AN INVESTIGATION OF STUDENTS' HOMEWORK SELF-REGULATION AND TEACHERS' HOMEWORK PRACTICES

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

BY

YASEMİN TAŞ

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

JUNE 2013

Approval of the Graduate School of Social Sciences

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ABSTRACT

AN INVESTIGATION OF STUDENTS' HOMEWORK SELF-REGULATION AND TEACHERS' HOMEWORK PRACTICES

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June 2013, 320 pages

This study investigated Grade 7 students' Science and Technology homework self-regulation in relation to science achievement and teachers' homework practices. This was a nationwide study; 8318 seventh grade students and 344 Science and Technology teachers in Turkey participated. Participating students completed Student Homework Scale and Science Achievement Test while their Science and Technology teachers responded to the items in Teacher Homework Scale.

Hierarchical Linear Modeling (HLM) analyses were conducted due to the nested structure of data. Results revealed that controlling for students' prior-achievement and gender, students' perceptions of homework quality and feedback provided on homework predicted students' homework self-regulation (i.e., goal orientations in homework,

homework procrastination, and homework strategy use) and science achievement. Moreover, pursuing high levels of mastery and low levels of work-avoidance goals, having low tendency to procrastinate homework, and using deep learning strategies during homework positively predicted science achievement. Class level analyses revealed that students in classes with higher average perceptions of homework quality were espoused to more mastery and performance goals and less work-avoidance goals; were less likely to delay homework; and used more homework management and deep learning strategies than students in other classes. Besides, students' shared perceptions of homework feedback positively predicted students' homework management and deep learning strategy use, and achievement. Additionally, students in classes with higher teacher support for deep learning strategy use performed better on the science achievement test than did students in other classes.

Keywords: Homework Self-Regulation, Homework Quality, Feedback on Homework, Science Achievement, Hierarchical Linear Modeling

ÖZ

ÖĞRENCİLERİN ÖDEVLE İLGİLİ ÖZ-DÜZENLEME BECERİLERİNİN VE ÖĞRETMENLERİN ÖDEV UYGULAMALARININ ARAŞTIRILMASI

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Bu çalışma. 7. sınıf öğrencilerinin Fen ve Teknoloji ödevlerindeki öz-düzenleme becerilerini, fen başarısı ve öğretmenlerin ödev uygulamaları ile ilişkili olarak araştırmaktadır. Yurt çapında yapılan çalışmaya Türkiye genelinden 8318 yedinci sınıf öğrencisi ve 344 Fen ve Teknoloji öğretmeni katılmıştır. Çalışmaya katılan öğrenciler, Öğrenci Ödev Ölçeği ve Fen Başarı Testi'ni tamamlamış, Fen ve Teknoloji öğretmenleri ise Öğretmen Ödev Ölçeği'ndeki maddeleri yanıtlamışlardır.

Hiyerarşik veri yapısı sebebiyle Hiyerarşik Lineer Modelleme (HLM) analizi kullanılmıştır. Analiz sonuçlarına göre, öğrencilerin ön-başarısını ve cinsiyetini kontrol ederken, öğrencilerin ödevin kalitesi ve ödev hakkında aldıkları geri bildirim ile ilgili

algıları, öğrencilerin ödevle ilgili öz-düzenleme becerilerini (ödevi yapmaktaki hedef yönelimleri, ödevi erteleme eğilimleri ve ödev yaparken strateji kullanımları) ve fen başarısını tahmin etmektedir. Yüksek seviyede öğrenme hedef yönelimini ve düşük seviyede işten-kaçınma hedef yönelimini benimseme, ödevi erteleme eğilimi içinde olmama ve ödev yaparken derin öğrenme stratejileri kullanma, fen başarısını pozitif olarak tahmin etmektedir. Sınıf düzeyindeki analiz sonuçlarına göre, ödevin kalitesi hakkında ortalama algının daha yüksek olduğu sınıflarda okuyan öğrenciler, diğer sınıflardaki öğrencilere göre daha çok öğrenme ve performans hedef yönelimi benimserken daha az işten-kaçınma hedef yönelimine yönelmekte, ödevlerini ertelememekte ve ödev yaparken daha çok ödev yönetimi ve derin öğrenme stratejileri kullanmaktadırlar. Bunun yanı sıra, öğrencilerin ödev hakkında sağlanan geri bildirim ile ilgili ortak algıları, öğrencilerin ödev yönetimi ve derin öğrenme strateji kullanımını ve fen başarısını pozitif olarak tahmin etmektedir. Ek olarak, ödevlerinde daha çok derin öğrenme stratejilerini kullanmaları için öğrencilerini destekleyen öğretmenlerin bulunduğu sınıflardaki öğrenciler, fen testinde diğer sınıflardaki öğrencilerden daha başarılı olmuşlardır.

Anahtar Kelimeler: Ödev Öz-Düzenleme Becerileri, Ödevin Kalitesi, Ödevle ilgili Geri-Bildirim, Fen Başarısı, Hiyerarşik Lineer Modelleme

To My Parents

Aysel and Baki Taş

ACKNOWLEDGMENTS

I would like to express my sincerest gratitude to Assoc. Prof. Dr. Semra Sungur Vural, my supervisor and Prof. Dr. Ceren Öztekin, my co-supervisor. This dissertation would not have been possible without their invaluable advice and consistent encouragement. I am very happy to be their student and thankful for their contribution to my educational and professional development.

I would also like to thank to my committee members Prof. Dr. Jale Çakıroğlu, Prof. Dr. Ercan Kiraz, Assoc. Prof. Dr. Murat Günel, and Assist. Prof. Dr. Çiğdem Haser for their valuable comments and suggestions to improve my dissertation.

I extent my heartfelt thanks to my friends Berna Sicim, Esra Balgalmış, Gülsüm Gök, Deniz Mehmetlioğlu, Deniz Kahriman Öztürk, Yasemin Esen, Ayşe Yenilmez, Zeliha Büyükfidan, Özlem Karslı, Alev Yıldırım, and Ahu Kiremit who cared and supported me during the dissertation process. I am happy to have my HLM study group friends Sündüs Yerdelen and Savaş Pamuk who shared in my difficulties and success in the data analyses process. In deed, I want to thank to all of my friends from ELE department.

Very special thanks go to my family; my parents, my siblings and their spouses, and my cousins for their strong support and encouragement throughout this long journey and I am grateful for their efforts and patience.

I would like to express my gratitude to the students and the science teachers for their participation to this study and also EARGED for its help in data collection process.

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AVOID_GOAL	Work-avoidance goal orientation
DEEP	Deep learning strategy use
FEEDBACK	Perceived feedback on homework
FEED_MEAN	Aggragated students' perceptions of feedback on homework
HW	Homework
MANAGE	Management strategy use
MASTERY_GOAL	Mastery goal orientation
PERFOR_GOAL	Performance goal orientation
PRIOR_ACH	Prior achievement
PROCRAST	Procrastination
QUALITY	Perceived homework quality
QUAL_MEAN	Aggragated students' perceptions of homework quality
T_DEEP_SUPPORT	Teacher support for students' use of deep learning strategies

CHAPTER I

INTRODUCTION

Homework is defined as "tasks assigned to students by school teachers that are intended to be carried out during non-school hours" (Cooper, 2007, p. 4). Teachers give homework for a variety of purposes. For instance, teachers assign homework to give students opportunity to practice skills learned in class; to prepare students for the next lesson; to increase students' participation; and to support their personal development. Teachers' purposes of assigning homework also include promoting parent-child relations; supporting parent-teacher communications; encouraging peer interaction; and fulfilling school or district requirements in homework policy (Epstein & Van Voorhis, 2001).

Although teachers utilize homework for several reasons, there are both opponents and proponents of homework. Some criticize that homework takes students' time from leisure time and community activities (Warton, 2001), such as socialization, play, and sleep (Bennett, 2007; Kohn, 2007), causes frustration and exhaustion (Kohn, 2007), and leads to satiation by exposing students too much academic tasks (Cooper, 2007). Parental interference is another suggested negative effect of homework; parents may make pressure on students to complete homework, they may cause confusion being unfamiliar with the material taught in the class or approaching the material differently than the way taught in the class, or they may provide too much help which is beyond simple tutoring and becoming cheating (Cooper & Valentine, 2001). On the other hand, proponents of homework suggests that homework contributes to students' retention of information, understanding of the course material, critical thinking, development of study skills, and parental involvement (Cooper, 2007; Cooper & Valentine, 2001).

During homework, students set goals, motivate themselves, use strategies to complete homework like managing distractions and organizing time. Therefore, students engage in self-regulation during homework completion (Ramdass & Zimmerman, 2011).

Despite the long history of homework research, the association between homework and achievement is not well established (Trautwein & Koller, 2003). The research investigating the relationship between achievement and homework has mostly focused on homework time. In their meta-analysis, Cooper, Robinson, and Patall (2006) covered 32 studies conducted between the years of 1987 and 2004 which examined the time spent on homework and academic achievement. The studies reported 69 correlations; 50 were positive while 19 were negative with a weighted average correlation of .24 which was statistically different from zero. The correlation between time spent on homework and class grades (r= .27) was similar to correlation that involved standardized achievement scores (r= .24). Regarding grade level, studies sampling students from Grades K-6 revealed no significant relationship between time spent on homework and achievement (r= -.04) whereas a positive and statistically significant correlation was found in studies sampling Grades 7-12 students (r= .25). The researchers, however, pointed out that all studies had design flaws such as non-random assignment of subjects or classes to homework or no-homework conditions and not controlling for pretreatment differences like students' achievement level. In their study, Muhlenbruck, Cooper, Nye, and Lindsay (2000) found that elementary school teachers and high school teachers differed in their purposes of assigning homework; elementary school teachers reported to assign more homework to develop students' study skills while high school students, already expected to develop these skills, were generally given homework which focused on the subject material. The researchers suggested that the small correlation between achievement and time spent on homework at elementary level might be due to this reason.

While most of the homework research has concentrated on the time spent on homework, time is only one of the aspects of homework behavior (Trautwein, Ludtke, Schnyder, & Niggli, 2006). Plant, Ericsson, Hill, and Asberg (2005) proposed that quality of study time should also be considered. Indeed, they found that college students' amount of study time was a significant predictor of cumulative GPA only when quality of study time was taken into consideration. In order to better understand the relationship between homework and achievement, more homework variables other than time should be investigated (Trautwein, 2007). In their review on homework research, Trautwein and Koller (2003) pointed out that there is a critical need for studying a range of homework variables to gain insight about students' self-regulatory processes in homework. Ramdass and Zimmerman (2011) further suggested to study on homework variables such as managing time, managing distractions, setting a place for homework completion, and goal setting.

There has been a long discussion about characteristics of homework which are more effective for students' learning, such as having a specific purpose and addressing skills students need to practice (Cushman, 2010), with appropriate difficulty, and in line with students' interest areas and experiences (Corno, 2000; Epstein & Van Voorhis, 2001). However, little empirical research investigated role of such qualities of homework in student learning (Dettmers, Trautwein, Ludtke, Kunter, & Baumert, 2010) and there is need for studies to investigate the relationship between quality of homework and achievement (Warton, 2001). Trautwein and Ludtke (2009) found that students' shared perceptions of homework quality (class level) and individual perceptions of homework quality (student level) were significantly and positively related to students' homework motivation and homework effort.

Feedback is another aspect of homework that should be considered closely. In their review on feedback, Hattie and Timperley (2007) suggest that feedback which includes information about how well a task is accomplished, the processes underlying the task, and students' monitoring and regulating of their actions are suggested to be highly effective. Feedback which offers correction for errors and permitting resubmission of the assignment (Nicol & Macfarlane-Dick, 2006) and providing timely feedback is recommended (Gibbs & Simpson, 2004). However, a few studies have investigated the relationship between teacher feedback on homework and students' self-regulation and achievement (e.g., Xu, 2008a, 2009a) and there is need for further studies. Teacher feedback on homework found to be a significant and positive predictor of students' homework management (Xu, 2009a, 2012; Xu & Wu, 2013) and homework interest (Xu, 2008a).

Besides quality of homework and feedback provided on homework, investigation of teachers' goal orientations and their support for students' use of homework strategies may provide insight about students' homework practices. Learning environment which emphasizes understanding of the material and students' self-improvement (i.e., classroom mastery goal structure) was found to promote more adaptive student outcomes such as students' use of learning strategies, self-efficacy, positive attitudes toward class, low levels of self-handicapping, and high academic achievement than classroom context which focuses on performance and relative abilities of students (Ames & Archer, 1988; Fast et al. 2010; Kaplan & Maehr, 1999; Midgley & Urdan, 2001; Rolland, 2012). Furthermore, teacher's strategy instruction has positive influences on students' strategy use and their achievement (Hamman, Bethelot, Saia, & Crowley, 2000; Kistner et al., 2010). For instance, teacher's instructions about use of strategies, like "You should probably consider planning some homework time each night to work on your research project" (p. 345) and providing rationale for strategy use like "I suggest you take a practice test—Putting yourself in a similar testing situation will help you determine whether or not your prepared for the test" (p. 345) was found to be statistically significantly and positively related to students' use of rehearsal strategies, metacognitive regulation, and effort regulation (Hamman et al., 2000). Explicit strategy instruction (i.e., the teacher explains importance of a particular strategy to students and tells students directly to use it) was found to be significantly and positively related to mathematics achievement (*r*= .52) (Kistner et al., 2010). Although the influence of teachers' goal orientations and teacher support for students' use of strategy use was investigated in a number of studies, no study was encountered investigating teachers' goal orientations in the homework process and their strategy support for students' use of homework strategies. There is need for studies investigating how teachers' homework goal orientations and their support for students' use of homework strategies relate to students' homework self-regulation and achievement.

1.1 Significance of the Study

The limitations in homework research make it difficult to reach conclusions about the effects of homework on students' learning. Homework research should be more closely connected to educational theories in order to understand underlying relations in the homework process more thoroughly (Trautwein & Koller, 2003). Recently, Trautwein and his colleagues (Trautwein & Ludtke, 2009; Trautwein et al., 2006) examined students' homework motivation and homework effort from expectancy-value theory perspective. The researchers developed a homework model which asserts that learning environment, teacher, and homework characteristics may influence students' homework motivation. In this model, homework motivation included expectancy and value components and it was suggested that homework motivation may affect students' homework behavior (i.e., effort, time, and strategy use). The model further suggests that learning environment characteristics and homework behavior influence students' achievement. However, the model does not provide insight about students' homework goal orientations and their tendency to procrastinate homework. Another theory which provides a comprehensive view on homework including such variables is suggested to be self-regulation theory (Trautwein & Koller, 2003). According to this theory, during homework, students are expected to engage in self-regulation: Depending on the task, students motivate themselves and set goals; use cognitive strategies to complete homework, such as making an outline before writing an essay; and monitor their progress and use metacognitive strategies such as rereading the text they did not understand. Therefore, during homework, students operate in the three areas of self-regulation; motivation, cognition, and metacognition (Ramdass & Zimmerman, 2011). Planning time (e.g., setting priorities and planning ahead), organizing workplace (e.g., locating materials necessary for the homework), monitoring motivation (e.g., trying to make homework more interesting), handling distractions (e.g., not playing around with other things during homework), and controlling emotion (e.g., telling oneself to calm down) help students with homework management (Xu, 2008b). Although one of the main purposes of assigning homework is to develop students' self-regulation (Epstein & Van Voorhis, 2001; Warton, 2001), little research has investigated this view empirically, particularly at the middle school level. It is assumed that middle school students began to take responsibility for their homework; however, little is known about middle scholars' homework practices (Xu & Corno, 2003). Most of the homework research has sampled high school and college school students and there is need for studying younger students' homework practices (Ramdass & Zimmermen, 2011).

Another limitation in the homework research is that, multilevel structure of homework needs to be considered by the researchers (Trautwein, 2007; Trautwein & Koller, 2003). The homework is generally given to the whole class and students' homework practices within a class are interrelated such that teacher effects may play role in students' homework behaviors. Despite the nonindependence of individual students' data, most of the homework studies have used students as the unit of analysis (Trautwein & Koller, 2003). When dealing with a hierarchical data structure, such as students nested within classrooms, it is essential to use multilevel techniques (Raudenbush & Bryk, 2002) because these techniques provide more accurate estimates by permitting correlated responses within groups (Roberts, 2004). Recently, some of the homework studies handled data using Hierarchical Linear Modeling analyses and demonstrated that there were significant variations among classes in terms of homework variables of interest.

For instance, Dettmers et al. (2010), studying with a nationally representative sample of German students (*n*= 3483) from 155 classes, found that perceived homework quality varied significantly across classes; 18% and 11% of the variance in homework quality indicators of homework selection and homework challenge, respectively were between classes. Therefore, there is a need to differentiate between teacher effects and student effects in homework research by using multilevel analysis techniques (Trautwein & Koller, 2003). Although students' homework motivation and behavior are expected to be influenced by their teachers' homework attitudes and behaviors (Trautwein et al., 2006, Trautwein, 2007), little research evidence exists regarding this impact.

Another limitation in homework research involves use of domain independent measures. Student motivation and behavior is domain specific and homework research should also take into account this specificity (Trautwein et al., 2006). Most of the homework research has used domain independent measures (e.g., Hong & Milgram, 1999; Xu, 2010). The research which considered subject specificity on the other hand generally focused on mathematics and reading and there is relatively little research on science homework in particular (Ramdass & Zimmerman, 2011).

The present study aims to investigate the relationships among learning environment (teacher and homework characteristics), students' homework self-regulation, and achievement in science from self-regulation theory perspective and by using Hierarchical Linear Modeling analysis. The predictive effect of teacher support for homework strategy use, teacher goals, feedback provided on homework, and quality of homework on students' homework self-regulation (i.e., goal orientations in homework, tendency to procrastinate homework, and homework strategy use) and achievement will be investigated. The associations between homework self-regulation variables and achievement will be also examined. The study attempts to reveal self-regulatory processes students engage during homework, how these processes are influenced from homework and teacher related factors and in turn affect achievement. This study seeks to contribute homework research by (a) being based on self-regulation theory, (b) considering a range of homework variables (i.e., mastery, performance, work-avoidance goal orientations; deep learning and management strategy use; procrastination), (c) employing multilevel analyses techniques to handle hierarchically ordered homework data, and (d) being science subject specific. Furthermore, predictive effect of quality of homework, feedback on homework, teachers' goal orientations, and teachers' support for students' use of homework strategies on students' homework self-regulation and achievement, if any, will provide implications for teacher education programs.

1.2 Definition of Important Terms

Homework self-regulation

In the present study, homework self-regulation is conceptualized as incorporating students' goal orientation in homework, use of homework strategies, and procrastination in homework.

Students' goal orientations in homework

Mastery goal orientation

Mastery goal orientation refers to students' purposes of doing homework in order to develop their skills and knowledge.

Performance goal orientation

Performance goal orientation refers to students' purposes of doing homework in order to demonstrate competence relative to others, gaining approval of others, and getting good grades.

Work-Avoidance goal orientation

Work-avoidance goal orientation refers to students' purposes of doing homework with as little effort as possible.

Homework strategy use

Deep learning strategy use

Deep learning strategy use refers to students' use of cognitive and metacognitive strategies which leads to deeper processing of information while doing homework.

Management strategy use

Management strategy use refers to "arranging the environment, managing time, handling distraction, monitoring motivation, and controlling emotion" during homework" (Xu, 2008b, p. 82).

Homework procrastination

Homework procrastination refers to students' tendency to postpone their homework.

Homework quality

Homework quality refers to students' perception of the extent to which their homework varies in difficulty, leads them to think on concepts, helps them improve understanding of the material, and contributes to skill development.

Homework feedback

Homework feedback refers to students' perceptions of whether their homework is checked regularly, evaluated in a short time, discussed in the class, and whether students are informed about their performance on homework.

Achievement

Achievement refers to students' performance in science achievement test which is composed of 14-multiple-choice items from first and second units of seventh grade curriculum – (1) Body Systems and (2) Force and Motion.

Teacher perception of homework quality

Teacher perception of homework quality refers to teachers' use of different sources while preparing homework, assigning homework varying in difficulty, and consideration of students' characteristics while preparing homework, such as prior knowledge and interest areas.

Teacher perception of homework feedback

Teacher perception of homework feedback refers to teachers' checking homework regularly, evaluating homework in a short time, discussing with students about homework, and informing students about their performance on homework.

Teacher support for students' strategy use

Teacher support for students' use of deep learning strategies

Teacher support for students' use of deep learning strategies refers to teachers' emphasis on the use of cognitive and metacognitive strategies leading to deeper processing of information.

Teacher support for students' use of homework management strategies

Teacher support for students' use of homework management strategies refers to teachers' recommendations for students about structuring homework environment, organizing time, reducing distractions, monitoring motivation, and controlling emotion during homework.

Teachers' goal orientation

Teachers' mastery goal orientation

Teachers' mastery goal orientation refers to teachers' concerns about students' making effort, gaining new perspectives, and showing improvement in homework.

Teachers' performance goal orientation

Teachers' performance goal orientation refers to teachers' making comparisons among students on their homework performance.

1.3 Research Questions

The research questions addressed in the study are:

1. To what extend do students in different classes vary in homework self-regulation and science achievement?

   1.a. To what extend do students in different classes vary in homework mastery goal orientation?

   1.b. To what extend do students in different classes vary in homework performance goal orientation?

   1.c. To what extend do students in different classes vary in homework avoidance goal orientation?

   1.d. To what extend do students in different classes vary in homework procrastination tendency?

   1.e. To what extend do students in different classes vary in use of homework deep learning strategies?

   1.f. To what extend do students in different classes vary in use of homework management strategies?

   1.g. To what extend do students in different classes vary in science achievement?

2. To what extend do student characteristics and learning environment characteristics predict homework self-regulation?

   2.a.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict homework mastery goal orientation?

2.a.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework mastery goal orientation?

2.b.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict homework performance goal orientation?

2.b.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework performance goal orientation?

2.c.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict homework avoidance goal orientation?

2.c.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework avoidance goal orientation?

2.d.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict homework procrastination tendency?

2.d.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework procrastination tendency?

2.e.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict students' use of homework deep learning strategies?

2.e.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict students' use of homework deep learning strategies?

2.f.1. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict students' use of homework management strategies?

2.f.2. To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict students' use of homework management strategies?

3. To what extend do student characteristics, learning environment characteristics, and homework self-regulation predict science achievement?

   3.a. To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (students' perceptions of homework quality and feedback on homework) predict science achievement?

   3.b. To what extend do student characteristics (gender and prior achievement), student level learning environment variables (students' perceptions of homework quality and feedback on homework), and homework self-regulation (homework goal orientations, procrastination tendency, and strategy use) predict science achievement?

   3.c. Does homework self-regulation (homework goal orientations, procrastination tendency, and strategy use) mediate the relationship between student level learning environment variables (students' perceptions of homework quality and feedback provided on homework) and science achievement?

   3.d. To what extend do class level variables (homework quality, feedback on homework, teacher support for homework management and deep learning strategy use during homework, and teacher homework goals) predict science achievement?

1.4 Overview of the Proposed Model

Based on the self-regulation theory and related literature on homework, a model was developed. The model displays relationships among variables of the study (See Figure 1.1). Basically, the model predicts that learning environment (i.e., teacher and homework characteristics) and student characteristics (i.e., gender and prior achievement) predict students' homework-self-regulation (i.e., goal orientations in homework, homework procrastination, and stategy use during homework) and achievement. Students' homework self-regulation is further hypothesized to associate with students' achievement. The proposed relationships among variables will be explained in detail in the second chapter of the dissertation (See Section 2.9).

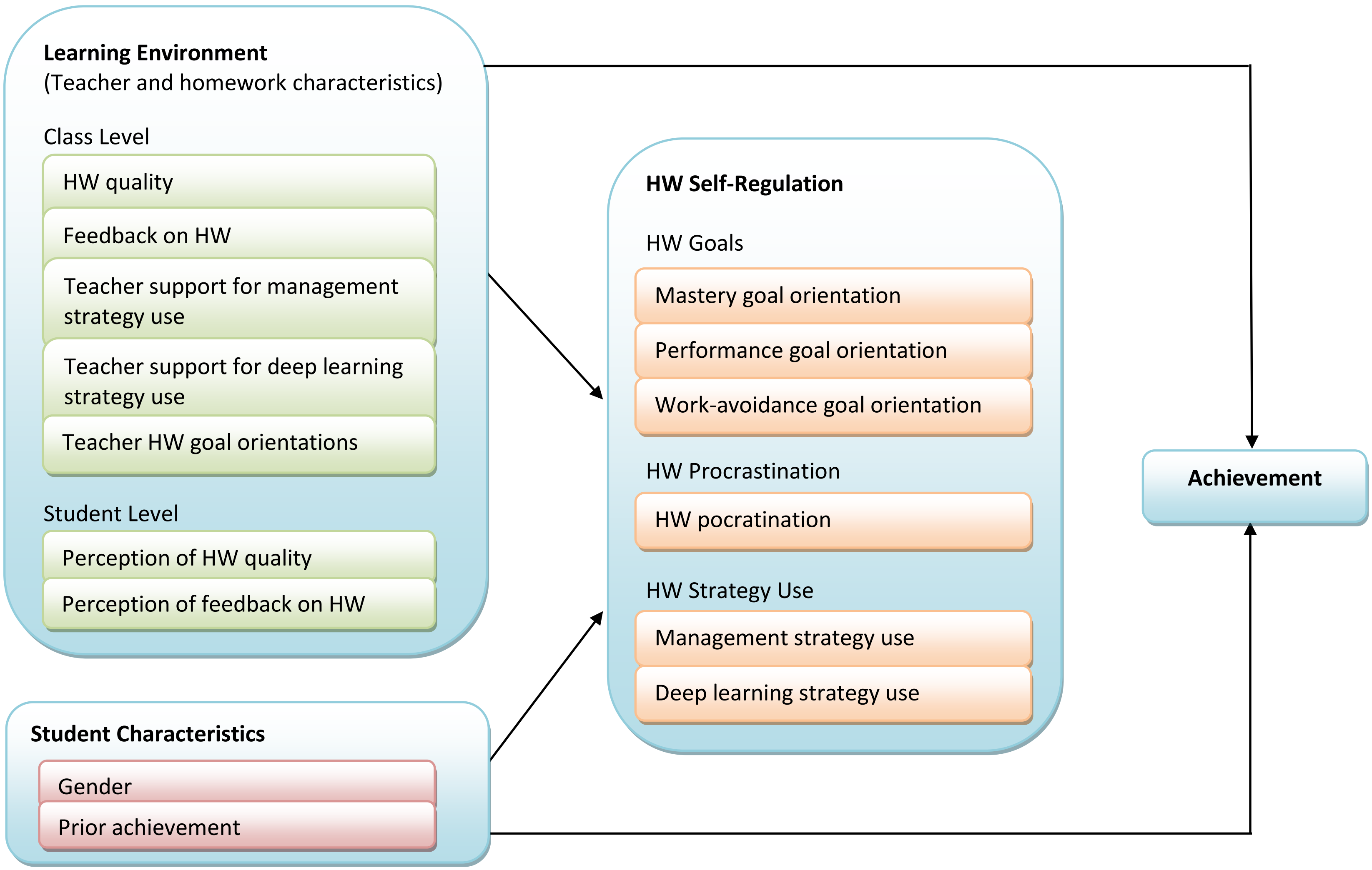

Figure 1.1 Proposed homework model

CHAPTER II

LITERATURE REVIEW

This chapter of the dissertation was devoted to review of the literature. Firstly, theoretical background was presented. Then, studies investigating how gender, homework quality, homework feedback, classroom goal structures, and teacher support for students' strategy use is related to homework self-regulation and achievement were reviewed. Next, studies examining the associations between homework self-regulation and achievement were reviewed. Then, study context and homework studies in Turkey were mentioned. Finally, based on theoretical framework and previous research findings, a homework model was proposed.

2.1 Self-Regulation Theory

Self-regulation is defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2005, p. 14). Self-regulated learners set goals for themselves, they have strategic knowledge and use strategies to attain their goals, they monitor effectiveness of their strategies, and make self-reflection by evaluating their performance in achieving their goals and making cause-effect relationships which helps to adjust their future strategies (Zimmerman, 2002). They have ability to adopt their goals and strategies according to changing conditions in intrapersonal, interpersonal, and contextual factors (Zimmerman, 2005). Self-regulated learners are characterized as "... autonomous, reflective, and efficient learners who have the cognitive and metacognitive abilities as well as the motivation beliefs and attitudes needed to understand, monitor, and direct their own learning" (Wolters, 2003a, p. 189). Since self-regulated learners are able to regulate their own learning by improving their knowledge, skills, and attitudes, self-regulation is considered to be a key factor for successful learning (Boekaerts, 1999).

Several models for self-regulated learning were developed in the literature. Models developed by Boekaerts (1997), Pintrich (2005), Winne and his colleagues (Winne, 1995; Winne & Perry, 2005), and Zimmerman (2005) are widely used by researchers. Although models differ in some constructs and conceptualizations they propose, they assume that self-regulated learning is cyclical, and students' *cognitive* and *metacognitive strategy use* and their *motivation* are important features of self-regulated learning. The present study was guided by models of Pintrich (2005) and Zimmerman (2005).

One of the main components of self-regulated learning is *use of cognitive strategies* (Pintrich, 1999). Cognitive strategies include rehearsal, elaboration, and organizational strategies (Weinstein & Mayer, 1986). Rehearsal strategies refer to recitation of items to be learned and assumed to help students keep the information in the working memory, but may not reflect a deep level of processing. For instance, repeating the names of the planets to remember the order from the sun and copying a portion of the lesson are examples for rehearsal strategies. Elaboration strategies include formation of associations between items of the material to be learned and also relating the new information to existing knowledge. For instance, summarizing or paraphrasing the material to be learned, creating analogies, question answering, and generative note-taking are examples for elaboration strategies. Organizational strategy is the other deeper processing strategy which includes strategies related to grouping or ordering the items of the material to be learned and creating a hierarchy. For instance, organizing items into categories, outlining a text, and creating diagrams to show the relationships are organizational strategies (Weinstein & Mayer, 1986).

Use of *metacognitive strategies* is another important component of self-regulated learning (Pintrich, 1999). Metacognitive strategies are related to regulation of cognition component of the metacognition. Three metacognitive strategies mostly included in the models are planning, monitoring, and regulation strategies. Planning aids learner's use of cognitive strategies which contribute to understanding of the material. For instance, before reading a text, the learner can skim or generate questions which makes comprehension of the text easier. Monitoring refers to the learners' checking of understanding or behavior against some goal, standard, or criterion. Tracking of attention during a lecture, monitoring speed during a test, and while reading a text, asking questions about the text to check understanding are some examples of monitoring strategy use. Monitoring strategies help the learners to identify deficiencies in their learning which can be completed or corrected by use of regulation strategies. For instance, the student, who is asking questions while reading a text to monitor understanding, can go back and reread a portion of the text. This rereading is a regulation strategy. Reviewing course material that is not understood in order to be prepared for an examination is also a regulation strategy (Pintrich, 1999).

Besides cognitive and metacognitive strategies, Pintrich's (1999) addresses *resource management strategies* as a third type of strategy category. Resource management strategies refer to strategies which are used to manage and control learning environment, like managing time and arranging learning environment. For instance, the learner can isolate him/herself from anything that is distracting, such as the learner can turn off the radio to concentrate on studying and make learning easier (Zimmerman & Martinez-Pons, 1986).

Although strategies are very important, if the learner cannot *motivate* oneself to implement these strategies, they are not as useful (Zimmerman, 2005). Therefore, students' ability to regulate their motivation has a key impact on their learning and achievement (Wolters, 2003a). Regulation of motivation was described as "the activities through which individuals purposefully act to initiate, maintain, or supplement their willingness to start, to provide work toward, or to complete a particular activity or goal"

(Wolters, 2003a). Motivational beliefs include self-efficacy beliefs, task value beliefs, and goal orientations (Pintrich, 1999). Self-efficacy is learners' judgments of their capabilities to perform a given task (Schunk, 1991) while task value refers how important performing well on a given task for the individual (attainment value), how enjoyable the task (intrinsic value), how useful the task (utility value), and how much effort is needed and what to give up to do the task (cost) (Wigfield, 1994). Goal orientation, the other component in the motivational beliefs, refers to individuals' reasons for engaging in achievement behavior (Ames, 1992; Dweck, 1986; Nicholls, 1984). Two goal orientations have received particular attention of researchers. Researchers have labeled these goal orientations mastery versus performance (Ames & Archer, 1988; Ames, 1992); learning versus performance (Dweck & Leggett, 1988; Elliott & Dweck, 1988); task-focused versus ability-focused (Maehr & Midgley, 1991); and task-involved versus ego-involved (Nicholls, Patashnick, & Nolen, 1985). Among these terms, mastery and performance goals have been mostly used (Pintrich, Conley, & Kempler, 2003). The common criteria for these goal orientations is whether the learner values learning as an end itself and concerned with developing competence or perceives it as a way of demonstrating competence and gaining social approval. Mastery goal oriented students value learning itself and try to develop their competence. On the other hand, performance goal oriented students are concerned with demonstrating their abilities to others (Ames, 1992; Ames & Archer, 1988; Meece et al., 1988). More recent research has divided performance goals into approach-avoidance dimensions (e.g., Middleton & Midgley, 1997; Skaalvik, 1997). Accordingly, for performance-approach goal oriented individuals it is important to show their abilities and being the best performers of the task while performance-avoidance goal oriented individuals are concerned with avoiding inferiority and looking incompetent in comparison to others (Pintrich, 2005). While mastery goal oriented individuals evaluate their performance against self-referenced standards, like self-improvement; performance goal oriented individuals use normatively based standards, like comparisons relative to others. Therefore, goal orientations serve as a reference point for individuals to evaluate their performance (Pintrich, 2000a). Besides mastery and performance goals, work-avoidance goals are proposed as another type of goal orientation (Duda & Nicholls, 1992; Meece, Blumenfeld, & Hoyle, 1988; Meece & Holt, 1993; Skaalvik, 1997). Accordingly, work-avoidant goal oriented individuals are concerned to “get work done with a minimum amount of effort” (p. 515) or do as little work as possible (Meece et al., 1988). Among goal orientation frameworks, mastery, performance, and work-avoidant goal orientation framework (Meece et al., 1988) is more comprehensive than others (Somuncuoglu & Yildirim, 1999). Indeed, goal orientation is a key motivational construct for self-regulatory processes that receives researchers attention (Pintrich, 2005).

Being able to manage their cognition, metacognition, and motivation, self-regulated learners are less likely to involve in procrastination (Wolters, 2003b). Indeed, procrastination has been conceptualized as a failure of self-regulation by researchers (e.g., Howell & Watson, 2007; Steel, 2007). Procrastination is defined as “the tendency to put off or completely avoid an activity under one’s control” (Tuckman & Sexton, 1989 as cited in Tuckman, 1991, p. 474). Although the individual is aware of that he/she is supposed to do an activity, the individual may fail to motivate oneself to complete the activity within the desired period of time. For instance, the individual may delay starting of the task which ultimately causes distress (Senecal, Koestner, & Vallerand, 1995). Procrastination has been found to be associated with a variety of factors, such as poor academic performance (e.g., Lay & Schouwenburg, 1993, Steel, Brothen, & Wambach, 2001; Van Eerde, 2003), task aversiveness (i.e., finding the task unpleasant) (Milgram, Marshevsky ,& Sadeh, 1994; Steel, 2007), timing of rewards (i.e., when it is delayed) (Steel, 2007), low self-esteem and high anxiety (Senecal et al., 1995). Procrastination is especially widespread in academic context (Senecal et al., 1995).

Although self-regulated learning has been widely studied by researchers, students’ self-regulation in homework has been rarely investigated (Bembenutty, 2005; Hong, Peng, & Rowell, 2009). In the following sections, studies investigating the variables of interest were reviewed. If there is limited research in the homework context, studies in general academic context were examined.

2.2 How *prior achievement* and *gender* are related to homework self-regulation and achievement?

Previous studies suggested that students' entry characteristics can influence students' subsequent perceptions of school environment and also their subsequent school related outcomes (see Andersen, 1982). Prior achievement is one of the student entry characteristics that has been documented to be an important factor to be considered for (Cooper et al., 2006). The effect of prior achievement was controlled in many studies in order to account for differences in the outcome variables of interest that is attributable to prior achievement, (e.g., Roeser, Midgley, & Urdan, 1996). Studies generally reported a positive association between high prior achievement and adaptive student outcomes. For example, Araz and Sungur (2007) studying with Grade 8 students (n= 126) found that students who had higher prior achievement were more likely to engage in the academic tasks for learning and understanding purposes. Roeser et al. (1996) found that prior achievement was a significant and positive predictor of academic self-efficacy among eight grade students (n= 296).

Prior achievement was also found to be an important predictor of students' subsequent achievement (e.g., Araz & Sungur, 2007; Roeser et al., 1996; Reynolds & Walberg, 1991; Reynolds & Walberg, 1992; Trautwein, Koller, Schmitz, & Baumert, 2002; Zimmerman & Kitsantas, 2005). For instance, Roeser et al. (1996) reported a high positive correlation (r= .72) between second semester eight grade GPA and end-of-the-year sixth grade GPA. Similarly, Reynolds and Walberg's (1991) structural equation modeling analyses results revealed a positive effect of Grade 7 science achievement on students' Grade 8 science achievement (β= .729).

Gender is another student characteristic that is investigated by researchers. Generally, studies have found a gender difference in study habits, learning strategies, and motivational outcomes in the favor of girls. For instance, Martin (2004) examined gender differences in a set of motivational components among high school students (*n*= 2927) in Australia. MANOVA results revealed that girls scored higher than boys on learning focus, planning, study management, persistence, but also on anxiety. Although being statistically significant, the associated effect sizes were generally small. Similarly, Zimmerman and Martinez-Pond (1990) found gender differences in Grade 5, 8, and 11 students' (*n*= 180) self-regulated learning. They conducted MANOVA analysis and found significant gender effect. Univariate test results revealed that girls used record keeping, monitoring, environmental structuring, goal setting, and planning strategies more than boys. Likewise, in a survey study with Grade 7 and 8 students (*n*= 445), girls reported to use more cognitive strategies than boys (Patrick, Ryan, & Pintrich, 1999). Another study (Honigsfeld & Dunn, 2003) investigated learning styles of Grade 7 through 13 students (*n*= 1627) from five countries (Bermuda, Brunei, Hungary, Sweden, and New Zealand). MANOVA results revealed that girls were more self-motivated and exhibited greater persistence and responsibility than boys. Boys, on the other hand were more kinesthetic and peer oriented than girls. Regarding personal goal orientations, while some studies revealed gender differences, others reported no gender differences. For instance, some of the studies reported that girls were more mastery focused than males (e.g., Anderman & Midgley, 1997; Kayan Fadlelmula, 2011) while some studies found no gender difference in terms of mastery goal adoption (e.g., Anderman & Anderman, 1999; Middleton & Midgley, 1997; Roeser et al., 1996; Tas, 2008). Males were more performance goal oriented than females according to results of some of the study results (e.g., Anderman & Anderman, 1999; Anderman & Midgley, 1997; Middleton & Midgley, 1997; Roeser et al., 1996) while Kayan Fadlelmula (2011) found no gender difference for performance-approach goal orientation and Tas (2008) found that girls were more performance-approach goal focused than boys. Meece and Miller

(2001) reported that boys were more concerned with minimizing their effort (work-avoidant goal oriented) than did girls.

Research on procrastination yielded either no gender difference or males' procrastinating slightly more than females. For instance, no gender difference was found regarding individuals' tendency for procrastination in Haycock, McCarthy, and Skay (1998) and Solomon and Rothblum's (1984) studies. On the other hand, males reported to postpone academic tasks slightly more frequently than females in some of the studies (e.g., Milgram, Marshevsky, & Sadeh, 1994; Prohaska, Morrill, Atiles, & Perez, 2000; Senecal, Koestner, & Vallerand, 1995; Uzun Ozer, Demir, & Ferrari, 2009). A recent meta-analysis on procrastination (Steel, 2007) supported that males procrastinate only slightly more than females (r= -.08).

Specific to homework, Hong and Miligram (1999) examined American (n= 272) and Korean (n= 219) seventh grade students' preferred and actual homework styles on a number of measures, namely sound, light, temperature, design, place, motivation, persistence, responsibility, structure, order, alone/peer, authority figures, auditory, visual, tactile, kinaesthetic, intake, mobility, parent-motivated, and teacher motivated. There were more similarities than differences between boys and girls in terms of the homework style measures. In both cultures, boys reported that they prefer doing homework which requires tactile and kinaesthetic learning more than girls. On the other hand, girls more than boys expressed that they do homework in a bright environment and organize their homework assignments. In a national study conducted in America, Mau and Lynn (2000) examined gender differences in homework time among Grade 10 and 12 students (n= 20,612). Girls were found to devote more time on their homework than boys. The researchers suggested that girls may have more work ethic and thus they are more ready to expend greater effort on homework than boys.

Xu (2006) surveyed high school students (*n*= 426) attending a rural public school on a range of homework management strategies including arranging environment, managing time, focusing attention, monitoring motivation, and controlling emotion. Additionally, students were asked about the time spent on homework (during a normal week), frequency of completing homework, and whether they find homework interesting. MANOVA results showed that girls used homework management strategies of arranging environment, managing time, and controlling their emotion more than boys while there was no gender difference in terms of focusing attention and monitoring motivation. Furthermore, girls reported to spent more time on homework, more frequently completed their homework, and found homework interesting more than boys. Most of the effect sizes calculated were small other than for controlling emotion which was considered medium. The researcher suggested that there is need to investigate students' homework management and its relation to gender with different students populations (e.g., gifted and learning disabilities), different grade levels (e.g., Grades 5-12), and from different cultures. Another research (Xu & Corno, 2006) studying with Grade 7 and 8 students (*n*= 238) from a rural public middle school found that girls take more initiative than boys in managing homework time, monitoring motivation, and controlling emotion.

While majority of studies have yielded a significant effect of gender on homework, Hong et al. (2009), studying with Grade 7 (*n*= 330) and Grade 11 (*n*= 407) Chinese students, found no gender difference in any of the homework self-regulation components of utility value, intrinsic value, effort, persistent, planning, and self-checking. In fact, the nonsignificant gender difference was unexpected and the authors suggested that this might be due to gender equity trend in China's education.

Taken together, it appears that, compared to boys, girls prone to exhibit more desirable homework behaviors (e.g., spending more time on homework), motivation (e.g., controlling emotion), and use of strategies (e.g., time management and planning). No study was encountered which investigated homework procrastination in relation to gender.

Regarding science achievement, while some studies reported that females perform better than males in science (e.g., Britner & Pajares, 2006; Hacieminoglu, Yilmaz-Tuzun, & Ertepinar, 2009), some other studies reported the opposite (e.g., Cavallo, Potter, & Rozman, 2004; Mau & Lynn, 2000).

To sum up, it seems that gender and prior achievement are student characteristics that are included in previous research and shown to be related to self-regulation and achievement, in general and in specific to homework context. For this reason, gender and prior achievement will be incorporated in the models developed in the present study in order to account for the variability in the homework self-regulation variables and science achievement due to these variables.

2.3 How *homework quality* is related to homework self-regulation and achievement?

There has been a long discussion about characteristics of homework which are more effective for students' learning. It is recommended that homework should have a specific purpose and students should be communicated about this purpose clearly. Otherwise, students may not understand why the particular task is assigned which lowers students' motivation to do homework (Cushman, 2010). Clarity of teachers' messages and expectations may contribute to students' personal investments to do homework (Epstein & Van Voorhis, 2001). Furthermore, homework should match to skills students need to work on and improve. Therefore, teachers are expected to prepare homework by considering their students' strengths and weaknesses (Cushman, 2010). Besides students' skills, their interest areas and experiences are also important; design and content of the homework should match with students' interests (Corno, 2000; Epstein & Van Voorhis, 2001). In terms of difficulty of homework, "right combination of challenge and skill" (Corno, 2000, p. 530) is recommended; while too complex assignments may cause frustration, too easy assignments may cause boredom. Additionally, assigning different types of homework is suggested; rather than over-relying on one type of homework, different types of homework may provide students with opportunities for learning (Corno, 2000).

Gentry and Springer (2002) developed an instrument which assesses secondary school students' perceptions of classroom quality. Exploratory factor analysis results revealed four factors; meaningfulness, challenge, choice, and appeal. *Meaningfulness* refers to the degree to which students perceive activities as practical, related to their daily life, and connected to real life. *Challenge* refers to whether students find assignments and class work to be intellectually challenging. *Choice* addresses whether students are given choices, such as selecting projects, which increases students' responsibility and feeling of ownership for their learning and a*ppeal* refers to whether students find class materials and assignments interesting and enjoyable. The instrument was suggested to be a promising tool to assess students' perceptions of their classroom environment in terms of quality of class activities.

Despite the long debate about *quality of homework*, little empirical research investigated quality of homework (Dettmers et al., 2010). Trautwein and Ludtke (2009) investigated predictive effect of perceptions of homework quality on homework motivation and homework effort in six school subjects (German, English, history, biology, mathematics, and physics). Grade 8 and Grade 9 students (*n*= 511) participated in the study. Students' perceptions of homework quality (i.e., how well their homework was prepared and interesting) was found to be positively and statistically significantly related to expectancy beliefs, value beliefs, homework compliance, and percentage of tasks attempted at both student and classroom levels. Therefore, student perceptions' of homework quality was suggested to be an important homework characteristic that may influence students' homework motivation and homework behavior.

Dettmers et al. (2010) examined homework quality with two indicators. The first indicator was *homework selection* which referred to “selection of appropriate and interesting homework tasks” (p. 469). This definition of homework selection was very similar to operationalization of homework quality made by Trautwein and Ludtke (2009). The second indicator was *homework challenge* which measured “students’ perceptions of the cognitive challenge inherent in the homework tasks” (p. 469). A total of 3483 students in Grade 9 and 10 completed self-reported scales. The predictive effect of homework quality indicators on students’ homework motivation (expectancy and value beliefs), homework behavior (homework effort and homework time), and achievement in mathematics subject were investigated in a multilevel design. Students who perceived that their homework was well selected reported higher homework expectancy, homework value, homework time, and homework effort at both student and class level while also outperformed students in other classes on achievement test. Students who perceived their homework challenging reported lower levels of homework expectancy beliefs than other students. Homework challenge was found to be a negative predictor of achievement at the student level, indicating that students who perceived homework assignments to be cognitively challenging scored lower than did their classmates; while students’ shared perceptions of homework challenge positively predicted achievement at the class level, meaning that students in classes with higher perceptions of homework challenge performed better on the achievement test than students in other classes. Therefore, differential effects of homework challenge at student and class level were observed. In short, students in classes where well selected and challenging homework tasks were assigned showed higher mathematics achievement and the researchers emphasized the importance of well prepared and adequately challenging homework assignments for students’ learning in mathematics. The researchers suggested further studies to examine different aspects of homework quality, such as variation in the assigned tasks, opportunities for students to apply various strategies and generate new ideas.

To sum up, homework quality appears to be an important construct that may be related to students' homework self-regulation and achievement.

2.4 How *homework feedback* is related to homework self-regulation and achievement?

Feedback is defined as "actions taken by (an) external agent(s) to provide information regarding some aspect(s) of one's task performance" (Kluger & DeNisi, 1996, p. 255). There are several review studies on feedback and assessment (e.g., Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Black & Wiliam, 1998; Gibbs & Simpson, 2004; Hattie & Timperley, 2007; Kluger & DeNisi, 1996; Shute 2008). Feedback about the task (i.e., feedback which includes information about how well a task is accomplished), feedback about the processing of the task (i.e., feedback which includes information about the processes underlying the task), and feedback about self-regulation (i.e., feedback which includes information about students' monitoring and regulating of their actions) are suggested to be more effective than feedback about the self as a person (e.g., "Good girl") which generally includes little information about the task performance and does not contributes to further understanding of the task or self-regulation (Hattie & Timperley, 2007). Timing of feedback is also important for feedback to be supportive for students' learning (Gibbs & Simpson, 2004). At the end of their review on feedback, Hattie and Timperley (2007) concludes that "To be effective, feedback needs to be clear, purposeful, meaningful, and compatible with students' prior knowledge and to provide logical connections. It also needs to prompt active information processing on the part of learners, have low task complexity, relate to specific and clear goals, and provide little threat to the person at the self level. The major discriminator is whether it is clearly directed to the task, processes, and/or regulation and not to the self level." (p. 104). Evaluative feedback (i.e., feedback focuses on grading) is less effective than formative feedback (i.e., feedback informing learner about how to correct misunderstanding or track progress) for students' self-regulation (Davis & Neitzel, 2011).

Nicol and Macfarlane-Dick (2006) addressed feedback within a self-regulation perspective. Accordingly, students have goals to be achieved for and feedback provides information about students' current performance in relation to these goals. In fact, feedback helps students develop self-assessment which enables students identify problems in their learning by themselves (Sadler, 1998) and therefore students can take step to close the gap between their goals and current performance. In order to facilitate self-regulation, Nicol and Macfarlane-Dick (2006, p. 205) suggested seven principles for feedback:

1. helps clarify what good performance is (goals, criteria, expected standards);
2. facilitates the development of self-assessment (reflection) in learning;
3. delivers high quality information to students about their learning;
4. encourages teacher and peer dialogue around learning;
5. encourages positive motivational beliefs and self-esteem;
6. provides opportunities to close the gap between current and desired performance;
7. provides information to teachers that can be used to help shape teaching.

Regarding the relationship between feedback and learning outcomes, previous research has suggested positive impacts of feedback on student learning and performance. A meta-analysis over 250 studies of feedback (Black & Wiliam, 1998) revealed that feedback can lead to significant learning gains. Feedback which provides correct answer was found to be more effective than feedback which only informs learners about correctness of their responses (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991). High quality feedback which offers correction for errors and permitting resubmission of the assignment is recommended. Discussion with teacher is a form of dialogical feedback which helps to correct misunderstandings and set appropriate goals (Nicol & Macfarlane-Dick, 2006).

Specific to homework, a few studies have investigated the relationship between teacher feedback on homework and students' self-regulation and achievement. Among these researchers, Xu (2009a) investigated predictive power of teacher feedback on students' homework management among Grade 8 and Grade 11 students (*n*= 1895) from 111 classes. HLM analyses revealed that teacher feedback was significantly and positively related to homework management at the student level while it was not a significant predictor at the class level. However, it should be noted that teacher feedback items used in the study addressed how much of the homework is ‘discussed/ collected/ checked/ graded/ counted in overall grade’ which mainly focuses on amount of feedback received on the assigned homework rather than quality of feedback. With the same conceptualization of feedback, Xu and Wu (2013) examined Grade 8 (n= 866) and Grade 11 (n= 745) students’ purposes of doing homework in relation to teacher feedback. Teacher feedback was found to be statistically significantly and positively correlated with students’ purposes of doing homework for peer-oriented reasons (r= .20), adult-oriented reasons (r= .29), and learning-oriented reasons (r= .31).

Trautwein and Ludtke (2009) examined predictive effect of homework control (i.e., teacher control of students’ homework completion) on homework motivation and homework effort variables in different school subjects. HLM analyses results revealed some mixed results; among the six school subjects, homework control was a significant class level predictor for three of the subjects. The researchers suggested that teachers’ increase in strict control of homework may cause decrease in students’ intrinsic motivation by leading students an explicit focus. Therefore, they pointed out the need to further investigating homework control in terms of quality and frequency, and using appropriate measures.

In summary, based on the related literature, teacher feedback on homework may have a potential to influence students’ self-regulation in homework and their achievement.

2.5 How *classroom goal structure* is related to students' homework self-regulation and achievement?

Although there is limited research on the effects of classroom goal structure / teachers' goal orientations on homework variables, extensive research has examined goal structure of the learning environment in the general academic context. An early study by Ames and Archer (1988) investigated how salience of mastery and performance classroom goal structures in the classroom relates to students' learning strategies and motivational processes. Totally 176 students in Grades 8-11 who attended academically advanced junior high and high schools participated in the study. It was found that student who perceived their classroom as mastery goal oriented (i.e., working hard is important, mistakes are viewed as part of learning, and success is defined as personal improvement which also constitutes basis for evaluation) used more learning strategies, preferred challenging tasks, hold more positive attitudes toward class, and had a stronger belief that success results from effort. On the other hand, students' perceptions of performance goal emphasis (i.e., performing better than others and getting high grades are important, and evaluation is based on normative basis) was not associated with learning strategy use or tasks choices but they were negatively linked to attitude toward class and self-perceptions of ability, while positively related to a tendency to attribute failure to lack of ability. In a survey study (Kaplan & Maehr, 1999), which included Grade 6 students (n= 168) as participants, showed that mastery goal structure of school positively predicted overall grade point average (GPA) while performance goal structure was not a significant predictor. On the other hand, in their study with Grade 8 students (n= 296) Roeser, Midgley, and Urdan (1996) found no significant relationship between students' perceptions of school mastery and performance goal structure with achievement as measured by the averages of grades from core school subjects (English, mathematics, science, and social sciences) in the final semester of eight grade.

Wolters (2004) conducted a study to examin relationships between classroom goal structures and students' motivation, use of learning strategies, and achievement in mathematics subject. Grade 7 and 8 students (*n*= 525) completed self-reported surveys. Hierarchical regression analyses were conducted to examine predictive effect of classroom goal structures on the dependent variables of interest. Analyses results revealed that classroom mastery goal structure was a significant and positive predictor of choice, effort, persistence, mastery goal orientation, performance-approach goal orientation, self-efficacy, cognitive strategy use, metacognitive strategy use, and course grade, while it was a significant negative predictor of performance-avoidance goal orientation and procrastination. On the other hand, performance-approach goal structure was found to be significantly and positively related to cognitive strategy use, metacognitive strategy use, performance-approach goal orientation, performance-avoidance goal orientation, and procrastination, while it was significantly and negatively related to persistence in math, and performance-approach goal structure was not related to choice, effort, mastery goal orientation, self-efficacy, and course grade. Another study (Midgley & Urdan, 2001) investigated predictive effect of classroom goal structures on Grade 7 students' (*n*= 484) use of self-handicapping strategies specific to mathematics domain. Self-handicapping strategies are defined as "strategies to deflect attention away from ability as a reason for low performance, should it occur" (Midgley & Urdan, 2001, p. 62), such as putting off doing a task until last minute so that if their task performance is not good, they can say that is the reason. Hierarchical regression analyses revealed that students' perceptions of learning environment which emphases self-improvement and effort (classroom mastery goal structure) was negatively related to self-handicapping while learning environment which emphasizes competition and relative ability among students (classroom performance goal structure) was positively related to reports of self-handicapping. Therefore, the associations between classroom mastery goal structure and adaptive student outcomes were more consistent for mastery goal structure than for performance goal structure.

Studying with 1163 Grade 4-6 students, Fast et al. (2010) investigated the influence of students' perceptions of mathematics learning environment on their mathematics achievement measured through standardized test scores. It was found that students who reported more mastery oriented learning environments had higher levels of mathematics self-efficacy. Moreover, higher self-efficacy levels were associated with higher levels of mathematics performance. Although students' perceptions of learning environment did not directly influence students' mathematics performance, it was related indirectly through the mediating effect of self-efficacy.

The influences of classroom goal structures on student learning outcomes were investigated in a number of studies in Turkey. Recently, Kahraman (2011) investigated antecedents and consequences of goal orientations in science among Turkish students. Totally 977 Grade 7 students were surveyed. Perceived teacher goal orientations were measured as mastery (i.e., students' perceptions of the teacher emphasize on science learning) and performance goals (i.e., students' perceptions of teacher emphasize on grades and competition with others). Path analysis revealed that perceived teacher's mastery goal orientation was positively related to students' personal mastery goal orientation, task value, and metacognition while perceived teacher's performance goal orientation was positively associated with higher levels of maladaptive coping strategies of projective coping (i.e., blaming others when facing with an academic failure), denial coping (i.e., not caring about the failure), and non coping (i.e., blaming themselves for the failure). In a previous study (Tas, 2008), Grade 7 Turkish students' goal orientations were examined in relation to classroom goal structures using HLM. From 62 classes, totally 1950 students completed self-reported scales. Classroom learning environment which emphasized students' science learning and developing competence encouraged students' mastery goal endorsement while classroom environments which focused on performance and comparison of students promoted students to adopt performance-approach goals.

A recent meta-analysis (Rolland, 2012) on classroom goal structures in middle and high schools (Grades 6-12) revealed that classroom mastery goal structure promotes adaptive student outcomes such as personal mastery goal orientation, personal competence, self-efficacy, and self-esteem. Regarding achievement, a positive correlation was found between classroom mastery goal structure and achievement in sixth grades but no association was found in older grades. On the other hand, students' perceptions of higher levels of classroom performance goal structure was linked to students' personal performance goal orientations while no relationship was found with students' feelings of personal competence. As regard to achievement, a negative correlation was found between classroom performance goal structure and achievement in sixth grades but again no association was found in for studies including older grades. The researcher pointed out that sixth grade is a critical period; six graders may be more vulnerable and respond differently to classroom climate than older students due to transition from elementary to middle school.

To sum up, research on classroom goal structure has generally addressed mastery and performance goal structure division in learning environment. These studies suggest that classroom mastery goal structure is promotive of more positive student outcomes such as cognitive and metacognitive strategy use, personal mastery goal orientation, and achievement than classroom performance goal structure which is generally related to negative student outcomes such as performance-avoidance goals and procrastination. However, it should be noted that the expected positive relationship between mastery goal structure and achievement was found in some of the studies while others reported a non-significant relationship. Although aforementioned studies are not specific to homework context, it might be reasonable to explore teachers' goal emphasize in the homework situation and expect somewhat similar findings.

2.6 How *teacher support for students' use of homework strategies* is related to students' homework self-regulation and achievement?

The effect of strategy instruction on student outcomes was investigated in a number of studies. For instance, Hamman, Bethelot, Saia, and Crowley (2000) examined teachers' coaching of students' learning and its relations to students' strategy use. Coaching was described as teacher's instructions about learning processes and strategies, such as suggesting use of a strategy like "You should probably consider planning some homework time each night to work on your research project" (p. 345) and providing rationale for strategy use like "I suggest you take a practice test—Putting yourself in a similar testing situation will help you determine whether or not your prepared for the test" (p. 345). Eleven middle school teachers were videotaped and students were surveyed regarding learning-strategy use. When the correlations between coaching of learning and students' strategic activity was examined, teachers' coaching was found to be statistically significantly and positively related to students' use of rehearsal strategies, metacognitive regulation, and effort regulation.

A longitudinal study was conducted by Kistner et al. (2010) to examin teachers' strategy instruction in relation to students' achievement. They differentiated between teachers' explicit strategy instruction (i.e., the teacher explains importance of a particular strategy to students and tells students directly to use it) and implicit strategy instruction (i.e., the teacher prompts use of a particular strategy without directly referring to it). Twenty German mathematics teachers and their students' (*n*= 538, Grade 9) were videotaped and students' mathematics achievement was tested through several tests. The most frequently instructed strategies were cognitive strategies; specifically organization and elaboration strategies. An example of teacher statement for elaboration strategy was "Now we will quickly summarise, so that we know what actually the point is." (p. 163) and organization strategy was "While working on this kind of task, you should always ask yourself: 'What do I already know?' and 'What am I looking for?'" (p. 163).

Strategy instruction mostly occurred in an implicit way (85% of the total number of strategies) and explicit strategy instruction was rare (15% of the total number of strategies). When the correlations among the instructed strategies and student mathematics performance measures were examined, only organization strategy instruction was found to be statistically significantly and positively related to student achievement (*r*= .47) while rest of the strategy instructions (elaboration, planning and systematic activity, monitoring and evaluation, resource management, and feedback) were unrelated to achievement. The researchers suggested that the low occurrence of particular strategy instruction might be the reason for these null relationships. When the explicit and implicit strategy instruction division was considered, explicit strategy instruction was significantly and positively related to achievement (*r*= .52) while a null relationship found between implicit strategy instruction and achievement (*r*= .17). This result was expected because explicit strategy instruction helps students maintain the strategy and transfer it to appropriate settings (Brown, Campione, & Day, 1981). Despite the rare occurrence of explicit strategy instruction in the classrooms, students benefited more from explicit strategy instruction. Therefore, the researchers called attention to teacher education programs to provide their students with explicit strategy instruction training.

Several intervention studies examined the effects of teacher strategy support on student outcomes. For instance, Lan (1996) investigated effects of self-monitoring on students' use of learning strategies, attitude, self-judgment ability, and performance. Graduate students (*n*= 72) in a statistics class were assigned to self-monitoring group (in which students recorded frequency and intensity of learning activities they involved), instructor-monitoring group (in which students monitored teaching activities of the instructor), and control group (in which students took the course without any treatment). Students in the first and second group were given self-monitoring protocol and instructor monitoring protocol, respectively. Self-monitoring protocol included statistical concepts that were going to be learned in the course. Along with each concept, students recorded amount of time they spent in reading textbook, completing assignment, participating in group discussions, and other activities that they involved to master the concepts. The teacher-monitoring protocol was parallel to self-monitoring protocol with the difference that students rated instructors' teaching activities. Analyses results revealed that self-monitoring group reported higher levels of self-regulated learning strategies of self-evaluation, environmental structuring, rehearsal, memorization, and reviewing previous tests and assignments for test preparation more than did the students in the other groups. Moreover self-monitoring students outperformed students in the other groups on the course examination. However, no attitude differences were found among the groups. The researcher asserted that self-monitoring helped students to be alerted about effectiveness of self-regulated strategies and suitability of learning environment. Therefore, it is important for educators to support students' self-regulation and provide opportunities for students to practice them. He concluded that "We cannot expect self-monitoring or other self-regulated learning strategies to be automatic products of course work. Students at all levels, from learning-disabled students to graduate students, need systematic help to learn and use self-regulated learning strategies." (p. 113).

Arsal (2009) investigated the effect of self-regulation instruction through diaries and teacher feedback on students' achievement in and attitudes towards mathematics in a pretest-posttest control group design in Turkey. Totally 60 Grade 4 students participated in the study. During six weeks period, students in the experimental groups reported their planning, monitoring, goal setting, and self-evaluation in a self-report form. At the end of every week, the teacher controlled the self-report form and gave feedback to students such as effectiveness of their strategy use. Students in the experimental group outperformed students on the mathematics achievement test and also reported higher levels of attitudes towards mathematics than students in the control group. The researcher concluded that self-regulation instruction helped students to monitor and evaluate their learning process which contributed to their achievement and also to their attitudes, and suggested teachers to provide instruction on self-regulation.

A meta-analysis on self-regulated learning intervention studies (Dignath & Buttner, 2008) investigated the effects of training characteristics on training outcomes. A total of 74 studies from primary and secondary school levels were included in the analysis. Regarding students' academic performance, at the primary school level, studies which included metacognitive strategy training yielded higher effect sizes; whereas at the secondary school level, metacognitive reflection trainings were more effective. This difference was attributed to difference in students' developmental level, because as students get more experienced they begin to use sophisticated strategies but at earlier ages, students might more benefit from pure metacognitive instruction to enhance their strategy repertoire (Schneider & Sodian, 1997). With regard to motivational outcomes, the effect sizes were higher for primary school students than for secondary school students. The researchers asserted that this finding is in line with previous research which demonstrated that students have higher motivation in early grades and this motivation declines as students increase in grade level.

Ley and Young (2001) recommended four instructional principles that support students' self-regulation. Accordingly, it is important to give advice to students about how to arrange environment. For instance, suggesting students how to structure environment by eliminating distractions are recommended. Secondly, organizing instructional material to promote cognitive and metacognitive processes is emphasized. In order to do so, use of concept maps, graphic and advance organizers, and previews, which help to visualize and identify concept relationships and aid organization, are highly suggested. Thirdly, in order to promote students' monitoring, use of instructional goals and feedback are suggested. For instance, students can be prompted to observe and record their activities and track progress in their assignments. Feedback can be provided on the assignment and students can be prompted to attain desired goals. Finally, students should be provided with evaluation information. For instance, student performance on the tests or assignments that is evaluated against some standards should be reviewed with students and they can get corrective feedback. Students can also be provided with occasions to self-evaluate their performance. For example, they can be given a checklist including observable criteria and instructed about how to use it in order to evaluate their performance.

Although the influence of teacher support on several affective and cognitive outcomes has been investigated, no study was encountered investigating teacher support for students' use of strategies during homework. Teachers frequently assign homework (van Voorhis, 2004) and expect their students to make effort and complete their homework in time (Ersoy & Anagun, 2009), then it seems reasonable to explore what teachers do to support their students in the homework process.

2.7 How *homework self-regulation* is related to achievement?

In this section, due to the limited research on the relationships between students' achievement and self-regulation in the homework context, firstly studies which examined the association between self-regulation in general academic context and achievement were reviewed and then available research on homework self-regulation and achievement were examined.

As far as the relationship between students' personal goal orientations, as one of the components of self-regulation, and achievement is considered, previous studies did not reveal straightforward relationships. While some studies revealed a positive relationship between mastery goal orientation and achievement, others failed to find a relationship between goal orientations and achievement. For instance, Kaplan and Maehr (1999) surveyed Grade 6 students (*n*= 168) and conducted hierarchical multiple regression analyses on the data. Personal mastery goal orientation was found to be a significant and positive predictor of overall grade point average (GPA). Another correlational study (Wolters, Yu, & Pintrich, 1996) also revealed a positive association between students' mastery goal orientation and academic performance among Grade 7 and 8 students (*n*=

434). On the other hand, a survey study (Roeser et al., 1996) with Grade 8 students (*n*= 296) found that students' second semester GPA (average of core subject grades) was not related to their personal mastery goal orientations. Similarly, Barron and Harackiewicz's (2001) study with undergraduate students (*n*= 166), Skaalvik's (1997) study with Grade 6 students (*n*= 434), and Wolters (2004) survey study with Grade 7 and 8 students (*n*= 525) found a non-significant relationship between endorsement of mastery goals and achievement.

Studies have not either revealed consistent results about the relationship between students' performance goal orientations and academic achievement. While some research found a null relationship between performance/performance-approach goal orientation and achievement (Kaplan & Maehr, 1999; Roeser et al., 1996; Wolters et al., 1996), others demonstrated that performance-approach goal orientation was positively related to academic achievement (Skaalvik, 1997; Wolters, 2004). The relationship between performance-avoidance goal orientation and achievement is more clearly established; performance-avoidance goal orientation was generally found to be negatively related to achievement (Elliot & McGregor, 2001; Skaalvik, 1997), although this has not always been the case; a null relationship was found between performance-avoidance goals and students' mathematic grades (Wolters, 2004). Work-avoidance goal orientation, another type of goal orientation, has generally found to be negatively related to achievement (e.g., Ainley, 1993; Meece et al., 1988). For instance, Meece et al. (1988) reported a statistically significant and negative correlation (*r*= -.21) between work-avoidance goal orientation and standardized achievement scores.

As far as the relationship between strategy use and achievement is considered, studies generally indicated that students who displayed high levels of strategy use also demonstrated high achievement. For instance, in a correlational study (Pintrich & De Groot, 1990) the relationships among cognitive strategy use (rehearsal, elaboration, and organization strategies), self-regulation (metacognitive and effort management strategies), and achievement was investigated. Achievement was measured by five performance scores; in-class seat work and homework, quizzes and tests, essays and reports, first semester grade, and second semester grade. Participants were Grade 7 students (*n*= 173) from English and science classes, and they responded surveys specific to English or science domain. Zero-order correlations between cognitive strategy use and achievement measures were significant and positive other than the non-significant correlation for in class seat work. Regarding self-regulation strategies, all achievement measures were found to be significantly and positively related to self-regulation strategies. Another study (Zimmerman & Martinez-Pons, 1990) compared academically gifted (*n*= 90) and regular students (*n*= 90) in Grade 5, 8, and 11 regarding their use of self-regulated strategies. MANOVA results yielded significant main effect for giftedness. Univariate test results indicated that gifted students reported significantly higher use of organizing and transforming strategies, environmental structuring, seeking peer assistance, and strategy of reviewing notes than regular students. In an early study, (Zimmerman & Martinez-Pons, 1986) Grade 10 students' (*n*= 80) self-regulated learning strategy use statistically significantly and positively predicted students achievement in mathematics and English as measured by a standardized achievement test.

Yumusak, Sungur, and Cakiroglu (2007) investigated Turkish high school students' biology achievement in relation to several motivational beliefs and cognitive and metacognitive strategy use variables. Grade 10 students (*n*= 519) from 15 high schools completed MSLQ and biology achievement test. Multiple linear regression analysis results revealed that among the motivational variables of interest, task value (β= .16) was a positive predictor while extrinsic goal orientation (β= -.22) was a negative predictor of achievement. Motivational variables in the model accounted for 10% of the variance in the achievement scores. Another multiple regression was conducted with strategy use predictors. Results indicated that organization (β= .13) and time and study environment (β= .15) positively predicted achievement while rehearsal (β= -.22) and peer learning (β= -.12) negatively predicted achievement. Strategy use variables accounted for 9% of the variance in students' achievement scores. Therefore, students who studies for the reason of demonstrating abilities to others (i.e., extrinsic goal oriented) obtained lower scores in the achievement test. On the other hand, students who perceived biology course to be interesting, useful, and important (i.e., high task value), who used higher levels of organization strategies and managed time and study environment were more successful in the achievement test. The negative relationship found between achievement and rehearsal strategy use and peer learning was unexpected. The researchers explained that since the biology test involved questions requiring higher order thinking skills, just memorization and simple recall might not be sufficient to get high scores on the test and the lack of emphasis in group work and collaboration in the biology curriculum might be the reasons. Another study from Turkey (Sungur & Gungoren, 2009) investigated students' science achievement (measured by students' self-reported science grades) in relation to motivational beliefs (measured trough self-efficacy and intrinsic value), goal orientations (measured through mastery and performance goal), and strategy use. Grade 6-8 students (n= 900) from 5 public schools participated in the study. Structural equation modeling analysis results revealed a positive link between achievement and motivational beliefs (β= .11) and goal orientations (β= .21). On the other hand, no significant relationship between achievement and strategy use (β= -.04) was observed. The model explained 7 percent of the variance in science achievement.

Several studies have investigated the relationship between procrastination and academic achievement. In an early study (Solomon & Rothblum, 1984), college students' (n= 342) course grade in the introductory psychology course was found to be unrelated to self-reported procrastination. The researchers explained that, since the procrastination scale used in the study addressed students' procrastination in general rather than specifically focusing on the psychology course, might result in this null relationship between procrastination and academic performance. They suggested investigating the association between procrastination and course grade specific to course taken. On the other hand, in a sample of 286 students enrolled in general psychology at an urban community college, students' academic procrastination level was found to be negatively correlated with GPA (cumulative grade point average) (Prohaska et al., 2000). In another study, Moore (2008) surveyed college students (*n*= 889) in the first day of introductory biology course regarding their procrastination tendency. Students who got As at the end of the class reported the lowest levels of procrastination than other students. Similarly, studying with undergraduate students (*n*= 368) enrolled in an education faculty in a public university in Turkey, Akkaya (2007) found a negative relationship between students' GPA and academic procrastination tendency. A recent meta-analysis on procrastination (Steel, 2007) revealed negative correlation between procrastination and overall GPA (*r*= -.16), course GPA (*r*= -.25), scores on final exam (*r*= -.17), and assignment grades (*r*= -.21). Therefore, majority of research yielded a negative relationship between procrastination and academic achievement.

A few studies particularly focused on homework self-regulation and achievement. A homework study from China (Hong et al., 2009) examined whether students' reported homework self-regulation differed as a function of students' achievement levels. Participants were Grade 7 (*n*= 330) and Grade 11 (*n*= 407) students from a metropolitan city. Students' final mathematics examination scores were used to measure achievement. Students with examination scores in the bottom quartile were grouped into low-achievers; students who scored in the middle 25% were grouped into medium achiever; and students in the top quartile were assigned into high achievers. Among seventh graders, high achievers reported the highest homework self-regulation levels (*M*=2.93; *SE*=.05), followed by medium achievers (*M*=2.89; *SE*=.05), and low achievers (*M*=2.66; *SE*=.05). The mean difference in homework self-regulation scores between low and medium achievers; and between low and high achievers was statistically significant. However, in eleventh grade, there was no difference among low, medium, and high achievers in terms of their mean homework self-regulation scores.

In another study, Xu and Corno (2003) surveyed Grade 6-8 students (n= 121) from an urban middle school regarding their homework management strategy use. Students' had taken a standardized reading test (California Test of Basic Skills) and mathematics test (California Achievement Test) two months prior to the survey administration. None of the Pearson correlations between achievement and components of homework management strategies (i.e., regulating environment, time, attention, motivation, and emotion) were statistically significant indicating that there seems to be no relationship between standardized test scores and self-reported homework management strategies. The researchers suggested that investigating the relationship between homework management strategies with alternative forms of assessments which resembles with more real life situations, such as requiring managing time and dealing with distractions, is needed to better understand the underlying relationships.

A study from Germany (Dettmers et al., 2010) investigated Grade 9 and 10 students' (n= 3483) mathematics achievement in relation to homework quality, homework motivation, and homework behavior in mathematics. Homework motivation was represented by two components; homework expectancy (e.g. item: "If I make an effort, I can do all my mathematics homework") and homework value (e.g. item: "Our mathematics homework takes a lot of time and is of little use to me" [reverse scored]). Homework behavior was addressed through homework effort (e.g. item: "I always try to do my complete mathematics homework") and homework time. Homework time was measures by an open-ended question asking amount of time (in hours) students spent on homework per week and mathematics achievement was measured by a mathematics achievement test. Multilevel modeling analysis revealed that while homework value and homework time was not a statistically significant predictor of achievement, homework expectancy and homework effort statistically significantly and positively predicted achievement. Therefore, students who had positive beliefs about their capability to do homework (high homework expectancy) and who do homework to the best of their ability (high homework effort) performed well on the achievement test.

In summary, based on the related literature, students' homework self-regulation may have a potential to influence students' achievement. Having examined the relationships between homework self-regulation and achievement, the next section focuses on the study context and reviews homework studies conducted in Turkey.

2.8 Study context and homework studies in Turkey

Education system in Turkey has changed recently. In March 2012, a new legislation passed which prolonged compulsory education from 8 years to 12 years (4 years of elementary education, 4 years of middle school education, and 4 years of high school education) (Turkey Grand National Assembly, 2012). The new science program was published in February 2013 and the implementation of the program will begin in 2013-2014 academic year (Board of Education, 2013). The pilot studies of the current study were conducted in the spring term of 2010-2011 academic year and the main data were collected in December 2011. Therefore, when the data were collected, the previous program that is, the program revised in 2005, was practiced. According to this program, homework is one of the main aspects of the Turkish Science and Technology curriculum, because it provides opportunity for students to review the material learned in the school and contribute to students' scientific thinking (Ministry of National Education, 2006). For instance, while doing homework, students summarize knowledge from different sources, organize knowledge, and state understandings in their own words. The program also emphasizes that in order homework to be beneficial for students' learning, it should posses certain characteristics such as contributing to students' personal development and responsibility for learning, consolidating newly learned material, being appropriate for students' social and cultural conditions, and giving students opportunity to think about how much of the material has been learned (Ministry of National Education, 2006).

Despite its importance, relatively few homework studies were conducted in Turkey. Majority of studies however, mainly investigated teachers' and students' views on homework (e.g., Aladag & Dogu, 2009; Ersoy & Anagun, 2009) and attitudes toward homework (e.g., Yesilyurt, 2006; Yucel, 2004). For instance, in one of the studies (Aladag & Dogu, 2009), Grade 6-8 students (n= 426) from 8 public schools in Konya were surveyed regarding their views on science homework. Descriptive statistics were conducted and results revealed that most of the students thought that homework helps them understand and consolidate the subject material. Students reported that teachers' checking of the homework encouraged them to give more importance to their homework and homework contributed to teacher-student interaction. Students' responses to the survey items further revealed that homework which was connected to up to date issues and which was done as a group was preferable to homework done individually.

Another study (Ersoy & Anagun, 2009) examined Grade 5 elementary school teachers' (n= 8) views on science homework. Semi-structured interviews were conducted and the data were analyzed through descriptive data analyses methods. Results revealed that seven of the participating teachers' main purpose of assigning homework was consolidating science concepts; they assigned homework which requires students to practice newly learned material. Only one of the teachers mentioned assigning homework in order to develop students' responsibility and another teacher aimed to encourage parent involvement. All teachers perceived homework as complementary to school learning. The researchers recommended that teachers should assign different types of homework which support students' use of science process skills and development of study discipline in their students.

Yesilyurt (2006) investigated high school students' attitudes toward biology homework. From 5 high schools in different districts of Erzurum, 580 Grade 9 students were surveyed and 25 of the students were interviewed. Mann-Whitney U test results of the means of all items in the survey indicated that girls (M= 3.39) statistically significantly had more positive attitudes towards biology homework than boys (*M*= 3.25). Each item in the survey was further analyzed and for most of the items difference was in the favor of girls. For instance, girls (*M*= 3.97, *SD*= 1.28) thought that biology homework had an important role in their learning of the biology concepts more than boys (*M*= 3.34, *SD*= 1.41). Regarding homework control by teacher, students generally hold positive attitudes; they believed that teacher's control of homework was important and controlling of homework contributed to correction of errors and also development of teacher-student relationships. For all homework control items, again girls had statistically significantly higher means than boys. In the interview, participants were asked about characteristics of an effective homework. Students responded that homework should be in line with their needs and skills, for instance homework which required making research and support creativity would encourage them do homework. Students were further asked about the ways that could be helpful for doing homework correctly. They responded that teacher should teach how to search for and use different resources and they emphasized importance of clear explanations about the purposes of homework and how the homework could be prepared. They also told that control of and feedback on homework could enhance its effectiveness.

Yildirim, Cikrikci Demirtasli, and Akbas (2012) examined and compared homework related opinions of Grade 8 mathematics teachers who participated in TIMSS 1999 (*n*= 204) and TIMSS 2007 (*n*= 146). Z-test was employed in order to compare teachers' responses to items. Most of the teachers' responses did not changed over time, but teachers' frequency of "checking whether the homework was done or not" increased; the percentage of teachers who reported to check homework *sometimes* increased from 23.6% to 50.6%. However, percentage of teachers in *almost always* category (43.6%) was still much lower than the international mean (79.9%). Furthermore, the percentage of teachers who reported to *almost always* "correct assignments and then give feedback to students" increased from 20.9% to 38.5% by time, but Turkish teachers were still below international average, which was 56.7% for the *almost always* category. Turkish teachers reported to use homework to contribute towards students' marks more frequently in 2007 than 1999 and their percentage was above the international mean. This might be as a result of changes made in the curriculum which emphasizes importance of homework and project assignments in students' performance evaluation (Ministry of National Education, 2006).

Recently, Iflazoglu and Hong (2011, 2012) investigated Turkish students' homework motivation and homework preferences. Iflazoglu and Hong (2012) examined predictive power of homework motivation and homework preferences variables on students' perceived homework achievement and homework attitudes. Grades 5-8 students (*n*= 1776) from 10 schools participated in the study. Turkish version of Homework Motivation and Preference Questionnaire (HMPQ; Hong & Milgram, 1998, 2001) was used. Accordingly, students' sources of homework motivation referred to factors that may influence students' willingness to start and do homework (Hong, Miligram, & Rowell, 2004); self-motivation (e.g., "When I do my homework, I like to do the best work that I can"), parent-motivation (e.g., "I like to do my homework well so that my parents will be proud of me") and teacher-motivation (e.g., "I like to do my homework well so that my teacher will be proud of me"). Homework preferences addressed "learner's intrapersonal and interpersonal preferences about how, where, when, and with whom to do homework" (Hong, Miligram, & Rowell, 2004, p. 198) which included organizational (order and place), surroundings (sound and light), perceptual-physical (tactile and intake), and interpersonal (alone/peers and authority figures) components. Perceived homework achievement (e.g., "I finish the homework that is assigned to me every time") and homework attitude (e.g., "I like doing homework") were the dependent variables. Multiple regression analyses were conducted separately for each grade level that is, for Grade 5, 6, 7, and 8. Analyses results revealed that the predictors accounted for large amount of variance (from 37.4% to 56.5%) in homework achievement and homework attitude. Among the predictors, self-motivation and order were found to be statistically significantly and positively related to the dependent variables in all grade levels. Accordingly, self-motivated students and students who set order when there are many assignments to do, such as starting from the easy assignment, had positive perceptions of homework achievement and homework attitude. On the other hand, neither parent motivation nor teacher motivation was related to students' homework achievement and attitude. However, it should be noted that the study did not consider domain-specificity in homework.

The aforementioned studies provide some information about Turkish teachers' and students' views of homework, students' attitudes toward homework, and also about students' sources of homework motivation and homework preferences but no study from Turkey investigating students' homework self-regulation and characteristics of homework in relation to their subject achievement was encountered.

2.9 Proposed homework model

The present study proposes a domain specific and multilevel homework model (See Figure 1.1) which is based on self-regulation theory from socio-cognitive perspective (Pintrich, 2005; Zimmerman, 2005). Basically, the relationships among learning environment, student characteristics, homework self-regulation, and achievement in science are modeled. The model predicts that students' homework self-regulation (i.e., goal orientations, use of strategies, and procrastination) is related to their achievement. As students with purpose of improving understanding of the material and developing skills (i.e., mastery goal oriented) are more likely to demonstrate higher achievement (e.g., Hsieh, Sullivan, & Guerra, 2007; Kaplan & Maehr, 1999; Wolters, et al., 1996), it is hypothesized that mastery goal orientation in doing homework will be positively associated with science achievement. On the other hand, as students' purpose of minimizing the effort they exert in a given task and get away with (i.e., work-avoidance goal orientation) is found to be negatively related to students' achievement (e.g., Ainley, 1993; Meece et al., 1988), it is hypothesized that students who are highly work-avoidance goal oriented in doing homework will perform poorly in the science achievement test. Since previous research has revealed inconsistent results regarding the relationship between performance goal orientation and achievement (e.g., Kaplan & Maehr, 1999; Wolters, 2004), no priory hypothesis is made about the association between students' performance goal orientation in homework and their science achievement. Furthermore, as students' tendency to postpone or completely avoid doing a given task (i.e., procrastination) is found to be associated with low levels of achievement (e.g., Akkaya, 2007; Moore, 2008; Prohaska et al., 2000), it is hypothesized that students who delay their homework will perform poorly in the science achievement test. In addition, as students who use higher levels of strategies are more likely to have higher achievement (e.g., Pintrich & De Groot; Zimmerman & Martinez-Pons, 1986, 1990), it is expected that students who utilize more strategies during homework will score higher on science achievement test.

Moreover, the model predicts that learning environment characteristics (teacher and homework characteristics) and student characteristics (gender and prior achievement) influence students' homework self-regulation and achievement. Information is lacking regarding the effect of quality of homework on students' goal orientations, however, as characteristics of task such as meaningfulness and difficulty has found to be associated with students' goal orientations (Kumar & Jagacinski, 2011; Seifert & O'Keefe, 2001) and procrastination (Ferrari, Mason, & Hammer, 2006; Ferrari & Scher, 2000), quality of homework is expected to influence students' homework self-regulation and achievement. As teacher feedback was found to be related to students' reasons for doing homework (e.g., Xu & Wu, 2013) and students' homework management strategies (e.g., Xu, 2009a), feedback provided on homework is another factor included in the model that is hypothesized to predict students' homework self-regulation and achievement. Furthermore, as teacher support for students to use learning strategies promote students' strategy use and also achievement (Hamman et al., 2000; Kistner et al., 2010), teachers' support for students' use of deep learning and management strategies during homework is hypothesized to relate to students' homework self-regulation and achievement. Additionally, as teachers' emphasize on learning and developing competence is associated with more adaptive student outcomes like higher levels of learning strategy use and achievement than teacher emphasize on performance (e.g., Ames & Archer, 1988; Kaplan & Maehr, 1999), teachers' goal orientation in homework situation is also expected to relate to students' self-regulation and achievement.

Meanwhile, gender and prior achievement were student characteristics included in the proposed model to control for their effects on students' homework self-regulation and achievement since they have been found to be related to students' self-regulation and achievement (e.g., Reynolds & Walberg, 1991; Reynolds & Walberg, 1992; Roeser et al., 1996; Trautwein et al., 2002).

The model is multilevel; it includes both student level (e.g., gender and achievement) and classroom level (e.g., teacher support for strategy use) variables, and the model is domain specific. The need for domain specificity and multi-level analyses in homework research is explained in the following sections through empirical findings of the previous research.

2.10 The need for multilevel analyses in homework research

When dealing with a hierarchical data structure, such as students nested within classrooms, it is essential to use multilevel techniques (Raudenbush & Bryk, 2002) because these techniques provide more accurate estimates by permitting correlated responses within groups (Roberts, 2004). If there is significant variation between classes as indicated by intraclass correlation (ICC), there is violation of independence of observation which is a requirement of traditional models (Hox, 2002). Recently, some of the homework studies handled data using Hierarchical Linear Modeling analyses and demonstrated that there were significant variations among classes in terms of homework variables of interest. For instance, Trautwein and Ludtke (2009) examined students' homework effort (homework compliance and percentage of homework tasks attempted), homework motivation (expectancy and value beliefs), and perception of homework characteristics (homework quality and control) in six school subjects. Totally 511Grade 8 and Grade 9 students, from 42 classes of 9 schools participated in the study. HLM analyses were used and 36 intra-class correlation coefficients (ICC) were calculated. Among these, other than two (for English and mathematics homework compliance), all of the between-class variance components were statistically significant, implying that there were meaningful differences among classes in terms of homework variables of interest. Another study (Xu, 2009a) investigating students' homework management strategies among Grade 8 and Grade 11 students (*n*= 1895) from 111 classes found that students' homework management varied across classes. Although most of the variance in homework management was at the student level, 6.9 per cent of the variance in homework management was between classes as indicated by ICC. Dettmers et al. (2010), studying with a nationally representative sample of German students (*n*= 3483) from 155 classes in Grades 9 and 10, reported ICC of .18 and .11 for mathematics homework quality indicators of homework selection and homework challenge, respectively. By utilizing multilevel data analyses, these studies point out that between classes variances are different than zero and significant variations exist between classes in terms of homework variables of interest. Furthermore, aforementioned studies showed that class level variables were able to explain some of the variance between classes in homework variables of interest. For instance, students from different classes differed in their homework motivation and behavior as a function of varying levels of homework quality (Dettmers et al., 2010). Therefore, there is need to utilize multilevel techniques to handle hierarchically nested homework data (Trautwein & Koller, 2003).

2.11 The need for domain specificity in homework research

Recent studies provided evidence for domain specific patters of students' motivation, cognition, and behavior (e.g., Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Pintrich, 2003). For instance, Jacobs et al. (2002) documented that students' task-value and self-competence beliefs varies for mathematics, language arts, and sports. Thus, in order to better understand students' motivation and behavior, it is important to consider domain specificity (Trautwein et al., 2006).

In homework research, on the other hand, most of the studies investigated homework in general and has not taken into account subject differences (e.g., Hong & Milgram, 1999; Xu, 2010). Recently, Trautwein and his colleagues focused on the differences in a number of homework constructs across different school subjects. One of the studies (Trautwein & Ludtke, 2009) investigated differences in students' homework behavior, perceptions of homework quality and control, and homework motivation across six school subjects namely, German, English, history, biology, mathematics, and physics. Totally 511 students in Grade 8 and 9 participated in the study. Considerable differences were found across the subjects. Accordingly, percentage of homework tasks attempted was highest in mathematics (75%) and was lower in German (69.9%), English (68.8%), history (63.2%), biology (51.7%), and physics (50.7%). Students' expectancy beliefs (i.e., students' beliefs about their capability that they can successfully do homework assignment) (*M*= 3.21, *SD*= .63) was highest in history and lowest in physics (*M*= 2.85, *SD*= .76), while homework value (i.e., students' perception about the utility and cost of homework assignment) was highest in mathematics (*M*= 3.06, *SD*= .71) and again lowest in physics (*M*= 2.71, *SD*= .76). Students' perceptions of the homework quality was highest for history homework (*M*= 2.73, *SD*= .73) and they reported to highest homework control in German (*M*= 3.07, *SD*= .79). Furthermore, the correlations among school subjects for each of the homework variable were examined. Although some of the correlations were significant, no perfect relationships were detected pointing out domain specificity of the homework constructs.

Trautwein et al. (2006) examined domain specificity in homework behavior, homework motivation, and perceptions of homework quality and control across mathematics and English as a foreign language (Study 1). Totally 411 eight grade students completed self-reported surveys which included items strictly the same wording other than name of the subject. Paired sample t test results revealed that students reported statistically significantly higher levels of concentration and time on mathematics homework than English homework. Furthermore, students believed mathematics homework to be more useful while they were more confident of doing their English homework. Additionally, correlations between mathematics and English homework constructs demonstrated that there were small-to-moderate relationships. For instance, the correlation between mathematics homework expectancy and English homework expectancy was .11 and it was .22 for homework value. Therefore, the research provided evidence for domain specificity of homework constructs and researchers called attention to consider this issue in order to better understand homework process.

To sum up, most of the homework research used domain independent measures. The research which considered subject specificity on the other hand generally focused on mathematics and reading and there is little research on science homework in particular (Ramdass & Zimmerman, 2011).

CHAPTER III

METHOD

3.1 Design of the Study

This study is a quantitative research due to the nature of research questions addressed, hypothesizes generated at the outset, description of the sample and population, data collection procedures, statistical techniques used to analyze data, and generalizations of the study findings. The research questions mainly addressed relationships among a set of variables (i.e., teachers’ homework practices, students’ homework self-regulation, and science achievement). Based on theory and previous research, hypotheses were generated and a model describing the associations among variables of interest was developed. A sample of seventh grade students which respresents all seventh grade students in Turkey were chosen. In order to develop Student Homework Scale and Teacher Homework Scale, which were used to collect self-reported data, pilot studies were conducted and validity evidence was inspected for the scales. Factor analyses were conducted to explore and confirm factor structures of the scales and hierarchical linear modeling was used to analyze main data which was hierarchically ordered. A flow-chart describing participants, instruments, and data analyses of the present study is given in Figure 3.1.

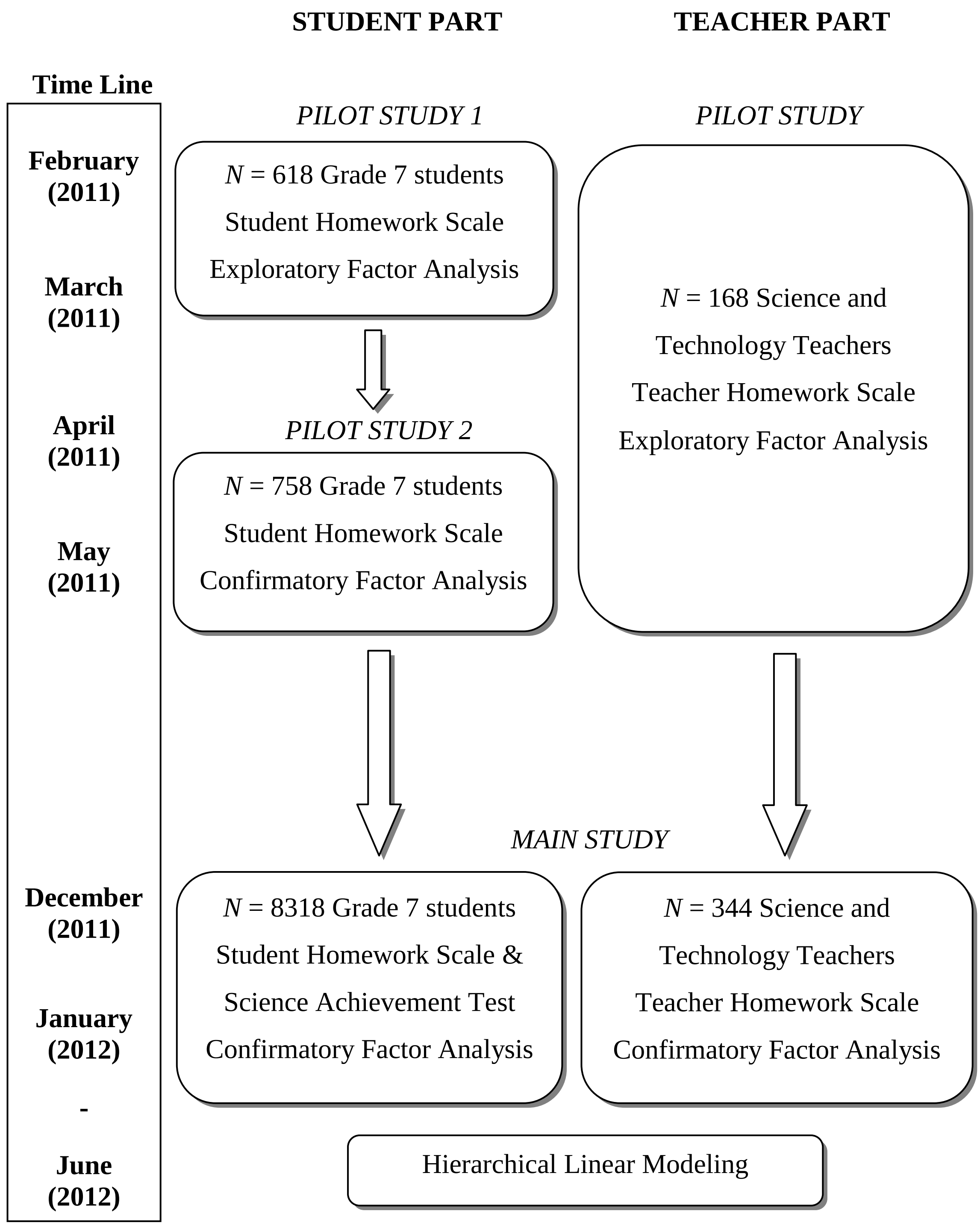

Figure 3.1 Overview of the participants, instruments, and data analyses of the present study

3.2 Population and Sampling

This study is a nationwide study. Population of the study is all 7th grade students and their science teachers in public schools located in province and district centers of Turkey. The reason for choosing Grade 7 is that Grade 6 is a transition from elementary school to middle school which constitutes an adaptation period for middle scholars. On the other hand, Grade 8 students take a central examination at the end of the school year and being oriented towards this examination, their self-regulation may be influenced. Therefore, studying with Grade 7 students seems to be more appropriate. According to Ministry of National Education 2009-2010 formal education statistics, there are 10137 public schools in province and district centers. A sample of schools was drawn from this population. In order to calculate representative sample size, it is recommended to use the formula of $n= [n_0/(1+(n_0/N))]$ (Buyukozturk, Kılıc Cakmak, Akgun, Karadeniz, & Demirel, 2010). In this formula, n_0 is found from the equation of $n_0= [(t \text{ x } S)/d]^2$ where d represents correctness degree, N is population size, S is predicted standard deviation and t is the value from the table for the related confidence interval (Buyukozturk et al., 2010). In this study, by taking d= .05, S= .5, t= 1.96 (for 0.95 confidence interval), the appropriate sample size for N= 10137 schools was 370. Therefore, 370 schools were decided to be selected.

According to Turkish Statistical Institute's (Turkiye Istatistik Kurumu; TUIK, 2005) statistical regional unit classification, Turkey is composed of 12 regions in term of socioeconomic, cultural, and geographic conditions. The regions along with cities are presented in Table 3.1. In the present study this classification is considered when drawing sample. When deciding on the number of schools to be included from each region, the ratio of sample size (370) to the population size (10137) was taken into account. From each region, approximately 3.7% of the schools were included in the sample (See Table 3.1). Thus, the number of sample size was calculated to be 376.

Table 3.1 Turkish Statistical Institute's statistical regional unit classification and number of schools to be included from each region

	Region	*City*	*Total number of schools in province and district centers*	*Number of schools to be included in the sample*
1.	North East Anatolia	Erzurum, Erzincan, Bayburt, Ağrı, Kars, Iğdır, Ardahan	425	16
2.	Central East Anatolia	Malatya, Elazığ, Bingöl, Tunceli, Van, Muş, Bitlis, Hakkari	567	21
3.	South East Anatolia	Gaziantep, Adıyaman, Kilis, Şanlıurfa, Diyarbakır, Mardin, Batman, Şırnak, Siirt	1055	39
4.	İstanbul	İstanbul	1172	43
5.	West Marmara	Tekirdağ, Edirne, Kırklareli, Balıkesir, Çanakkale	440	16
6.	Aegean	İzmir, Aydın, Denizli, Muğla Manisa, Afyon, Kütahya, Uşak	1311	49
7.	East Marmara	Bursa, Eskişehir, Bilecik, Kocaeli, Sakarya, Düzce, Bolu, Yalova	966	36
8.	West Anatolia	Ankara, Konya, Karaman	1032	38
9.	Mediterranean	Antalya, Isparta, Burdur, Adana, Mersin, Hatay, Kahramanmaraş, Osmaniye	1272	47
10.	Central Anatolia	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir, Kayseri, Sivas, Yozgat	782	29

Table 3.1 (Continued)

	Region	*City*	*Total number of schools in province and district centers*	*Number of schools to be included in the sample*
11.	West Black See	Zonguldak, Karabük, Bartın, Kastamonu, Çankırı, Sinop, Samsun, Tokat, Çorum, Amasya	722	27
12.	East Black See	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	394	15
	Total		10137	376

School lists were entered into SPSS. Then from each region, the specified number of schools was randomly selected. Surveys were mailed to selected schools by Department of Research and Development of Education (Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı; EARGED). In the direction form, it was written that in every selected school, one 7th grade class would be included in the study. If there were more than one 7th grade class in the school, one of the classes would be randomly selected by the administration. All students in the selected class and their Science and Technology teacher would complete surveys. From the selected schools, 348 schools agreed to participate in the study.

3.2.1 Student sample

A total of 8318 students completed surveys. Characteristics of the students who participated in the study are presented in Table 3.2. Approximately half of the students (51.2%) were girls. Mean age of the students was 12.16 (SD= .46) years. Students' sixth grade science course report card grade mean was 3.90 (SD= 0.98) out of 5. More than half of the mothers (62.7 %) and fathers (52.4 %) were graduates of elementary school. Majority of the mothers were unemployed (79.0%) while most of the fathers were employed (82.3%). About half of the participants (50.9%) had an internet connected computer and 68.7% of the students had a study room at their homes.

Table 3.2 Characteristics of the students (N= 8318)

Variable	*Frequency*	*Percentage (%)*
Gender		
Boys	4026	48.4%
Girls	4258	51.2%
Missing	34	0.4%
Mother Education Level		
No schooling	893	10.7%
Elementary school	5217	62.7%
High school	1494	18.0%
University	598	7.2%
Missing	116	1.4%
Father Education Level		
No schooling	217	2.6%
Elementary school	4440	53.4%
High school	2197	26.4%
University	1162	14.0%
Missing	302	3.6%
Mother working status		
Employed	1555	18.7%
Unemployed	6571	79.0%
Retired	124	1.5%
Missing	68	0.8%

Table 3.2 (Continued)

Variable	*Frequency*	*Percentage (%)*
Father working status		
Employed	6844	82.3%
Unemployed	782	9.4%
Retired	539	6.5%
Missing	153	1.8%
Having a study room at home		
Yes	5715	68.1%
No	2507	30.1%
Missing	96	1.2%
Having an internet connected computer at home		
Yes	4230	50.9%
No	4000	48.1%
Missing	88	1.1%

3.2.2 Teacher sample

Three hundred and forty four teachers completed surveys. Characteristics of the teachers who participated in the study are presented in Table 3.3. About 53.5% of the teachers were female. Teachers' age ranged from 21 to 62 with a mean of 35.77 (*SD*= 9.69) years. About 59.88% of the participants graduated from a Science and Technology teacher education program, 22.38% were graduates of another teacher education program, while 17.71% of the teachers graduated from a non teacher education program. Teachers' experience in the profession ranged from 1 to 35 with a mean of 12.00 (*SD*= 9.08) years. Teachers reported to teach 22.62 (*SD*= 5.09) hours in a week and in average there were 29 students in their classes.

Table 3.3 Characteristics of the teachers (N= 344)

Variable	*Frequency*	*Percentage (%)*
Gender		
Male	159	46.2%
Female	184	53.5%
Missing	1	0.3%
Graduated program		
Science and Technology teacher education	206	59.88%
Teacher education other than Science and Technology	77	22.38%
Non teacher education program	61	17.73%

3.3 Instruments

Student Demographic Information Scale, Science Achievement Test, Student Homework Scale, Teacher Demographic Information Scale, and Teacher Homework Scale were used. Student Homework Scale and Teacher Homework Scale were developed for this study. During scale development process, firstly, related literature on homework and self-regulation was reviewed and existing scales were examined. Then, an item pool was generated: Some of the items were taken from existing instruments in English. These items were translated and adapted into Turkish following the guidelines of Hambleton and his colleagues (Hambleton, Merenda, & Spielberger, 2005; Hambleton & Patsula, 1999). Forward translation was made by three translators. During translation process, appropriateness of the expressions for Turkish culture and the target groups were considered. Some other items used in the scales were previously translated into Turkish; however some modifications were made in order items to suit the homework context, and some other items were generated by the researchers based on the literature. The items were examined by two faculty members in terms of content validity. They also judged the quality of items regarding clarity, sentence structure, and comprehensiveness. Some revisions were made according to their evaluations. Additionally, in order to make the items more clear and understandable by participants, one Science and Technology teacher and a middle school student were interviewed about the clarity of the items to them and according to their suggestions, necessary revisions were made. After these revisions, scales became ready for pilot studies.

3.3.1 Student demographic information scale

Student Demographic Information Scale assesses students' gender, age, 6th grade Science and Technology report card grade, working status and education levels of parents, and possession of a study room and internet connected computer at home, and time spend on science homework in a week.

3.3.2 Student homework scale

Two pilot studies were conducted. In the first pilot study, the scale was administrated to 618 seventh grade students and the data were analyzed through exploratory factor analyses in order to identify number of factors and items to be retained in each section of the scale. Then in the second pilot study, data from 758 seventh grade students were subjected to confirmatory factor analyses in order to test the hypothesized factor structure. In the following section, results for the pilot study-1 are presented.

3.3.2.1 Exploratory factor analyses for student homework scale with pilot study-1 data

The scale was administrated to 618 seventh grade students in 25 classes of 18 elementary schools in Kecioren and Yenimahalle districts of Ankara. Of the sample, 315 were girls and 302 were boys while one participant did not respond to gender item. The mean age of the participants was 13.15 (*SD*= .43).

Exploratory factor analyses (with principle axis factoring and promax rotation) were conducted for each section of the Student Homework Perception Scale: Homework goal orientation, strategy use, procrastination, and perception of homework quality and feedback.

3.3.2.1.1 Exploratory factor analysis for homework goal orientation scale

Homework goal orientation scale included 15 items on a 5 point likert scale ranging from 1 “strongly disagree” to 5 “strongly agree” (See Appendix A.1). Items were adapted from items developed by Meece and Miller (2001) and Xu (2009a). The Kaiser-Meyer-Olkin measure of sampling adequacy was .894 and Barlett’s Test of Sphericity was statistically significant, $\chi^2(105)= 2916.341$, $p< .05$, suggesting that the data were suitable for factor analysis. There were two factors with eigen value greater than 1. In the scree plot, the curve began to tail off after two points and parallel analysis suggested a two-factor solution, as well. When pattern matrix is examined (See Table 3.4), it was seen that items which were intended to belong mastery goal orientation (e.g. “It is important for me to learn new things from my science homework”) and performance goal orientation (e.g. “I want my classmates to think that I am doing well on my science homework”) were combined in the first factor and the second factor composed of items about work-avoidance goal orientation (e.g. “I want to do science homework as easily as possible so that I won’t have to work hard”).

Table 3.4 Factor loadings of goal orientation scale

Item	Factor 1	Factor 2
While doing my Science and Technology homework, I want to learn as much as possible. (goal 5)	.687	
I do my Science and Technology homework because it helps me develop a sense of responsibility. (goal 11)	.684	
While doing my Science and Technology homework, it is important for me to consolidate my skills I learned in the class. (goal 2)	.683	
It is important for me to learn new things from my Science and Technology homework. (goal 1)	.669	
I do my Science and Technology homework because it improves my study discipline. (goal 9)	.644	
I want to do well on my Science and Technology homework because it is important for me to gain adults' (teacher, parents, etc.) approval. (goal 4)	.629	
I want to do better on my Science and Technology homework than other students. (goal 8)	.628	
While doing my Science and Technology homework, I want to develop my study skills. (goal 14)	.621	
I want my classmates to think I am doing well on my Science and Technology homework. (goal 6)	.610	
I want to do well on my Science and Technology homework because it is important for me that others think I am smart. (goal 13)	.568	
I want to do Science and Technology homework without much effort. (goal 10)		.822

Table 3.4 (Continued)

Item	Factor 1	Factor 2
I want to complete Science and Technology homework with as little effort as possible. (goal 12)		.800
I wish I do not have to do Science and Technology homework. (goal 15)		.632
I want to do Science and Technology homework as easily as possible so that I won't have to work very hard. (goal 3)		.554
I just want to do what I am supposed to do on my Science and Technology homework and get it done. (goal 7)	.276	.348

Theoretically, however, we expected that students' aims of doing homework to develop skills and knowledge are separate from students' aims of doing homework to show their abilities. Given that theory suggested a priori that mastery and performance goal orientations were conceptually distinct but correlated constructs, the solution was restricted to three factors and results were examined to identify problematic items. Restricting number of factors in consistent with theory can give valuable information about items which cross-load on factors and thus candidate for deletion (Netemeyer, Bearden, & Sharma, 2003). When pattern matrix for three-factor solution is examined (See Table 3.5), most items loaded highly on their intended factors. The first factor mainly composed of items which reflect students' purposes of doing homework in order to improve their competence and therefore the first factor was named as mastery goal orientation. This factor explained 32.286% of the variance in the correlation matrix. Item goal 8 ("I want to do better on my science homework than other students"), however; loaded on the both first and third factors with loadings of .381 and .304, respectively. This item was intended to represent students' performance goal orientation and was considered to belong to the third factor. The rest of the items' (*n*= 6 items) factor loadings ranged from .581 to .749. Item-total correlations of the mastery items were high and all contributed to reliability of the subscale (See Table A.1 in Appendix A.1.1). The reliability of the mastery goal orientation as calculated by Cronbach alpha was .838.

The second factor included 5 items which were about students' purposes of doing homework with less effort as possible and this factor was named as work-avoidance goal orientation. This factor explained 17.662% of the variance in the correlation matrix. Item goal 7 ("I just want to do what I am supposed to do on my science homework and get it done") loaded on work-avoidance factor with a loading of .350. When item-total correlations were examined (See Table A.2 in Appendix A.1.1), item goal 7 has the lowest item-total correlation (.323) and its deletion increases the reliability of the subscale from .773 to .795. Therefore, goal 7 decided to be dropped from the scale.

The third factor included items which were about students' doing homework with the purpose of demonstrating competence to others and this factor was named as performance goal orientation. This factor explained 5.713% of the variance in the correlation matrix. When pattern matrix is examined (See Table 3.5), item goal 8 ("I want to do better on my science homework than other students") loaded on the first and third factors with similar loadings; .381 and .304, respectively. Its deletion decreased reliability of the performance subscale from .745 to .694. Moreover, goal 8 had a high item-total correlation (.524) with other performance goal orientation items (See Table A.3 in Appendix A.1.1). Therefore, goal 8 decided to be retained in the scale but this item will be further investigated in the next pilot study, especially regarding its loading on different factors. Mean inter-item correlation is considered to be an important measure of internal consistency (Clark & Watson, 1995). Robinson, Shaver, and Wrightsman (1991, p.13) advocated that inter-item correlation average of .30 and above provides exemplary evidence; .20 – .29 provides extensive evidence; and .10 – .19 provides moderate evidence when evaluating attitude measures. Average inter-item correlations for goal orientation subscales were substantial; well above .30 (See Table A.4 in Appendix A.1.1). The number of factors to be extracted in the goal orientation scale warrants more investigation, however, and will be further examined in the next pilot study.

Table 3.5 Factor loadings of goal orientation scale in three-factor solution

Item	Factor 1	Factor 2	Factor 3
goal 9	.749		
goal 2	.736		
goal 11	.691		
goal 1	.632		
goal 14	.631		
goal 5	.581		
goal 8	.381		.304
goal 10		.838	
goal 12		.806	
goal 15		.622	
goal 3		.543	
goal 7		.350	
goal 4			.589
goal 6			.532
goal 13			.385

3.3.2.1.2 Exploratory factor analysis for homework strategy use scale

Homework strategy use scale included 16 items on a 5 point likert scale ranging from 1 "never" to 5 "always" (See Appendix A.2). Items were adapted from cognitive and metacognitive learning strategy use subscales of Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & Mckeachie, 1991) and Homework Management Scale (Xu, 2008b). The KMO measure of sampling adequacy was .903 and Barlett's test of sphericity was statistically significant, $\chi^2(120) = 2115.689$, $p < .05$, suggesting that data is appropriate for factor analysis. Eigen value, scree plot and parallel analyses all supported two factor structure. Thus, number of factors to be retained in the strategy use section of the student survey was two. The first factor accounted for 30.710% of the variance in the correlation matrix. This factor included 7 items related to cognitive and metacognitive strategies students use while doing homework (e.g., "I try to do my Science and Technology homework by making connections between the concepts I learned from the lectures and the readings."). This factor was named as "deep learning strategy use in homework". Factor loadings ranged from .572 to .674 (See Table 3.6). The second factor explained 9.190% of the variance in the correlation matrix. This factor included 9 items related to management strategies students' use when doing homework (e.g., "Before starting my Science and Technology homework, I locate the materials I need for my homework"). This factor was named "management strategy use in homework". The items' factor loadings were substantial; ranging from .363 to .715 (See Table 3.6). The reliability of the deep learning strategy use and management subscales were .82 and .74, respectively. Item-total statistics were presented in Table A.5 and A.6 in Appendix A.2.3. Average inter-item correlations for deep learning strategy use and management subscales were .39 and .25, respectively (See Table A.7 in Appendix A.2.3).

Table 3.6 Factor loadings of homework strategy scale

Item	Factor 1	Factor 2
When reading for my Science and Technology homework, I try to relate the material to what I already know. (deep5)	.674	
I ask myself questions to make sure I am on the right track on my Science and Technology homework. (deep7)	.627	
I ask myself questions to make sure I am on the right track on my Science and Technology homework. (deep6)	.612	

Table 3.6 (Continued)

Item	Factor 1	Factor 2
When doing my Science and Technology homework, I try to think what I am supposed to learn from it. (deep4)	.604	
When doing my Science and Technology homework, I go over the material I don't understand. (deep1)	.598	
I try to do my Science and Technology homework by making connections between the concepts I learned from the lectures and the readings. (deep3)	.593	
When doing my Science and Technology homework, I pull together information from different sources, such as lectures, discussions, and readings. (deep2)	.572	
While doing my Science and Technology homework, I fully concentrate on it. (man4)		.715
I change my surroundings so that it is easy to concentrate on my Science and Technology homework, such as turning off the TV, removing things from table, etc. (man8)		.580
I don't play around with other things while doing my Science and Technology homework. (man9)		.568
I keep up with Science and Technology homework. (man2)		.479
I motivate myself by telling myself that I can complete my Science and Technology homework successfully. (man7)		.458
Before starting my Science and Technology homework, I locate the materials I need for my homework. (man1)		.418
When doing my Science and Technology homework, I tell myself to pay attention to the homework. (man3)		.392
I find ways to make Science and Technology homework more interesting. (man6)		.382

Table 3.6 (Continued)

Item	Factor 1	Factor 2
I try to do my Science and Technology homework at a time when I can concentrate on it, such as after meal, before getting sleepy, etc. (man5)		.363

3.3.2.1.3 Exploratory factor analysis for homework procrastination scale

Homework procrastination scale included 12 items on a 5 point likert scale ranging from 1 "strongly disagree" to 5 "strongly agree" (See Appendix A.3). Items were adapted from items used by Uzun Ozer, Sackes, and Tuckman (2009). With the approval of the authors, items which were originally developed to measure students' procrastination in general school requirements were modified to suit homework situation. The KMO measure of sampling adequacy was .970 and Barlett's test of sphericity was statistically significant, $\chi^2(66)= 6500.721$, $p< .05$, suggesting that the data were appropriate for factor analysis. There was one factor with eigen values greater than 1. Scree plot and parallel analyses supported unidimensional factor structure, as well. The factor accounted for 70.745% of the variance in the correlation matrix. The factor included 12 items related to students' tendency to postpone their homework (e.g., "I needlessly delay doing my Science and Technology homework, even when it's important"). Therefore, this factor was named as "homework procrastination". Factor loadings ranged from .733 to .871 (See Table 3.7). The Cronbach alpha reliability for the subscale was .964. All items had high item-total statistics (See Table A.8 in Appendix A.3.1) and average inter-item correlations was .69 (See Table A.9 in Appendix A.3.1).

Table 3.7 Factor loadings of homework procrastination subscale

Item	Factor 1
Even if I make a plan for my Science and Technology homework, I don't follow it. (proc9)	.871
I keep putting off improving my Science and Technology homework habits. (proc4)	.864
I don't put time into Science and Technology homework which I find boring. (proc6)	.860
I don't get started in my Science and Technology homework even though I know its importance. (proc12)	.857
Even though I promise myself I'll do my Science and technology homework, I drag my feet. (proc8)	.856
Even though I promise myself I'll do my Science and technology homework, I drag my feet. (proc5)	.849
I don't complete my Science and Technology homework in time even when it is important. (proc11)	.845
I postpone starting in Science and Technology homework I don't like to do. (proc2)	.794
I needlessly delay doing my Science and Technology homework, even when it's important. (proc1)	.790
Even though I hate myself if I don't get started in my Science and Technology homework, it doesn't get me going. (proc10)	.788
I believe that when Science and Technology homework is too difficult, I delay it. (proc7)	.785
When there is a deadline for Science and Technology homework submission, I wait till the last minute. (proc3)	.733

3.3.2.1.4 Exploratory factor analysis for perception of homework quality and feedback on homework scale

Students' perceptions of the homework quality included 8 items on a 5 point likert scale ranging from 1 "strongly disagree" to 5 "strongly agree"; 4 items were adapted from Trautwein et al. (2006) and 4 items were newly constructed. On the other hand, perception of feedback on homework scale included 7 items on a 5 point likert scale ranging from 1 "never" to 5 "always" (See Appendix A.4). Feedback items were developed based on the literature. The KMO measure of sampling adequacy was .909 and Barlett's test of sphericity was statistically significant, $\chi^2(105)= 2356.631$, $p< .05$, suggesting that data is appropriate for factor analysis. Although there were three factors with eigen value greater than 1, scree plot and parallel analyses supported two factor structure. The number of factors to be retained in this section of the student survey was two. The first factor accounted for 34.464% of the variance in the correlation matrix. This factor included 8 items related to students' perceptions of the quality of homework (e.g., "Science and Technology homework makes us think on concepts reviewed in the class"). This factor was named as "student perception of homework quality". However, item 8 in quality scale (qual8) had low loading (.252) (See Table 3.8) and its deletion increased the scale reliability from .787 to .794 (See Table A.11 in Appendix A.4.3). Therefore, item qual8 decided to be removed from the scale. For the rest of the quality items, loadings ranged from .331 to .810 (See Table 3.8). The second factor explained 9.072% of the variance in the correlation matrix. This factor included 7 items related to students' perceptions of the feedback they received (e.g., "We are informed about the correct and incorrect parts of our Science and Technology homework"). This factor was named "student perception of feedback on homework". The items' factor loadings were substantial; ranging from .319 to .798 (See Table 3.8). The reliability of the perception of homework feedback was .774. Item-total statistics for perception of homework feedback and homework quality were presented in Table A.10 and A.11 in Appendix A.4.3, respectively. Average inter-item correlations for student perception of homework quality and feedback subscales were .37 and .33, respectively (See Table A.12 in Appendix A.4.3).

Table 3.8 Factor loadings of student perception of homework quality and feedback subscale

Item	Factor 1	Factor 2
Science and Technology homework helps us develop our knowledge and skills. (qual6)	.810	
Science and Technology homework helps us understand the material covered in the class. (qual1)	.734	
Science and Technology homework makes us think on the material covered in the class. (qual3)	.662	
Science and Technology homework helps overcome knowledge deficiencies. (qual7)	.608	
Science and Technology homework is well prepared. (qual2)	.555	
Science and Technology teacher explains us purposes of assigning particular homework. (qual5)	.362	
Science and Technology homework varies in difficulty. (qual4)	.331	
Science and Technology teacher provides homework alternatives among which we can choose. (qual8)	.252	.203
Incorrect parts of our Science and Technology homework are reviewed in the class. (feed5)		.798
We discuss about Science and Technology homework in the class. (feed6)		.666
We are informed about the correct and incorrect parts of our Science and Technology homework. (feed3)		.573
We are given opportunity to correct our mistakes in Science and Technology homework. (feed7)		.512

Table 3.8 (Continued)

Item	Factor 1	Factor 2
Science and Technology homework is evaluated in a short time. (feed2)		.403
Evaluated Science and Technology homework enables us to see our deficiencies in the subject material. (feed4)	.259	.387
Science and Technology homework is checked regularly. (feed1)	.250	.319

3.3.2.2 Reliability of the subscales in student homework scale in pilot study 1

Cronbach alpha reliabilities of the subscales along with the number of items were presented in Table 3.9. The reliabilities ranged from .74 to .96.

Table 3.9 Reliabilities of the student homework subscales

	Number of items	Cronbach alpha
Mastery goal orientation	6	.84
Performance goal orientation	4	.75
Work-avoidance goal orientation	4	.80
Deep learning strategy use	7	.82
Management strategy use	9	.74
Homework procrastination	12	.96
Quality of homework	7	.79
Feedback on homework	7	.77

After conducting exploratory factor analyses and reliability analyses in the first pilot study, the second pilot study was conducted. Following section includes results for pilot study-2.

3.3.2.3 Confirmatory factor analyses for student homework scale with pilot study-2 data

The student homework scale was administrated to 758 seventh grade students in 26 classes of 23 elementary schools in Kecioren and Yenimahalle districs of Ankara. Of the sample, 404 were female, 353 were male while one of the participants did not report gender. The mean age of the participants was 13.14 (*SD*= .37).

The hypothesized factor structure of the student homework scale was tested through confirmatory factor analyses. Firstly, preliminary data analyses were conducted; the data were screened through descriptive statistics and missing data analysis was performed. Then, confirmatory factor analysis was conducted for each section of the scale to test the proposed model fit to the data.

3.3.2.3.1 Data screening

The minimum and maximum values, means, standard deviations, number of missing cases, skewness, and kurtosis values were inspected for the quantitative variables that would be subjected to factor analyses. The minimum and maximum values, means, and standard deviations of each of the variables were reasonable and within expected values. Percent of missing cases ranged from 0.3% to 4.1%. Skewness index ranged from -1.830 to 1.100 while kurtosis index was within the range of -1.590 and 2.782. Skewness index greater than 3.0 and kurtosis index greater 10 may suggest a problem for univariate normality (Kline, 2005). Therefore, there seems to be no serious problem with univariate normality. Percent of missing cases and descriptive statistics for each item were presented in Appendix A.5, in Table A.13 and A.14, respectively. If the percent of missing cases is below 5% of the sample, the method used for handling missing data does not make a serious effect on the data set (Tabachnick & Fidell, 2001). Missing cases was below 5%; maximum missing case was 4.1%. Missing values were replaced by multiple imputation with expected maximization (EM). Multiple imputation uses matching response patterns in the data and replaces missing values for several variables simultaneously (Schumacker & Lomax, 2004). After imputation, skewness index were in the range of -1.801 to 1.097 while kurtosis index ranged from -1.562 to 2.702 (See Table A.15 in Appendix A.5).

3.3.2.3.2 Confirmatory factor analyses results

Multivariate normality assumption requires (1) univariate normality of each variable, (2) bivariate normality of any pair of the variables, and (3) linearity of bivariate scatterplots and homoscadasticity of residuals. Violations of multivariate normality can be detected from examining univariate normality (Kline, 2005). There is no item with extreme skewness and kurtosis values (See Table A.15 in Appendix A.5). Thus, there seems to be no violation of multivariate normality. In order to detect multivariate outliers, Mahalanobis distance was examined. Cases which exceed the critical chi-square value are treated as outliers and suggested to be deleted (Kline, 2005). Accordingly, before conducting confirmatory factor analysis, multivariate outliers were deleted from the data.

3.3.2.3.2.1 Confirmatory factor analyses with student homework goal orientation

Goal orientation items were proposed to reflect students' mastery, performance, and work-avoidance goals in homework. However, results of the first pilot study were somewhat complicated in terms of numbers of factors retaining. The second pilot data will be analyzed for both two and three dimensional factor structure in order to decide on the number of factors more accurately. Firstly, two-factor structure was tested using maximum likelihood (ML) estimation in LISREL 8.8. Fit indices of root mean square error of approximation (RMSEA)= .0635, comparative fit index (CFI)= .978; standardized root mean square residuals (S-RMR)= .0527, and goodness-of-fit index (GFI)= . 944 suggested reasonable model fit. Then, three-factor structure was tested. Analysis results for three-factor structure revealed good model fit (RMSEA= .0462, CFI= .988, S-RMR= .0435, GFI= .964). All fit indices were improved in the modified model as compared to the initial model. Likelihood ratio test was significant [$\chi^2_{(2)}$= 84.683, p< .05] indicating that three-factor structure provides significantly better model fit. Therefore three-factor structure was decided to be retained. All items loaded significantly on their intended factors. Completely standardized solutions (Lambda-X estimates) for the latent factors of mastery, performance, and work-avoidance goal orientations are presented in Table 3.10.

Table 3.10 Lambda-X estimates for student goal orientations in homework

	Mastery goal orientation	Performance goal orientation	Work-Avoidance goal orientation
goal 1	.811		
goal 2	.758		
goal 5	.744		
goal 14	.738		
goal 11	.724		
goal 9	.703		
goal 4		.760	
goal 6		.709	
goal 8		.648	
goal 13		.620	
goal 10			.838
goal 12			.817
goal 15			.693
goal 3			.561

3.3.2.3.2.2 Confirmatory Factor Analyses with Strategy Use Scale

Confirmatory factor analysis results revealed good model fit for the strategy use section (RMSEA= .0590, CFI= .976, S-RMR= .0417, GFI= .941). All items loaded significantly on their intended factors. Lambda-X estimates for the latent factors of deep learning strategy use and management strategy use are presented in Table 3.11.

Table 3.11 Lambda-X estimates for management strategy use and deep learning strategy use

	Management strategy use	Deep learning strategy use
man 1	.553	
man 2	.533	
man 3	.373	
man 4	.725	
man 5	.465	
man 6	.525	
man 7	.610	
man 8	.619	
man 9	.686	
deep 1		.703
deep 2		.673
deep 3		.634
deep 4		.624
deep 5		.621
deep 6		.618
deep 7		.608

3.3.2.3.2.3 Confirmatory Factor Analyses with Homework Procrastination Scale

Confirmatory factor analysis results revealed good model fit for the homework procrastination section (RMSEA= .0765, CFI= .991, S-RMR= .0217, GFI= .939). All items' factor loadings were statistically significant. Lambda-X estimates for the procrastination latent variable was presented in Table 3.12.

Table 3.12 Lambda-X estimates for homework procrastination

	Procrastination
proc 1	.787
proc 2	.798
proc 3	.713
proc 4	.880
proc 5	.869
proc 6	.889
proc 7	.795
proc 8	.881
proc 9	.860
proc 10	.782
proc 11	.867
proc 12	.883

3.3.2.3.2.4 Confirmatory factor analyses with students' perceptions of homework quality and feedback scale

Confirmatory factor analysis results revealed good model fit for the students' perception of homework quality and feedback section (RMSEA= .0764, CFI= .971, S-RMR= .0495, GFI= .927). All items loaded significantly on their intended factors. Lambda-X estimates for the latent variables of students' perceptions of homework quality and feedback were presented in Table 3.13.

Table 3.13 Lambda-X estimates for students' perceptions of homework quality and feedback

	Feedback	Quality
feed 1	.412	
feed 2	.409	
feed 3	.732	
feed 4	.708	
feed 5	.800	
feed 6	.700	
feed 7	.671	
qual 1		.728
qual 2		.670
qual 3		.771
qual 4		.439
qual 5		.612
qual 6		.773
qual 7		.749

3.3.2.4 Reliability of the subscales of student homework scale in pilot study 2

Cronbach alpha reliabilities of the subscales ranged from .77 to .96 (See Table 3.14).

Table 3.14 Reliabilities of the subscales

	Number of items	*Cronbach alpha*
Mastery goal orientation	6	.88
Performance goal orientation	4	.77
Work-avoidance goal orientation	4	.82
Deep learning strategy use	7	.83

Table 3.14 (Continued)

	Number of items	*Cronbach alpha*
Management strategy use	9	.80
Procrastination	12	.96
Quality of homework	7	.85
Feedback on homework	7	.83

Following section presents findings related to confirmatory factor analyses conducted with main study data.

3.3.2.5 Confirmatory factor analyses for student homework scale with main study data

Factor structure of the student homework scale was further investigated in the main study data. The scale was administrated to 8318 seventh grader students in Turkey. Of the sample, 4258 (51.2%) were female, 4026 (48.4%) were male while 34 (0.4%) students did not respond to gender item. The mean age of the participants was 12.16 (SD= 0.46).

The hypothesized factor structure of the student homework scale was tested through confirmatory factor analyses. Firstly, preliminary data analyses were conducted; the data were screened through descriptive statistics and missing data analysis was performed. Then, confirmatory factor analysis was conducted for each section of the scale.

3.3.2.5.1 Data screening

The minimum and maximum values, means, standard deviations, number of missing cases, skewness, and kurtosis values were inspected. The minimum and maximum values, means, and standard deviations of each of the variables were reasonable and within expected values. Percent of missing cases ranged from 0.50% to 4.40%.

Skewness index ranged from -2.468 to 1.601 while kurtosis index was within the range of -1.598 and 6.335. Skewness index greater than 3.0 and kurtosis index greater 10 may suggest a problem for univariate normality (Kline, 2005). Therefore, there seems to be no serious problem with univariate normality. Percent of missing cases and descriptive statistics for each item were presented in Appendix A.6, in Table A.16 and A.17, respectively. Missing cases was below 5%; maximum missing case was 4.4%. Missing values were replaced by multiple imputation with expected maximization (EM). After imputation, skewness index were in the range of -2.468 to 1.601 while kurtosis index ranged from -1.586 to 6.306 (See Table A.18 in Appendix A.6).

3.3.2.5.2 Confirmatory factor analyses results for student homework scale

Tenability of multivariate normality assumption was examined through checking univariate normality. There was no item with extreme skewness and kurtosis values (See Table A.18 in Appendix A.6). In order to detect multivariate outliers, Mahalanobis distance was examined. Cases which exceeded the critical chi-square value were deleted.

3.3.2.5.2.1 Confirmatory factor analyses with student homework goal orientation

Confirmatory factor analysis results revealed good model fit for the goal orientation section (RMSEA= .0358, CFI= .991, S-RMR= .0295, GFI= .985). All items loaded significantly on their intended factors. Lambda-X estimates for the latent factors of mastery, performance, and work-avoidance are presented in Table 3.15.

Table 3.15 Lambda-X estimates for students' goal orientation in homework

	Mastery goal orientation	Performance goal orientation	Work-Avoidance goal orientation
goal 14	.743		
goal 8	.731		
goal 1	.717		
goal 9	.709		
goal 2	.708		
goal 11	.677		
goal 4		.717	
goal 6		.659	
goal 8		.633	
goal 13		.576	
goal 10			.841
goal 12			.825
goal 15			.697
goal 3			.516

3.3.2.5.2.2 Confirmatory factor analyses with strategy use scale

Confirmatory factor analysis results revealed good model fit for the strategy use section (RMSEA= .0491, CFI= .988, S-RMR= .0273, GFI= .968). All items loaded significantly on their intended factors. Lambda-X estimates for the latent factors of deep learning strategy use and management strategy use are presented in Table 3.16.

Table 3.16 Lambda-X estimates for management strategy use and deep learning strategy use

	Management strategy use	Deep learning strategy use
man 1	.570	
man 2	.631	
man 3	.501	
man 4	.720	
man 5	.515	
man 6	.545	
man 7	.652	
man 8	.568	
man 9	.592	
deep 1		.709
deep 2		.710
deep 3		.725
deep 4		.698
deep 5		.706
deep 6		.651
deep 7		.651

3.3.2.5.2.3 Confirmatory factor analyses with homework procrastination scale

Confirmatory factor analysis results revealed good model fit for the homework procrastination section (RMSEA= .0717, CFI= .993, S-RMR= .0174, GFI= .955). All items' factor loadings were statistically significant. Lambda-X estimates for the procrastination latent variable was presented in Table 3.17.

Table 3.17 Lambda-X estimates for homework procrastination

	Procrastination
proc 1	.825
proc 2	.818
proc 3	.637
proc 4	.866
proc 5	.906
proc 6	.898
proc 7	.762
proc 8	.849
proc 9	.891
proc 10	.832
proc 11	.906
proc 12	.889

3.3.2.5.2.4 Confirmatory factor analyses with students' perceptions of homework quality and feedback scale

Confirmatory factor analysis results revealed good model fit for the students' perception of homework quality and feedback section (RMSEA= .0499, CFI= .988, S-RMR= .0272, GFI= .972). All items loaded significantly on their intended factors. Lambda-X estimates for the latent variables of students' perceptions of homework quality and feedback were presented in Table 3.18.

Table 3.18 Lambda-X estimates for students' perceptions of homework quality and feedback

	Feedback	Quality
feed 1	.590	
feed 2	.589	
feed 3	.724	
feed 4	.713	
feed 5	.756	
feed 6	.695	
feed 7	.679	
qual 1		.727
qual 2		.690
qual 3		.730
qual 4		.413
qual 5		.618
qual 6		.743
qual 7		.752

3.3.2.5.3 Reliability of the subscales of student homework scale in main study

In the main study, Cronbach alpha reliabilities of the subscales ranged from .74 to .97 (See Table 3.19).

Table 3.19 Cronbach alpha reliabilities of the subscales in the main study

	Number of items	Cronbach alpha
Mastery goal orientation	6	.86
Performance goal orientation	4	.74
Work-avoidance goal orientation	4	.81
Deep learning strategy use	7	.87
Management strategy use	9	.82
Procrastination	12	.97
Quality of homework	7	.84
Feedback on homework	7	.86

3.3.3 Science achievement test

The items constituting science achievement test were taken from previous national examinations (i.e., Secondary Education Entrance Examination and Government Complimentary Boarder and Scholar Examination). The number of items was 14. All items were in multiple-choice question format with one correct answer and three distracters (See Appendix B). Since the instruments were going to be administrated at the end of the first semester, the test included questions from the first and second units of seventh grade curriculum, which were (1) Body Systems and (2) Force and Motion. Objectives stated in the curriculum were examined and each item was evaluated in terms of content validity and format. Table of specification was given in Table 3.20. The reliability coefficient computed by Kuder Richardson-20 was found to be 0.77. Total scores on the achievement test will be used to represent science achievement.

Table 3.20 Table of specification

Content	Instructional Objectives	Knowledge	Comprehension	Application
		Cognitive processing in Bloom's taxonomy		
Body Systems	Identifies functions of sense organs.	1*, 2		
	Names structure of sense organs.	3		
	Describes functions of inner glands.	4, 5		
	Matches digestive system organs with their functions on a given figure.		6	
	Exemplify hormone secretion in the human body.		7	
	Interprets chemical changes in digestion of nutrition.		8	
	Matches urinary system organs with their functions on a given figure.		9	
Force and Motion	Displays transformations of potential energy and kinetic energy on a given figure.		10	
	Predicts direction of force applied by the stretched and compressed springs.		11	
	Compares force applied on an object placed on different inclined planes.			12
	Relates magnitude of force applied on the lever with effort arm for balance position.			13
	Relates physical work with the direction of the force applied on an object.			14
	Total number of items	5	6	3

Note: *Item number

Following sections present information about teacher scales used in the study.

3.3.4 Teacher demographic information scale

Teacher Demographic Information Scale assesses teachers' gender, age, graduated program type, years of experience in the teaching profession, number of students in their class (class size), and average teaching hour in a week.

3.3.5 Teacher homework scale

In order to measure Science and Technology teachers' homework related views and practices, Teacher Homework Scale was prepared. The first part of the scale asks teachers about whether they think they were given sufficient education about homework in pre-service education; whether they took any in-service teacher education about homework; whether science and technology program gives clear information about appropriate homework they should assign; whether it takes too much time to prepare homework in line with the science and technology program; the frequency of assigning homework, the proportion of students in their classes who complete homework regularly; the types of homework they assign (10 items); the frequency of assigning individual and group homework (2 items); and their reasons for giving homework (13 items). Four of the items related to types of homework and 8 of the items related to the reasons for giving homework were originally developed by Sidhu and Fook (2010). These items were translated and adapted into Turkish while rests of the items were written for this study.

The second part of the Teacher Homework Scale addresses science teachers' perceptions regarding their *goal orientation* in assigning homework (i.e. mastery goal orientation and performance goal orientation), support for students' *strategy use* while doing homework (i.e. homework management strategy and deep learning strategy), *homework quality and feedback on homework*. The scale was initially pilot tested with 168 Science and Technology teachers. The data from the pilot study were examined through exploratory factor analysis (EFA) to identify factor structure and provide construct related validity evidence. Reliability and item based statistics, which are recommended to use in conjunction with EFA in scale development studies (Netemeyer et al., 2003), were applied. Then, in the main study, the scale was administrated to 344 Science and Technology teachers and the data were subjected to confirmatory factor analysis (CFA) to confirm hypothesized factor structure and finalize the scale.

3.3.5.1 Exploratory factor analyses for teacher homework scale

The Teacher Homework Scale was administrated to 168 Science and Technology teachers. Of the sample, 128 (76.2%) were females and 40 (23.8%) were males. The mean age of participants was 33.08 (*SD*= 8.23). About 66.9% (*N*= 111) of the participants graduated from a Science and Technology teacher education program, 17.4% (*N*= 29) were graduates of another teacher education program, while 15.6% (*N*= 26) of the teachers graduated from a non-teacher education program. Teachers' experience in the profession ranged from 1 to 35 years with a mean of 9.88 (*SD*= 7.72). They teach 22.32 (*SD*= 5.31) hours in a week and there were 29 students in their classes in average.

In scale development process, EFA is used to determine which items to delete or retain and to determine underlying dimensions in the initial item analysis (Netemeyer et al., 2003). EFA with principle axis factoring method and promax rotation were conducted for each section of the scale; *goal orientation* (mastery goal orientation and performance goal orientation), *strategy use* (homework management strategy and deep learning strategy), and *homework quality and feedback on homework* items.

3.3.5.1.1 Exploratory factor analyses for teacher homework goal orientation scale

Homework goal orientation scale included 9 items (See Appendix C.1) responded on a 5 point likert scale from 1 "strongly disagree" to 5 "strongly agree". Items were adapted from items developed by Friedel, Cortina, Turner, and Midgley (2007). The Kaiser-

Meyer-Olkin (KMO) measure of sampling adequacy was .746 and Bartlett's test of sphericity was statistically significant, $\chi^2(36)= 411.172$, $p< .05$, which indicates that correlation matrixes were not identity matrixes and some relations existed between variables (Field, 2009). This suggests that data is suitable for factor analysis. According to Kaiser-Guttman criterion, there were two factors with eigen values greater than 1. Inspection of scree plot and parallel analysis also supported a two-factor solution. The first factor accounted for 32.817% of the variance in the correlation matrix and included 5 items related to mastery goal orientation in assigning homework (e.g., "I appreciate the student who shows improvement in his/her homework"). This factor was named as "teachers' mastery goal orientation in homework" and reflects teachers' desire that students make effort, gain new perspectives and show improvement in homework. Factor loadings ranged from .507 to .744 (See Table 3.21). The second factor explained 24.554% of the variance in the correlation matrix. This factor included 4 items related to teachers' performance goal orientation in assigning homework (e.g., "I announce the student who gets the highest grade from homework in the class."). This factor was named "teachers' performance goal orientation in homework" and reflects teacher's focus on making comparisons among students about their homework performance. The items' factor loadings were substantial; ranging from .619 to .732 (See Table 3.21).

Cronbach's alpha was used to examine the internal consistency of the items within the scale. The Cronbach's alpha coefficient was found to be .77 for the mastery goal orientation scale and .75 for the performance goal orientation scale. In addition, examination of the corrected item-to-total correlations revealed high correlations of each item with the rest of the items in the set of items under consideration (See Table C.1 and C.2 in Appendix C.1.1). Moreover, the mean inter-item correlations for mastery and performance goal orientation were .43 and .44, respectively (See C.3 in Appendix C.1.1). Overall, findings revealed high internal consistency for the goal orientation subscales.

Table 3.21 Factor loadings of teacher homework goal orientation items

Item	Factor 1	Factor 2
I want students to understand what they do in their homework not just memorize it. (t_goal8)	.744	
I appreciate students who make effort in their homework. (t_goal4)	.718	
I appreciate students who show improvement in their homework. (t_goal1)	.697	
I want students to gain new perspectives when doing homework. (t_goal3)	.616	
I think students' mistakes in homework are okay as long as students learn from them. (t_goal6)	.507	
I point out students who get the high grades in homework as an example to all of the class. (t_goal9)		.732
I make comparisons among students according to their homework performance. (t_goal7)		.714
I let students know those students who don't do well on their homework. (t_goal5)		.622
I let students know those students who get highest grades on homework. (t_goal2)		.619

3.3.5.1.2 Exploratory factor analyses for teacher support for strategy use in homework scale

Teacher support for strategy use in homework scale included 17 items intended to measure teacher support for students to use deep learning and management strategies during homework (See Appendix C.2.1 and C.2.2). Support for deep learning strategy use items responded from 1 "strongly disagree" to 5 "strongly agree" while support for management strategy use items responded from 1 "never" to 5 "always" on a 5 point scale. Items were adapted from Homework Management Scale (Xu, 2008b) and Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). Items were modified to suit teacher's perceptions regarding their support for students to use various strategies while doing homework. The KMO measure of sampling adequacy was .873 and Barlett's test of sphericity was statistically significant, $\chi^2(136)= 1259.143$, $p<$ .05, suggesting that data is appropriate for factor analysis. Although there were three factors with eigen values greater than 1, scree plot and parallel analyses revealed two factor structure. Thus, number of factors to be retained in the strategy section of the scale was two. The first factor accounted for 40.913% of the variance in the correlation matrix. This factor included 13 items related to the teachers' support to use homework management strategies (e.g., "I tell students to manage their time efficiently when doing homework"). Therefore this factor was named as "teacher support in homework management". Factor loadings ranged from .466 to .821 (See Table 3.22). The second factor explained 10.214% of the variance in the correlation matrix. This factor included 4 items related to deep learning strategies teachers expect from their students to use when doing homework (e.g., "I expect students to gather knowledge he/she has learned from different sources"). Therefore, this factor was named "teacher support in deep learning strategy use for homework" and reflects teachers' emphasis on the use of strategies that require student to bring together information from different sources, to make connections between new learning and previous learning, and to question the trustworthiness of the knowledge acquired from different sources while doing homework. The items' factor loadings were substantial; ranging from .483 to .739 (See Table 3.22). The reliability of the management and deep learning strategy use subscales were .92 and .68, respectively. Item-total statistics were presented in Table C.4 and C.5 in Appendix C.2.3. Average inter-item correlations were substantial; above .35 (See Table C.6 in Appendix C.2.3).

Table 3.22 Factor loadings of teacher support for strategy use items

Item	Factor 1	Factor 2
I tell students to pay attention while doing homework. (t_man13)	.821	
I tell students not to deal with other things when doing homework. (t_man6)	.818	
I tell students to manage their time efficiently when doing homework. (t_man7)	.757	
I recommend students to believe in that they can successfully complete homework even they feel that homework is difficult. (t_man9)	.723	
I tell students not to panic when they have difficulty in doing homework. (t_man4)	.721	
I recommend students to prepare a study environment where they can concentrate on their homework. (t_man2)	.712	
I want my students to stay calm while doing homework. (t_man11)	.697	
I recommend students to locate the material they need for their homework before strating their homework. (t_man8)	.654	
I recommend students to do homework at a time when they can concentrate on their homework, such as after meal, before getting sleepy, etc. (t_man3)	.618	
I tell students to be proud of themselves when they do homework well. (t_man5)	.589	
I want students to find ways to make homework more interesting for themselves. (t_man12)	.558	
I want students to think of situations where it would be helpful for themselves to know the homework material. (t_man10)	.549	

Table 3.22 (Continued)

Item	Factor 1	Factor 2
I recommend students to connect the homework material with something they like doing or find interesting. (t_man1)	.466	
I assign homework which requires students to make connections with previous leanings. (t_deep3)		.739
I assign homework which enables students make connections between learnings from science class and other classes as much as possible. (t_deep2)		.591
I expect students to gather knowledge they have learned from different sources. (t_deep1)		.576
When doing homework, I want students question trustworthiness of the information acquired from different sources like internet. (t_deep4)		.483

3.3.5.1.3 Exploratory factor analysis for teacher perception of homework quality and feedback on homework scale

Homework quality scale included 7 items; 3 items were adapted from Trautwein et al. (2006) and 4 items were developed for the study (See Appendix C.3.1). Feedback on homework scale included 6 items which were developed for the present study based on the literature and these items were parallel to the items of students' perceptions of homework feedback scale (See Appendix C.3.2). Both homework quality and feedback on homework scales' items were on a 5 point likert scale ranging from 1 "never" to 5 "always". The KMO measure of sampling adequacy was .793 and Barlett's test of sphericity was statistically significant, $\chi^2(78)= 534.778$, $p< .05$, indicating that data is suitable for factor analysis. Although there were three factors with eigen values greater than 1, scree plot and parallel analysis suggested two factor structure. The first factor accounted for 31.880% of the variance in the correlation matrix. This factor included 7 items; 6 of the items were related to teacher feedback on homework (e.g., “I inform students about the correct and wrong parts in their homework”) while one of the items (item t_quality 5: “I assign homework which helps students understand the concepts reviewed in the class”) was related to quality of homework. The second factor explained 12.369% of the variance in the correlation matrix. This factor included 6 items related to the quality of homework teachers assign (e.g., “I prepare homework varying in difficulty”). Item t_quality 3 (“I provide homework alternatives among which students can choose”) loaded on both first (-.437) and second (.767) factors substantially. However, because the item had higher loading on the second factor, it was retained in the quality dimension of the scale (See Table 3.23).

Table 3.23 Factor loadings of teacher perception quality of homework and feedback on homework items

Item	Factor 1	Factor 2
Homework I evaluated helps students recognize deficiencies in the subject material. (t_feed 6)	.729	
I inform studenst about the correct and incorrect parts of their homework. (t_ feed 3)	.656	
I check homework regularly. (t_ feed 1)	.639	
We hold class discussions about homework students have completed. (t_ feed 2)	.606	
I give students opportunity to correct their mistakes in their homework. (t_ feed 4)	.446	
I evaluate homework in a short time. (t_ feed 5)	.441	
I assign homework which helps students understand the material covered in the class. (t_quality 5)	.407	
I provide homework alternatives among which students can choose. (t_quality 3)	-.437	.767

Table 3.23 (Continued)

Item	Factor 1	Factor 2
I prepare homework which makes students think critically on the material covered in the class. (t_quality 6)		.527
When prepring homework, I consider students' characteristics, such as prior knowledge, development level, interest arera, etc. (t_quality 4)		.497
When prepring homework, I exchange ideas with other Science and Technology teachers. (t_quality 7)		.430
When preparing homework, I make use of different sources. (t_quality 1)		.405
I prepare homework varying in difficulty. (t_quality 2)		.320

Because the item t_quality 5 ("I assign homework which helps students understand the concepts reviewed in the class") loaded on a different factor than expected, its contribution to content validity was examined. Its deletion seemed to cause no serious problem since the remaining quality items were judged to be adequate for representativeness of the construct being measured. Then, the item t_quality 5 was deleted and exploratory factor analysis was re-conducted for quality and feedback items. KMO measure of sampling adequacy was .787 and Bartlett's test of sphericity was statistically significant, $\chi^2(66)= 497.836$, $p< .05$. Results revealed two-factor structure: Factor one consisted of feedback items and named as "teacher perception of homework feedback" and reflects teacher's checking homework regularly, evaluating homework in a short time, discussing with students about homework they have completed, and informing students about their performance on homework. Factor loadings ranged from .419 to .748 (See Table C.7 in Appendix C.3.3.3) and the factor explained 33.150% of the variance in the correlation matrix. The second factor included quality items and named as "teacher perception of homework quality". It reflects teachers' use of different sources while preparing homework, assigning homework varying in difficulty, and consideration of students' qualifications (i.e., prior knowledge, developmental level, interest areas, etc.). Factor loadings ranged from 335 to .742 (See Table C.7 in Appendix C.3.3.3) and the factor explained 13.181% of the variance in the correlation matrix. The amount of explained variance in the correlation matrix increased after deletion of the t_quality 5 item. The reliability of Cronbach alphas for feedback and quality subscales were .77 and .68, respectively. All item-total correlations were positive (See Table C.8 and C.9 in Appