuca ulaşmak için bir işi yaparken kişinin kendi yeteneklerine olan inancı şeklinde tanımlanmıştır. İnsanların yaptıkları tercihler, bulundukları eylemler, çaba gösterme ve sebat gösterme, öz yeterlik inanışından etkilenen en önemli insani hareketlerdir. Böylesine etkin bir inanışın sosyo-bilişsel kuramın merkezinde bulunmasının sebebi budur (Pajares, 2002). Öz yeterlik alanyazında çokça araştırılmış ve önemli yapılarla ilişkisi belgelenmiştir. Benzer şekilde öz yeterlik işletme, eğitim, spor, iş dünyası ve sağlık alanında da çalışılmış ve insanların başarılarını yordadığı bulunmuştur (Multon, Brown, & Lent, 1991; Pajares, 1996; Schunk, 1995). Eğitim ortamları ele alındığında, öz yeterliğin öğrencilerin akademik başarı, motivasyon, biliş, ve gerçek performansları ile ilişkilendirildiği görülecektir (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Pajares, 1996; Pintrich & DeGroot, 1990). Öz yeterliği yüksek öğrenciler akademik bir işi tamamlamaya eğilimliyken düşük öz yeterlik sahibi öğrenciler bundan kaçınma eğilimindedirler (Pintrich & Schunk, 2002). Dahası, araştırmalar yüksek öz yeterlikli öğrencilerin yetenek seviyelerinden biraz daha üstte olan ve kendilerini zorlayacak hedefler koyduklarını, zorlayıcı görevleri seçtiklerini, zorluklar karşısında gayret gösterdiklerini ve bıkkınlık göstermediklerini ve çeşitli stratejiler kullandıklarını göstermiştir (Bandura, 1986; Pajares, 2002; 2006). Bu sebeplerden dolayı, bu çalışmada öğrenci öz yeterliğinin öğrenci katılımı ve akademik başarı ile pozitif ilişkili olacağı öngörülmektedir. Ayrıca, yüksek öz yeterlikli öğrencilerin ustalık yaklaşım hedeflerine kaçınma ve performans hedeflerinden daha fazla yönelim gösterecekleri beklenmektedir.

İlgili alanyazında belirtildiği gibi öğrenci katılımı, akademik başarı ve motivasyon gibi öğrenci çıktıları öğretmen motivasyonu ve iş doyumu ile ilişkili olarak bulunmuştur (Anderman & Young, 1994; Goddard & Goddard, 2001; Pamuk, 2014; Urdan, 2004; Yerdelen, 2013). Öğretmen ve öğrenci öz yeterliğinin ilişkisi ile ilgili olarak alanyazın karışık sonuçlar sunmaktadır. Kurien (2011) öğretmen ve öğrenci öz yeterliği arasında herhangi bir ilişki bulamazken Stuart (2006) fen dersinde pozitif bir ilişki bulmuştur. Dahası, ulusal çapta yapılan araştırmalar öğretmen öz yeterliği ile öğrenci başarısı arasında yine karışık sonuçlar sunmuştur. Örneğin Yerdelen (2013) ve Pamuk (2014) öğrenci katılımı için öğretmen öz yeterliğini öğrenci fen başarısı ile pozitif ilişkili bulurken, öğretmenlerin öğretim stratejileri öz yeterliği öğrencilerin fen başarısı ile ilişkisiz olarak bulunmuştur. Öğrenci katılımı ile ilişkili olarak Uden, Ritz ve Pieters (2014) öğretmen öz yeterliğini öğrencilerin davranışsal, bilişsel ve duyuşsal katılımı ile anlamlı şekilde ilişkili bulmuştur. Ancak alanyazın öğreten öz yeterliği ve öğrencilerin başarı hedef yönelimlerini araştıran çalışmalar açısından kısıtlıdır. Yukarıda belirtilen alanyazın verilerine göre bu çalışmada öğretmen öz yeterliği ile öğrenci katılımı ve fen başarısı arasında anlamlı bir ilişki bulunması beklenmektedir.

Öğretmenlerin kolektif yeterlikleri ve öğrenci çıktıları arasındaki ilişki yönünden öğrenci başarısı haricinde alanyazında çok çalışmaya rastlanamamıştır. Ross, Hogaboam-Gray & Gray'e (2004) göre öğretmenlerin bireysel öz yeterlikleri gibi, kolektif yeterlik de öğrenci başarısını etkiler ve güçlü bir yordayıcısıdır. Bandura'ya (1997) göre öğretmen kolektif yeterliği bazı çalışmalarda sosyo-ekonomik durumdan daha güçlü bir yordayıcı olarak bulunmuştur. Benzer şekilde Goddard (2001) kolektif yeterliğin öğrencilerin matematik ve okuduğunu anlama başarısında okullar arası varyansın %50'ye yakınını açıkladığını bulmuştur. Alanyazın kolektif öğretmen yeterliğinin öğrenci başarısı üzerindeki etkileri ile ilgili olarak farklı sınıf seviyeleri için de benzer sonuçlar sunmaktadır (bkz. Goddard, Hoy, & Hoy, 2000; Goddard, Hoy, & LoGerfo, 2003). Goddard ve Goddard (2001) kolektif öğretmen yeterliğinin okul kuralları ve yaptırımları şeklinde öğrenciye iletilerek öğrencilerin akademik görevler üzerinde ısrarcı olmasını sağlayarak dolaylı yoldan öğrenci başarısını etkilediğini savunmaktadır. Alanyazındaki bulgular ışığında bu çalışmada öğretmenlerin kolektif yeterlikleri ile öğrenci fen başarısı arasında pozitif bir ilişki beklenmektedir. Ancak kısıtlı çalışmalar öğrenci katılımı ve motivasyonu ile kolektif öğretmen yeterliği arasındaki ilişkilerle ilgili öngörüde bulunabilmeyi zorlaştırmaktadır. Yine de, yüksek düzeyde kolektif öğretmen yeterliğinin olduğu okul ortamlarında öğrenci motivasyonu ve katılımını arttıracak öğrenme ortamlarının bulunacağı beklenmektedir.

Çalışmadaki diğer öğretmen motivasyonu değişkeni olan öğretme yaklaşımları günümüze değin öğrenci motivasyonu (Meece ve diğ., 2006, Anderman & Young, 1994; Anderman & Midgley 1997; Urdan, 2004), katılımı (Anderman & Patrick, 2009; Wolters, 2004; Midgley & Urdan, 2001; Urdan, 2004) ve başarısı (Gutman, 2006; Lau & Nie, 2008; Linnenbrink, 2005; Wolters, 2004) gibi öğrenci çıktıları ile ilişkilendirilerek araştırılmıştır. Örneğin Anderman and Young (1994) öğretmenlerin fen derslerindeki ustalık öğretim hedeflerinin öğrencilerin ustalık hedefleri benimsemesine yol açtığını belirtmişlerdir. Öğretmenlerinin sınıf içinde ustalık öğretim yaklaşımını kullandığı öğrenciler ustalık başarı hedeflerine yönelirken, öğretmenleri sınıfta performans öğretim yaklaşımını kullanan öğrenciler performans eğilimli bulunmuştur (Urdan, 2004). Bu çalışmada da sonuçların alanyazınla uyumu şekilde bulunacağı beklenmektedir. Özellikle öğretmenlerin ustalık öğretim yaklaşımlarının öğrencilerin ustalık öğrenme hedeflerini yordayacağı ve benzer şekilde öğretmenlerin performans öğretim yaklaşımının öğrencilerin performans öğrenme hedeflerini yordayacağı öngörülmektedir. Öğretmenlerin öğretim hedefleri ile öğrenci katılımı arasındaki ilişki ustalık öğretme yaklaşımı için pozitif bulunmakta iken performans öğretim hedefleri için negatif yöne olmaktadır (Urdan, 2004; Wolters, 2004, Kaplan, Gheen, & Midgley, 2002). Bu çalışmada da öğretmenlerin ustalık öğretim hedeflerinin öğrenci katılımı ile pozitif bir ilişki vereceği beklenirken performans öğretim yaklaşımının negatif bir ilişki vermesi ya da hiç ilişkili vermemesi beklenmektedir. Öte yandan öğretmenlerin öğretim yaklaşımları ile öğrenci öz yeterliği pozitif ilişkiler vermektedir (Gutman, 2006; Urdan, 2004; Wolters, 2004). Öğretmenlerin her iki öğretim yaklaşımı da öğrencilerin öz yeterlikleri ile pozitif bir ilişki içindedir. Bu sebeple, öğretmenlerin öğretim hedeflerinin öğrenci öz yeterliği ile pozitif bir ilişki içinde olması beklenebilir. Son olarak, öğrenci başarısı için öğretmenlerin öğretim hedeflerinin öğrenci başarısı ile pozitif ilişkili olduğu söylenebilir (Lau & Nie, 2008; Urdan, 2004, Wolters, 2004). Ancak performans öğretim hedefleri sadece yüksek başarılı öğrenciler için anlamlı bir yordayıcı olarak bulunmuştur (Ee, Moore, & Atputhasamy, 2001). Bundan dolayı öğrenci başarısının öğretmenlerin ustalık öğretim hedefleri ile pozitif ilişkili olması beklenmektedir. Bu çalışmada ortalama öğrenci başarısı üzerinden analizler yapılacağından performans öğretim hedefleri ile öğrenci başarısı arasında pozitif bir ilişki beklenmemektedir.

Öğretmenlerin iş doyumu ile öğrenci çıktıları arasındaki ilişkiler günümüze değin pek az araştırmanın konusu olabilmiştir (Michaelowa & Wittmann, 2008; Yerdelen, 2013). İş doyumu ile ilgili araştırmalar iş doyumunun işyerindeki performans (Ololube, 2006), okul organizasyonlarında ve öğrencilerle ilgili meselelerde fazladan sorumluluk alma (Somech & Drach-Zahavy, 2000) ve yaşam doyumu ile pozitif ilişkiler verdiğini ortaya koymuştur. Ayrıca Demirtaş'a (2010) göre öğretmenler yüksek iş doyumuna sahip olduklarında nitelikli bir öğretim sergilemeleri ve öğrencilerin akademik çıktılarını yükseltmeleri beklenmektedir. Alanyazının öğretmen iş doyumu ve öğrenci çıktıları arasındaki ilişkiler konusunda kısıtlı olmasına rağmen yukarıda bahsedilen olumlu sonuçlardan dolayı olumlu öğrenci çıktıları beklemek şaşırtıcı olmayacaktır. Bundan dolayı bu çalışmada öğretmen iş doyumu ile öğrenci çıktıları arasında pozitif ilişkiler beklenmektedir.

Öğretmen motivasyonu ve iş doyumunun öğrenci çıktılarını etkileyebileceği gibi, okul ortamında olup bitenler de öğretmenlerin iş doyumlarını ve mesleki motivasyonlarını etkileyebilmektedir. Alanyazındaki araştırmalar olumlu bir kurumsal iklimin ve meslektaşlardan, öğrenci velilerinden ve okul yönetiminden gelen sosyal desteğin öğretmenlerin motivasyonlarına ve iş doyumlarına olumlu etkiler yaptığını belirtmektedir (Day ve diğ., 2007; Scheopner, 2010; Skaalvik & Skaalvik, 2009; 2011). Okul ortamı değişkenlerinin yanı sıra okul hedef yapılarının da öğretmen motivasyonu üzerinde önemli bir rol oynadığı bilinmektedir. Sınıf hedef yapıları veya öğretmenlerin öğretim hedefleri gibi, okullar tarafından da öğretmenlere ve öğrencilere vurgulanan belli hedefler mevcuttur. Okulların da ustalık ve performans olarak iki tüp hedef yapıları mevcuttur ve bu hedefler öğretmenler tarafından algılanıp dersler ve işleniş şekilleriyle öğrencilere iletilmektedir. Maehr ve Midgley (1991) ortaokulların okul politikaları, uygulamaları ve öğretmenlerin sınıf içi uygulamaları ile belli hedefleri öğrencilerine ilettiğini belirtir. Ustalık okul hedefleri okulların, bireyin kendini geliştirmesi, öğrenme, anlama ve entelektüel gelişime değer vermesini belirtir. Performans okul hedefleri ise sosyal kıyaslamaları, rekabetçi ortamı öğrenciler arasında göreceli kıyaslama yapılmasını belirtmektedir. Genel olarak ustalık okul hedefleri daha önce belirtilen ustalık hedef yapıları gibi adaptif öğrenme çıktıları ve akademik başarı ile ilişkilendirilmektedir. Diğer performans hedef yapılarına benzer şekilde okul performans hedef yapısı da daha çok adaptif olmayan öğrenme çıktıları ve düşük başarı ile ilişkilendirilmektedir. Öğretmen motivasyonu ile ilgili olarak okul hedeflerinin ilişkisini inceleyen çalışma sayısı alanyazında sınırlı sayıda yer almaktadır. Bu sebeple, öğretmenlerin öğretim hedefleri ile ilgili daha önceleri gerçekleştirilen çalışmalar temel alınarak okul ustalık hedeflerinin öğretmenlerin ustalık öğretim hedefleri, öz yeterlikleri ve kolektif yeterlikleriyle pozitif ilişkili olacağı öngörülmektedir. Benzer şekilde okul performans hedeflerinin de öğretmenlerin performans öğretim hedefleriyle pozitif bir ilişki içinde olacağı düşünülmektedir. Bu çalışmada sınıf içi disiplin sorunları, öğretmenlere okul yönetimi desteği, meslektaşlarla ilişkiler, velilerle ilişkiler ve okul hedef yapıları okul çevresi değişkenleri olarak ele alınarak öğretmen motivasyonu ve iş doyumu ile ilişkilendirilerek araştırılmaktadır.

Buna göre, bu çalışmada sınıf içi disiplin sorunu hariç bütün okul ortamı değişkenlerinin öğretmen motivasyonu ve iş doyumu ile pozitif ilişkili olacağı öngörülmektedir. Sınıf içi disiplin problemleri yapı olarak olumsuz bir karakterde olduğundan her öğretmen motivasyonu değişkeni ve iş doyumu için sabit olumsuz ilişki beklenmektedir.

Bu çalışmanın ana amacı öğretmen motivasyonu, öğretmen iş doyumu ve öğrenci motivasyonu, katılımı ve fen başarısı arasındaki ilişkileri incelemektir. Özel olarak bakıldığında bu çalışmada öğretmen motivasyonu olarak öğretmen öz yeterliği, kolektif yeterliği ve öğretim hedefleri incelenmektedir. Öğrenci motivasyonu olarak ise fen dersinde öğrenci öz yeterliği ve başarı hedef yönelimleri (ustalık yaklaşma-kaçınma ve performans yaklaşma-kaçınma) incelenmektedir. Öğrencilerin katılımı dört alt boyut ile incelenmektedir. Bunlar ajanssal katılım, davranışsal katılım, bilişsel katılım ve duyuşsal katılımdır. Ayrıca öğrencilerin fen başarısı öretmen motivasyonu ve iş doyumu ile birlikte öğrenci motivasyonu ve katılımı ile ilişkilendirilerek incelenmiştir. Dahası, öğretmen motivasyonu ve iş doyumu, öğrenci başarısının yanı sıra öğrenci motivasyonu ve katılımı ile de ilişkilendirilmektedir. Bütün bunlara ek olarak, öğrencilerin motivasyon değişkenleri hem kendi aralarında hem de katılım alt boyutlarıyla ilişkilendirilmiştir. Çalışma verisi hem öğrenci hem de öğretmen verilerini kapsadığından bu çalışmada öğrenci değişkenlerini yordayan öğretmen değişkenlerini belirleyebilmek için iki düzeyli Hiyerarşik Doğrusal Modelleme (HLM) kullanılmıştır. HLM analizinde ayrıca öğretmen ve öğrenci değişkenleri arasındaki etkileşimler de incelenmiştir.

Bu çalışmada öğretmen öğrenci ilişkilerinin incelenmesinin yanında öğretmen motivasyon ve iş doyumu değişkenlerinin okul çevresi değişkenleri ile de ilişkisi incelenmiştir. Okul çevresi değişkenleri öğretmenlerin algıladıkları okul ortamı değişkenleri ve okul hedef yönelimi değişkenlerinden oluşmaktadır. Okul ortamı değişkenleri sınıf içi disiplin sorunları, meslektaşlarla ilişkiler, okul yönetimi desteği ve öğretmen veli ilişkilerini içerirken okul hedef yapısı değişkenleri okul ustalık hedef yaklaşımı ve okul performans hedef yaklaşımıdır. Bu değişkenler arasındaki ilişkileri incelemek için bir yol analizi modeli geliştirilmiştir. Bu çalışma fen bilimleri dersi üzerine olduğundan çalışma boyunca bahsedilen öğretmenler fen bilimleri öğretmenleri, öğrenci motivasyonu ve katılımı fen derslerinde olan motivasyon ve katılım, başarı ise 7. Sınıf öğrencilerinin fen başarısıdır. Böylelikle bu çalışmanın örneklemini 7. sınıf ortaokul öğrencileri ve bu öğrencilerin fen bilimleri öğretmenleri oluşturmaktadır.

Bu çalışma, fen eğitiminin nihai amacının fen bilimlerine karşı pozitif motivasyonu olan, fen etkinliklerine davranışsal, bilişsel ve duyuşsal olarak katılan, bilimsel bilgileri, fikirleri ve açıklamaları derinlemesine kavrayabilen bilim okuryazarı bireyler yetiştirmek olmasından dolayı fen bilimleri alanında gerçekleştirilmiştir. Dahası, bilim, teknoloji, mühendislik ve matematik alanındaki işgücünü destekleyebilmek için öğrencilerin bu alanlara yöneltilebilmesi önemlidir. Ancak Türkiye için ulusal ve uluslararası sınavlar fen bilimleri alanında iyimser bir tablo çizememektedir. Örneğin PISA ve TIMMS sınavlarında Türk öğrencilerin başarısı ortalamanın çok altında kalmaktadır. Yine ulusal düzeyde yapılan TEOG sınavında fen bilimleri dersi matematikten sonra en çok zorlanılan ders olup başarı yüzdesi % 50'lerde kalmaktadır. Dolayısıyla yukarıda sayılan gereksinimiler ve Türk öğrencilerin ulusla ve uluslararası sınavlardaki başarı durumları göz önüne alındığında başarı ile ilişkili kavramların araştırılması önem kazanmaktadır. Bu çalışmada öğrencilerin fen dersindeki başarı, motivasyon ve katılım gibi özellikleri hem öğrenci değişkenleriyle hem de öğretmen motivasyonu ve iş doyumu ile ilişkilendirilerek araştırılmaktadır. Ayrıca bu çalışmada iki düzeyli veri toplanmış ve bu veri HLM analizi ile analiz edilmektedir. HLM analizi ülkemizde yeni kullanılmaya başlanmış bir analiz türü olup iki düzeyli veriyi aynı anda analiz edebilmesi ile öne çıkmakta ve bu özelliğiyle hata oranını azaltmaktadır.

Bu çalışmanın bir başka önemli katkısı da öğretmenlerin öğretim hedeflerini öğretmenlerin perspektifinden ölçmesidir. Önceki çalışmalarda bu durum sınıf hedef yapısı olarak değerlendirilmiş ve öğrencilerden öğretmenlerinin sınıfta yarattığı hedef ortamını değerlendirmeleri istenmiştir. Ancak bu çalışmada öğretmenlerden bu konuda görüş istenmiş ve öğretmenlerin kendi öğretim hedeflerini belirtmeleri istenmiştir. Araştırmacılar bu hedef yapılarının kavramsal olarak öğretmen, öğrenci ve sınıf hedef yapıları şeklinde ifade edilmesinde dolayı kavramsal bir karmaşanın olduğundan yakınmaktadırlar. Ancak bu çalışmada bu durum net bir şekilde ortaya konarak öğretim hedefleri öğretmen bakış açısından ölçüldüğünden alanyazına önemli bir katkı yapacağı düşünülmektedir.

Bu çalışmanın bir önemli noktası da okul ortamı değişkenlerinin öğrenci motivasyonu ve iş doyumu ile ilişkilendirilmiş olmasıdır. Bu alanda yapılan çalışmalar özellikle ülkemizde çok sınırlı sayıdadır. Mevcut çalışmalar okul müdürleri ve öğretmenlerle çalışmış ve bu grupların kolektif yeterlik ve öğretmen öz yeterliğine katkılarını incelemişlerdir. Ancak bu çalışmada öğretmen motivasyonu ve iş doyumu okul ortamı ve okul hedef yapısı ile ilişkilendirilerek daha geniş bir çerçevede bu ilişkileri incelemektedir. Tek bir yol analizi modeli kullanarak bu ilişkilerin inceleniyor olması da veri analizi açısından önemlidir. Öğretmen öz yeterliğinin yanı sıra öğretmenlerin kolektif yeterlik inanışları da bu çalışmada araştırılmakta olup bu değişkenin öğrenci çıktıları ile nasıl bir ilişkisi olduğu da çalışmaya değer katan bir başka boyuttur. Son olarak denebilir ki bu çalışmanın bulguları eğitim politikaları geliştirenlere, okul idarecilerine, hizmet öncesi öğretmen eğitimi kurumlarına ve hizmet içi fen bilimleri öğretmenlerine yol gösterebilir. Öğrenci motivasyonu ve katılımını öğretmen değişkenleri ve öğrencilerin kendi değişkenleri ile ilişkilendirerek incelemesinden dolayı bu çalışma müfredat geliştirme ve ders kitabı yazımında da yazarlara yardımcı olabilecektir.

Bu amaçlar doğrultusunda bu çalışmaya yön veren beş temel soru oluşturulmuştur:

1. Öğretmen düzeyi değişkenleri (*Ustalık Öğretim Hedefi, Performans Öğretim Hedefi, Öğrenci Katılımını Sağlama Öz-Yeterliği, Öğretim Stratejileri Kullanma Öz-Yeterliği, Sınıf Yönetimi Öz-Yeterliği, Grup Yeteneği, Görev Analizi ve İş Doyumu*) ve öğrenci motivasyonu (*Öz-Yeterlik, Ustalık Yaklaşma Hedefleri, Ustalık Kaçınma Hedefleri, Performans Yaklaşma Hedefleri ve Performans Kaçınma Hedefleri*) öğrenci katılımını (*Ajanssal Katılım, Davranışsal Katılım, Bilişsel Katılım ve Duyuşsal Katılım*) ne ölçüde yordamaktadır?
2. Öğretmen düzeyi değişkenleri (*Ustalık Öğretim Hedefi, Performans Öğretim Hedefi, Öğrenci Katılımını Sağlama Öz-Yeterliği, Öğretim Stratejileri Kullanma Öz-Yeterliği, Sınıf Yönetimi Öz-Yeterliği, Grup Yeteneği, Görev Analizi ve İş Doyumu*) ve öğrenci Öz Yeterliği, öğrenci başarı hedeflerini (*Ustalık Yaklaşma Hedefleri, Ustalık Kaçınma Hedefleri, Performans Yaklaşma Hedefleri Ve Performans Kaçınma Hedefleri*) ne ölçüde yordamaktadır?
3. Öğretmen düzeyi değişkenleri (*Ustalık Öğretim Hedefi, Performans Öğretim Hedefi, Öğrenci Katılımını Sağlama Öz-Yeterliği, Öğretim Stratejileri Kullanma Öz-Yeterliği, Sınıf Yönetimi Öz-Yeterliği, Grup Yeteneği, Görev Analizi Ve İş Doyumu*) ve öğrenci Öz Yeterliğini ne ölçüde yordamaktadır?
4. Öğretmen düzeyi değişkenleri (*Ustalık Öğretim Hedefi, Performans Öğretim Hedefi, Öğrenci Katılımını Sağlama Öz-Yeterliği, Öğretim Stratejileri Kullanma Öz-Yeterliği, Sınıf Yönetimi Öz-Yeterliği, Grup Yeteneği, Görev Analizi Ve İş Doyumu*), öğrenci motivasyonu (*Öz-Yeterlik, Ustalık Yaklaşma Hedefleri, Ustalık Kaçınma Hedefleri,*

Performans Yaklaşma Hedefleri Ve Performans Kaçınma Hedefleri) ve katılımı (*Ajanssal Katılım, Davranışsal Katılım, Bilişsel Katılım ve Duyuşsal Katılım*) öğrenci fen başarısını ne ölçüde yordamaktadır?

5. Öğretmenlerin okul çevresi değişkenleri algısı (*Okul Ustalık Hedefleri, Okul Performans Hedefleri, Velilerle İlişkiler, Meslektaşlarla İlişkiler, Okul Yönetimi Desteği ve Sınıf İçi Disiplin Sorunları*) ile öğretmen motivasyonu (*Ustalık Öğretim Hedefi, Performans Öğretim Hedefi, Öğrenci Katılımını Sağlama Öz-Yeterliği, Öğretim Stratejileri Kullanma Öz-Yeterliği, Sınıf Yönetimi Öz-Yeterliği, Grup Yeteneği, Görev Analizi*) ve iş doyumu arasındaki ilişkiler nelerdir?

Yöntem

Bu çalışmada Ankara ilinin iki ilçesi olan Yenimahalle ve Sincan'dan rasgele seçilmiş toplam 60 ortaokulda okuyan 7. Sınıf öğrencileri ve bu öğrencilerin fen bilimleri derslerini veren öğretmenlerden toplanan veriler kullanılmıştır. Verilerin toplanması için bir dizi öğretmen ve öğrenciler için ayrı ayrı ölçekler kullanılmış ve bu ölçeklerden elde edilen veriler yuvalanmış bir yapıda olduğundan çok düzeyli analiz yöntemi (HLM) ile analiz edilmiştir. Ayrıca, öğretmen okul çevresi algısı, motivasyon ve iş doyumu değişkenleri arasındaki ilişkileri araştırmak için yol analizi kullanılmıştır. Çalışmanın deseni tarama modeli olarak adlandırılabilir.

Evren ve Örneklem

Çalışmanın evrenini Ankara ilinde öğrenim gören 7. Sınıf öğrencileri ve bu öğrencilerin fen bilimleri öğretmenleri oluşturmaktadır. Bu çalışmaya 3394 7. Sınıf öğrencisi ve bu öğrencilerin fen bilimleri derslerini veren 134 öğretmen oluşturmuştur.

Veri Toplama Araçları

Çalışmada kullanılan veri toplama araçları iki kısımdan oluşmakta olup aşağıdaki tabloda gösterilmektedir. İlk tablo öğretmen veri toplama araçlarını tanıtırken ikinci tablo öğrenci ölçeklerini tanıtmaktadır.

Tablo 1 Öğretmen veri toplama araçları

Veri toplama aracı	Değişkenler
Demografik Bilgi Ölçeği	Cinsiyet Yaş Mezun olunan okul türü Mezun olunan bölüm Eğitim düzeyi Mesleki deneyim Haftalık ders saati Sınıf mevcudu Evlilik durumu Çocuk sayısı
Öğretmenler için Öz-Yeterlik Ölçeği *Geliştiren: Tschannen-Moran & Woolfolk-Hoy (2001)* *Türkçe'ye Adaptasyon: Çapa, Çakıroğlu, & Sarıkaya*	Sınıf Yönetimi Öğrenci Entegrasyonu Öğretim Stratejileri
Öğretmenlerin Öğretim Yaklaşımları Ölçeği *Geliştiren: Midgley ve diğ., 2000* *Türkçe'ye Adaptasyon: Araştırmacı tarafından yapılmıştır.*	Ustalık Öğretim Yaklaşımı Performans Öğretim Yaklaşımı
Öğretmen Kolektif Yeterlik Ölçeği *Geliştiren: Goddard, Hoy, ve Woolfolk Hoy (2000)* *Türkçe'ye Adaptasyon: Araştırmacı tarafından yapılmıştır.*	Grup Yeteneği Görev Analizi
Öğretmen İş doyumu Ölçeği *Geliştiren: Skaalvik and Skaalvik (2011)* *Türkçe'ye Adaptasyon: Araştırmacı tarafından yapılmıştır.*	İş Doyumu
Algılanan Okul Ortamı Ölçeği *Geliştiren: Skaalvik and Skaalvik (2010; 2011)* *Türkçe'ye Adaptasyon: Araştırmacı tarafından yapılmıştır.*	Zaman Baskısı Özerklik Disiplinsorunları Okul Yönetimi Desteği Velilerle İlişkiler Meslektaşlarla İlişkiler

Tablo 2 Öğretmen veri toplama araçları (Devamı)

Okul Hedef Yönelimi Ölçeği *Geliştiren: Midgley ve diğ., 2000* *Türkçe'ye Adaptasyon: Araştırmacı tarafından yapılmıştır.*	Okul Ustalık Hedefleri Okul Performans Hedefleri

Tablo 2 Öğrenci veri toplama araçları

Veri toplama aracı	Değişkenler
Demografik Bilgi Ölçeği	Cinsiyet Yaş Kardeş Sayısı Sosyo ekonomik durum
Öğrenci Katılım Ölçeği *Geliştiren: Reeve & Tseng (2011)* *Türkçe'ye Adaptasyon: Hıdıroğlu (2014)*	Ajanssal Katılım Davranışsal Katılım Bilişsel Katılım Duyuşsal Katılım
Hedef Yönelimleri Ölçeği *Geliştiren: Elliot & McGregor (2001)* *Türkçe'ye Adaptasyon: Senler & Sungur (2007)*	Öğrenme Yaklaşma Performans Yaklaşma Öğrenme Kaçınma Performans Kaçınma
Öğrenmede Güdüsel Stratejiler Ölçeği (MSLQ) *Geliştiren: Pintrich, Garcia, & McKeachie (1993)* *Türkçe'ye Adaptasyon: Sungur (2004)*	Öz Yeterlik
Fen Başarı Testi *Geliştiren: Yerdelen (2013)*	14 çoktan seçmeli fen bilimleri sorusu

Çalışmanın Sayıltıları

1. Tüm katılımcılar ölçekleri ciddiyet ve içtenlikle cevaplamışlardır.
2. Ölçeklerin uygulanması tüm katılımcılar için standart bir ortamda gerçekleşmiştir.
3. Veri toplama esnasında öğretmenler ve öğrenciler birbirleriyle etkileşim halinde bulunmamışlardır.

Bulgular ve Tartışma

Bu çalışmada elde edilen verilerin yuvalanmış yapıda olmasından dolayı çok düzeyli analiz (HLM) ile analiz edilmiştir. Ayrıca sadece öğretmenlerden toplanan verilerin analizi için de bir yol analizi modeli kullanılmıştır. Çok düzeyli verilerin analizinde HLM yöntemini kullanmak hata payını azaltacağından önemlidir çünkü çok düzeyli veriler ayrı düzeyler şeklinde incelendiğinde ciddi hata artışları görülmektedir. Bu çalışmada öğrenciler sınıflar içinde yuvalanmış olarak bulunduğundan her sınıf için de bir öğretmen atanarak ikinci düzey veri seti oluşturulmuştur. Bu yöntemle aynı sınıftaki öğrencilerin birbirine benzer sonuçlar üretebileceği göz önünde tutulmuş olmakta ve daha doğru sonuçlar elde edilebilmektedir. Ayrıca, çok düzeyli analizlerin bir başka güçlü yanı da öğretmen ve öğrenci değişkenleri arasındaki etkileşimi de analizde gösterebilmesidir.

Bu çalışmanın beş temel araştırma sorusu bulunmaktadır ve bulgular sırasıyla tartışılmıştır. Araştırmanın ilk 4 sorusu ve bu soruların alt soruları çok düzeyli analiz yöntemiyle analiz edilmiştir. Bu verilerdeki değerler regrasyon katsayılarının yorumlanma kolaylığından dolayı ve karşılaştırma yapılabilmesinden dolayı bütün sürekli değişkenlerin ortalamaları 0, standart sapmaları 1 olacak şekilde standart skorlara dönüştürülmüştür. Son soru olan 5. Soru ise sadece öğretmen seviyesi değişkenlerini içerdiğinden yol analizi yöntemiyle analiz edilmiştir.

Araştırma sorusu 1: Öğrenci Katılımını Yordama

Çalışmanın ilk sorusu ve alt soruları öğrenci katılımının boyutlarının sınıflar arasında farklılık gösterip göstermediğini, eğer gösteriyorsa bu farklılığın öğretmen ve öğrenci düzeyi değişkenlerinin hangileri tarafından yordandığını ve öğrenci katılımını yordarken öğretmen ve öğrenci değişkenleri arasında herhangi bir etkileşim olup olmadığını araştırmaktadır. Yapılan ilk çok düzeyli analiz boş model olarak adlandırılmaktadır ve yordanan değişkenin sınıflar arası farklılık gösterip göstermediğini incelemektedir. Bu analiz sonucuna göre tüm katılım alt boyutları (ajanssal, davranışsal, bilişsel ve duyuşsal) sınıflar arasında anlamlı farklılıklar göstermektedir. Dolayısıyla ileri çok düzeyli analizler yapılabilmektedir. Ajanssal katılım için ileri çok düzeyli analizler yapıldığında HLM analizi sonuçlarına göre öğretmen düzeyi değişkenlerinin hiçbiri ajanssal katılımı yordamazken öğrenci seviyesi yordayıcılardan öğrenci öz yeterliği, ustalık yaklaşma hedef yönelimleri, ustalık kaçınma hedef yönelimleri ve performans yaklaşma hedef yönelimleri öğrencilerin fen derslerindeki ajanssal katılımını pozitif olarak yordamıştır. Öğrencilerin davranışsal katılımları ile ilgili olarak, ajanssal katılıma benzer şekilde çalışmaya dâhil edilen öğretmen değişkenlerinden hiçbiri öğrencilerin davranışsal katılımını yordamazken öğrenci değişkenlerinden öz yeterlik, ustalık hedef yaklaşımı, ustalık hedef kaçınma ve performans hedef yaklaşımı anlamlı ve pozitif biçimde davranışsal katılımı yordamıştır. Öğrencilerin bilişsel katılımını yordayan model bulgularına göre, öğretmenlerin öğrenci katılımı öz yeterliği negatif biçimde öğrenci bilişsel katılımını yordamıştır. Bu bulgu beklentinin aksine şaşırtıcı bir sonuç olarak karşımıza çıkmaktadır. Diğer öğretmen değişkenleri ise öğrencilerin bilişsel katılımını anlamlı şekilde yordamamıştır. Öğrencilerin bilişsel katılımını öğrenci seviyesinde yordayan değişkenler ise öğrenci öz yeterliği, ustalık hedef yaklaşımı, ustalık hedef kaçınma ve performans kaçınma hedefleridir. Sayılan bütün bu öğrenci yordayıcıları bilişsel katılımı pozitif olarak yordamaktadır. Son olarak öğrencilerin duyuşsal katılımının öğretmen ve öğrenci seviyesindeki yordayıcılarını inceleyen HLM modelinin bulgularına göre öğretmenlerin ustalık öğretim hedefleri öğrencilerin duyuşsal katılımını pozitif olarak yordamaktadır. Ancak öğretmen öz yeterliği alt boyutlarından öğrenci katılımı için öğretmen öz yeterliği, beklenenin aksine, öğrencilerin duyuşsal katılımını olumsuz şekilde yordamıştır. Fen bilimleri dersine duyuşsal katılımın öğrenci seviyesi yordayıcıları olarak öğrenci öz yeterliği, ustalık yaklaşım hedef yönelimleri, ustalık kaçınma hedef yönelimleri ve performans yaklaşma hedef yönelimleri pozitif yordayıcılar olarak bulunmuştur.

Araştırma sorusu 2: Öğrencilerin Başarı Hedeflerini Yordama

Çalışmanın ikinci sorusu ve alt soruları öğrencilerin başarı hedeflerinin sınıflar arasında farklılık gösterip göstermediğini ve eğer farklılık gösteriyorsa bu farklılığı hem öğretmen hem de öğrenci değişkenleriyle yordamayı amaçlamaktadır. Ayrıca bu iki tip yordayıcı arasındaki etkileşimler de çok düzeyli analiz (HLM) tarafından hesaplanmaktadır. Öğrencilerin başarı hedef yönelimleri dört alt boyuttan oluşmaktadır: ustalık yaklaşma, ustalık kaçınma, performans yaklaşma ve performans kaçınma. Her bir alt boyutun yordayıcıları detaylı olarak incelenmiştir. Öncelikle her bir başarı hedefi alt boyutunun sınıflar arasında farklılık gösterip göstermediği incelenmiştir. Çok düzeyli analizin boş modeli olarak bilinen modelde hiçbir yordayıcı bulunmayıp sadece sınıflar arası farklılık olup olmadığını belirten bir katsayı sunmaktadır. Bu başlangıç analizine göre öğrencilerin hedef yönelimlerinin tüm boyutları az da olsa sınıflar arasında farklılık göstermekte olup bu sonuç ileri seviye çok düzeyli analize devam edebilmeye imkân tanımaktadır. İleri çok düzeyli analiz sonuçlarına göre, tek öğrenci seviyesi yordayıcı olan öğrenci öz yeterliği öğrencilerin fen bilimleri derslerindeki hedef yönelimlerinin tüm alt boyutlarını (ustalık yaklaşma-kaçınma ve performans yaklaşma-kaçınma) anlamlı ve pozitif olarak yordamaktadır. Bu ilişkiler içinde en güçlüsü öğrenci öz yeterliği ile ustalık yaklaşım hedef yönelimi arasında bulunurken en zayıf pozitif ilişki öz yeterlik ustalık kaçınma arasında bulunmuştur. Öğrencilerin hedef yönelimlerini yordayan öğretmen seviyesi değişkenleri incelendiğinde öğretmenlerin sınıf yönetimi öz yeterliği öğrencilerin ustalık yaklaşım hedef yönelimlerini anlamlı ve pozitif olarak yordamaktadır. Ustalık kaçınma hedef yönelimleri için çok düzeyli analiz sonuçlarına göre öğretmenlerin iş doyumları ile ustalık kaçınma hedef yönelimleri arasında negatif bir ilişki bulunmuştur. Performans yaklaşma hedef yönelimi için hiçbir öğretmen değişkeni yordayıcı olarak bulunmazken öğretmenlerin iş doyumu öğrenci öz yeterliği ve performans yaklaşımı arasındaki ilişkide aracı değişken olarak bulunmuştur. Ancak bu iş doyumu bu ilişkiyi negatif olarak yordamıştır. Performans kaçınma hedef yönelimi için öğretmenlerin kolektif yeterlik alt boyutlarından görev analizi öğrencilerin performans kaçınma hedefleri ile negatif ilişkili bulunmuştur. Buna ek olarak, öğretmenlerin öğretim stratejileri öz yeterliği öğrencilerin öz yeterliği ile performans kaçınma arasındaki ilişkide negatif ilişkili bir aracı değişken olarak bulunmuştur.

Araştırma sorusu 3: Öğrenci Öz Yeterliğini Yordama

Çalışmanın üçüncü araştırma sorusu ve alt sorusu öğrencilerin fen bilimleri derslerindeki öz yeterlik düzeylerinin sınıflar arasında anlamlı olarak farklılık gösterip göstermediğini, eğer gösteriyorsa bu farklılığı açıklayan öğretmen seviyesi değişkenleri belirlemeyi amaçlamaktadır. Öncelikle diğer sorularda yapıldığı gibi çok düzeyli analizin boş modeli denenmiş ve öz yeterliğin anlamlı şekilde sınıflar arasında farklılık gösterdiği saptanmıştır. İleri seviye çok düzeyli analizler sonucunda da öz yeterlik için öğretmen yordayıcıları saptanmaya çalışılmıştır. Bu analizler sonucunda da, öğrencilerin fen bilimleri derslerindeki öz yeterliklerini fen bilimleri öğretmenlerinin ustalık öğretim hedefleri anlamlı ve pozitif şekilde yordadığı tespit edilmiştir. Bu sonuç beklenen bir sonuçtur ve alanyazındaki diğer çalışmalarla da örtüşmektedir. Bu bulgudan başka öğretmenlerin öz yeterlik alt boyutlarından öğretim stratejileri öz yeterliği öğrencilerin fen bilimleri derslerindeki öz yeterliğini anlamlı ve negatif olarak yordamıştır. Bu sonuç beklenenin aksine olumsuz bir sonuç olarak karşımıza çıkmaktadır. Bu duruma sebep olarak Türkiye'de öğretmenlerin genellikle öğretmen merkezli bir öğretim yapıyor olmaları gösterilebilir.

Araştırma sorusu 4: Öğrenci Fen Başarısını Yordama

Bu çalışmanın dördüncü sorusu ve alt boyutları çok düzeyli analiz (HLM) kullanılan son sorudur. Bu soru çerçevesinde öğrencilerin fen başarılarının sınıflara göre farklılık gösterip göstermedikleri, eğer gösteriyorsa öğrencilerin fen başarılarını hangi öğretmen ve öğrenci değişkenlerinin yordadığını ve bu yordayıcı değişkenler arasında bir etkileşim olup olmadığı incelenmektedir. Tıpkı diğer çok düzeyli analiz kullanılan sorularda olduğu gibi ilk önce boş model test edilmiş ve bu analiz sonucunda öğrencilerin fen başarılarının sınıflar arasında anlamlı şekilde değiştiği sonucuna ulaşılmıştır. Böylelikle ileri seviye çok düzeyli analiz basamaklarına geçiş mümkün olmuştur. Öncelikle öğrenci fen başarısını yordayan öğretmen değişkenleri incelenmiş ve bunun sonucunda öğretmenlerin ustalık öğretim yaklaşımlarının öğrencilerin fen başarısını anlamlı ve pozitif şekilde yordadığı sonucunda varılmıştır. Bu anlamlı ve pozitif ilişki gösteriyor ki, öğrenmeye, anlamaya ve kendini geliştirmeye yönelik bir öğretim yapan öğretmenlerin sınıflarındaki 7. sınıf öğrencilerinin fen başarıları daha yüksek olmaktadır. Beklenenin aksine öğretmenlerin kolektif yeterlikleri ve iş doyumları öğrencilerin fen başarıları ile anlamlı bir ilişki sunmamıştır. Bunun olası bir sebebi olarak farklı seviyelerdeki öğrenci başarısı ile bu değişkenlerin ilişkili olabileceği düşünülmektedir. Bu çalışmada öğrenci başarısı değişik kategorilerde ele alınmadığından böyle bir sonuç bulunmuş olabilir. Ayrıca öğretmen değişkenlerinden hiçbiri yordayıcı öğrenci değişkenleri ile öğrenci başarısı arasındaki ilişkilerde aracı değişken rolünde bulunmamıştır.

Öğrenci fen başarısını yordayan öğrenci motivasyon ve katılım değişkenlerinin incelendiği modelin sonuçlarına göre 7. Sınıf öğrencilerinin fen bilimleri dersindeki başarılarını yordayan değişkenler öz yeterlik, davranışsal ve bilişsel katılım, ustalık yaklaşım hedefleri, ustalık kaçınma hedefleri, performans kaçınma hedefleri olarak bulunmuştur. Bu yordayıcılardan öz yeterlik, davranışsal katılım ve ustalık yaklaşım hedefleri öğrenci fen başarısı ile pozitif ilişkili iken ustalık kaçınma hedefleri ve performans kaçınma hedefleri negatif ilişkili bulunmuştur. Bu yordayıcılar öğrenci fen başarısında % 11,4'lük bir varyansı açıklamaktadırlar. Beklendiği üzere öğrenci öz yeterliği öğrenci fen başarısını alanyazınla uyumlu olarak anlamlı şekilde pozitif olarak yordamıştır. Benzer şekilde davranışsal katılım ve ustalık yaklaşım hedef yönelimleri de öğrenci fen başarısı anlamlı şekilde pozitif olarak yordamıştır. Bu sonuçlar da alanyazınla örtüşmektedir. Ancak alanyazına aykırı sayılabilecek bir sonuç olarak bilişsel katılım ile fen başarısındaki negatif ilişki verilebilir. Bu durum Türkiye bağlamına özgü bir sonuç olabilir. Çünkü başarılı öğrenciler ders çalışırken ve ders dinlerken pek çok stratejiyi aynı anda kullanabilirken bu durum onlara sorulduğunda kullandıkları stratejilerin farkında olmayarak bu stratejileri kullanmadıkları yönünde bildirimlerde bulunabilmektedirler. Böylece bu beklenmedik ilişki ile nadir de olsa karşılaşılabilmektedir.

Araştırma sorusu 5: Okul Çevresi ve Öğretmen Motivasyonu arasındaki ilişkiler

Bu çalışmanın son araştırma sorusu olarak öğretmenlerin algıladıkları okul çevresi değişkenleri ile öğretmenlerin motivasyonu ve iş doyumları arasındaki ilişkiler incelenmiştir. Bu ilişkilerin incelenmesinde yol analizi kullanılmıştır. Gerekli sayıltıları test edilen ve herhangi bir aykırılığa rastlanmayan yol analizi bulgularına göre sonuçlar yorumlanmıştır. Bu analiz sonuçlarına göre öğretmenlerin ustalık öğretim hedefleri, okul ustalık hedefleri ve öğretmen veli ilişkileri tarafından anlamlı şekilde pozitif olarak yordanırken öğretmenlerin performans öğretim hedeflerini sadece okul performans hedefleri yordamaktadır. Fen bilimleri öğretmenlerinin kolektif yeterlik alt boyutları olan grup yeteneği ve görev analizi alt boyutları da okul çevresi ve okul hedef yapısı ile ilişkilendirilmiştir. Buna göre okul ustalık hedef yapısı öğretmenlerin grup yeteneği kolektif yeterlik inancını pozitif olarak yordarken disiplin sorunları negatif olarak yordamıştır. Görev analizi alt boyutu için ise yol analizi sonuçları hem okul ustalık hedeflerinin hem de performans hedeflerinin öğretmenlerin görev analizi öz yeterliğini anlamlı şekilde pozitif olarak yordamıştır. Grup yeteneğine benzer şekilde öğretmenlerin görev analizi boyutunu sınıf içi disiplin sorunları negatif olarak yordamıştır. Öğretmenlerin öz yeterlik boyutlarını yordayan okul çevresi değişkenleri incelendiğinde yol analizi sonuçlarının okul ustalık hedef yapısı, disiplin sorunları ve öğretmen veli ilişkilerinin önemli yordayıcıları olduğu görülmektedir. Özel olarak incelendiğinde öğretmenlerin öğrenci katılımı öz yeterliği öğretmen veli ilişkileri ve okul ustalık hedef yaklaşımları tarafından pozitif olarak yordanırken disiplin sorunları negatif olarak yordamıştır. Öğretmenlerin öğretmen stratejisi yeterliğini ise öğretmen veli ilişkileri ve okul ustalık hedef yaklaşımları pozitif olarak yordamıştır. Öğretmenlerin sınıf yönetimi öz yeterliği için okul çevresi yordayıcıları olarak öğretmen veli ilişkileri pozitif ve disiplin sorunları negatif yordayıcıları olarak karşımıza çıkmaktadır. Son olarak öğretmenlerin iş doyumları okul çevresi değişkenleri ile ilişkilendirilmiş ve çarpıcı bir sonuç olarak okul hedef yapılarının öğretmen iş doyumu ile ilişkisiz olduğu ortaya çıkmıştır. Okul ortamı değişkenlerinde ise öğretmen veli ilişkileri, okul yönetimi desteği ve meslektaşlarla ilişkiler anlamlı olarak pozitif ilişkili bulunurken sınıf içi disiplin sorunları öğretmen iş doyumu ile negatif ilişkili bulunmuştur. Okul çevresi değişkenleri ile öğretmen motivasyonu ve iş doyumu arasındaki ilişkiler genel olarak alanyazınla uyumlu olup fark edilir bir ayrılık görülmemektedir.

Sonuç

Bu çalışma sonucunda genel olarak öğretmenlerin sınıf içi uygulamalarındaki hedefleri öğrencilerin akademik fen başarışlarını etkileyebilmektedir. Ayrıca, öğrencilerin fen başarılarını etkileyen önemli öğrenci değişkenleri olarak davranışsal katılım, öz yeterlik ve ustalık hedef yaklaşım hedefleri ön plana çıkmaktadır. Ancak öğrencilerin kaçınma hedefleri ve bilişsel strateji kullanımları öğrenci fen başarısı ile negatif ilişkili bulunmuştur. Öğrencilerin katılım boyutları incelendiğinde ise öğrenci katılımının en önemli öğrenci düzeyi yordayıcısı öğrenci öz yeterliği olurken, öğretmen düzeyinde ustalık öğretim hedefleri ve öğrenci katılımı için öğretmen öz yeterliği ön plana çıkmaktadır. Öğrenci öz yeterliğini yordayan öğretmen değişkenleri olarak ustalık öğretim hedefleri ve öğretmen stratejileri öz yeterliği ön plana çıkmaktadır. Öğrencilerin başarı hedef yönelimlerinin önemli yordayıcıları olarak ise öğrenci öz yeterliği ve öğretmenlerin iş doyumları ön plana çıkmaktadır. Son olarak, öğretmenlerin motivasyon ve iş doyumu değişkenlerini yordayan okul çevresi değişkenleri olarak öğretmen veli ilişkileri, sınıf içi disiplin sorunları ve okul hedef yapıları bu çalışmada belirlenen önemli değişkenlerdir.

Doğurgalar

Bu çalışma öğretmen motivasyonu ve iş doyumunun yedinci sınıf öğrencilerinin motivasyon, katılım ve fen başarısını nasıl yordadığını ve aynı zamanda okul çevresi değişkenlerinin öğretmenlerin motivasyon ve iş doyumuyla ne derece ilişkili olduğunu araştırmıştır. Bu çalışmada ön plana çıkan en önemli sonuç öğretmenlerin sınıf içi öğretim hedeflerinin öğrenci fen başarısını yordadığıdır. Dolayısıyla, öğrenci fen başarısını yordayan öğrenci değişkenleri de göz önüne alınarak, fen bilimleri öğretmenlerine öğrencilerin davranışsal katılım göstermesi için daha fazla destek olmaları gerektiği, öz yeterliklerini yükseltmeye yönelik etkinliklerin yapılabileceği ve ustalık yaklaşım başarı hedefleri benimsetilmesi önerilmektedir. Bu tür etkinliklerin gerçekleştirilmesinde fen bilimleri öğretmenleri öğrencilere etkinlikler için zaman tanımalı ve başarı hissini yaşamalarını sağlayacak kolaylıkta etkinlik sıralaması tasarlamalıdır. Öğrenci fen başarısını yordayan önemli faktör olarak öz yeterlik ön plana çıkmaktadır ve öz yeterlik dört ana kaynaktan beslenmektedir: geçmiş tecrübeler, karşılıklı öğrenme, sözel ikna ve fizyolojik durumlar. Fen bilimleri öğretmenleri sınıf içinde en etkili etmen olduğundan öğrencilerin tecrübelerini arttırmada, onlara örnek olarak yeterlik hissini geliştirmede, sözel olarak cesaretlendirici mesajlar göndermede ve onları fizyolojik ve psikolojik olarak olumsuz etkileyecek davranışlardan kaçınmada en önemli kişidir. Ayrıca, öğrencilerin yakın çevrelerindeki yetişkinler de öğrencilerin okuldaki başarılarına, hem iyi birer örnek olarak hem de sözel olarak ikna yoluyla katkıda bulunabileceklerinden, destekleyici olmaları eğitim çağındaki ergen bireyler için elzemdir. Öğretmenlerin algılanan okul ortamdan hem motivasyon hem de iş doyumu olarak etkileniyor olmaları bu çalışmanın önemli bulguları arasındadır. Okuldaki ustalık hedef yapıları pek çok öğretmen motivasyonunu boyutunu etkilemektedir. Dolayısıyla okullardaki hedef yapısının rekabetçi ve karşılaştırmacı bir anlayıştan öğrenme ve kişisel gelişime yönelik olması öğretmenlere, dolaylı olarak da öğrencilere yansıyacaktır. Böylelikle fen bilimlerinde daha başarılı okullar ortaya çıkabilecektir. Ayrıca öğretmen veli ilişkileri öğretmenlerin sınıf içi uygulamalarında belirleyici olduğundan olumlu bir öğretmen veli ilişkisi öğrencilere de pozitif olarak yansıyacaktır. Öğrencisinin durumunu ailesi aracılığıyla tanıyan öğretmen öğrenci hakkında daha detaylı bilgiye sahip olacak ve bu durum öğrenci öğrenmesine olumlu katkılar yapabilecektir. Son olarak, öğretmenlerin iş doyumları okul ortamından etkilendiğinden, olumlu bir okul ikilimi ve ortamı öğretmenlerin mesleklerinden doyum hissetmelerine bu durumda eğitimin kalitesinin artmasına önemli katkılar yapabilecektir.

Appendix F

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Kıran, Dekant
Nationality: Turkish (TC)
Date and Place of Birth: 08 February 1984, Yenice - Çanakkale
Marital Status: Married
Phone: +90 312 210 6413
Fax: +90 312 210 7984
email: dekantk@gmail.com

EDUCATION

Degree	Institution	Year of Graduation
MS	METU, Elementary Science and Mathematics Education	2010
BS	Hacettepe University, Elementary Science Education	2007
High School	Çanakkale Milli Piyango Anadolu Lisesi	2002

WORK EXPERIENCE

Year	Place	Enrollment
2007-Present	METU Department of Elementary Education	Research Assistant

TEACHING EXPERIENCE

Teaching Assistant at Undergraduate Courses:

ELE 225 Measurement and Assessment

ELE 240 Probability and Statistics

ELE 329 Educational Technology and Material Development

ELE 420 Practice Teaching

ELE331 Laboratory Applications in Science I

VISITING SCHOLAR

Year	**Place**	
August 2014 - August 2015	University of Kentucky, Department of Educational, school and Counseling Psychology (USA)	Visiting Scholar, Studied with Assoc. Prof. Dr. Ellen L. Usher

FOREIGN LANGUAGES

Advanced English, Basic German and French

PUBLICATIONS

1. **Kiran, D.** & Sungur, S. (2012). Middle school students' science self-efficacy and its sources: Examination of gender difference. *Journal of Science Education and Technology*, *21*(5), 619-630.

2. **Kiran, D.** & Sungur, S. (2012). Sources and consequences of middle school students' science self-efficacy. *The Asia-Pacific Education Researcher, 21*(1), 172-180.

3. Sungur, S. & **Kıran, D.** (2014). Adapting of inviting/disinviting index into Turkish. *Education and Science*, *39*(174), 119-128.

PRESENTATIONS

1. **Kiran, D.** & Sungur, S. (2011, September). *An examination of gender difference in middle school students' science self-efficacy and its sources*. Paper presented at the European Science Education Research Association (ESERA), Lyon, France.

2. **Kiran, D.** & Sungur, S. (2013, September). *A study on prevalence of transformative experiences in middle school science classes in Turkey*. Paper presented at the European Conference on Educational Research (ECER), İstanbul, Turkey.

3. Karaduman, M. A., **Kiran, D.** & Çetinkaya, G. (2013, September). *A comparison of nature of science understandings of preservice early childhood and science teachers.* Paper presented at the European Conference on Educational Research (ECER), İstanbul, Turkey.

4. **Kiran, D.** & Şen, M. (2014, May). *In-service science teacher profiles from the eyes of pre-service science teachers: what did they observe?* Paper presented at the International Conference on Education in Mathematics, Science & Teaching (ICEMST), Konya, Turkey.

5. **Kiran, D.**, & Usher, E. L. (2015, March). *Achievement and self-efficacy in science – An exploration of student and teacher beliefs in Turkey.* Paper submitted for presentation at the 2015 Spring Research Conference. Louisville, KY.

6. Turner, T. A., Cheatham, N. N., Jones, F. L., Waiters, B. L., Pritchard, M. J., Covington, S. T., **Kiran, D.**, & Usher, E. L. (2015, March). *Self-regulation and calibration in undergraduate biology students.* Paper submitted for presentation at the 2015 Spring Research Conference. Louisville, KY.

7. **Kiran, D.,** & Sungur, S. (2015, September). *A study on the relationships among school goal structures, science teacher self-efficacy and job satisfaction*. Paper presented at the European Conference on Educational Research (ECER), Budapest, Hungary.

8. **Kiran, D.**, & Usher, E. L. (2016, April). *Achievement and self-efficacy in science – An exploration of student and teacher beliefs in Turkey.* Paper submitted for presentation at the 2016 National Association for Research in Science Teaching (NARST). Baltimore, Maryland, USA.

9. **Kiran, D., &** Sungur, S. (2016, May). *A Study on the Relationships between Middle Grade Students' Science Self-Efficacy and Achievement Goal Orientations in Different Achievement Levels.* Paper submitted for presentation at The Eighth International Congress of Educational Research, Çanakkale, Turkey.

10. **Kıran, D.** & Sungur, S. (2010, September). *İlköğretim 8. Sınıf öğrencilerinin fen ve teknoloji dersine yönelik öz-yeterlik kaynaklarının incelenmesi.* Paper presented at the IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, (UFBMEK), İzmir, Turkey.

11. Çaylak, B., **Kıran, D.,** & Teksöz, G. (2014, September). *Fen bilimleri öğretmen adaylarının öğretmenlik uygulama deneyimleri: pedagojik alan bilgisi ve bileşenleri*. Paper presented at the XI. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, (UFBMEK), Adana, Turkey.

12. **Kıran, D.** (2016, September). *Ulusal fen bilimleri ve matematik eğitimi kongrelerinde özyeterlik çalışmaları: Bir içerik analizi.* Paper presented at the XII. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, (UFBMEK), Trabzon, Turkey.

13. Kaplan, G., Şen, M., & **Kıran, D.** (2016, September). *Ortaokul öğrencilerinin matematik ve fen bilimleri derslerindeki başarı hedef yönelimlerinin sınıf seviyelerine göre karşılaştırılması*. Paper presented at the XII. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, (UFBMEK), Trabzon, Turkey.

SEMINARS & WORKSHOPS

2013 European Educational Research Summer School (EERSS) Educational Methodology. Trondheim, Norway.

AWARDS

2012	The Scientific and Technological Research Council of Turkey (TUBITAK)	Publication Award
2015	The Scientific and Technological Research Council of Turkey (TUBITAK)	Publication Award
April 2016	American Educational Research Association, Annual Conference	International Travel Award

SCHOLARSHIPS

August 2014 - August 2015	The Scientific and Technological Research Council of Turkey (TUBITAK)	Abroad Research Scholarship for Doctoral Students

MEMBER

December 2015- December 2016	National Association for Research in Science Teaching (NARST)	Doctoral student member

COMPUTER PROGRAMS

MS Office, SPSS, LISREL, AMOS, HLM, GIMP

HOBBIES

Swimming, photography, running, cooking, and tasting local foods.

Appendix G

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ■

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : Kıran
Adı : Dekant
Bölümü : İlköğretim

TEZİN ADI (İngilizce) : Multilevel Investigations of Student Motivation, Engagement, and Achievement in Science in Relation to Teacher Related Variables

TEZİN TÜRÜ : Yüksek Lisans ☐ Doktora ■

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

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: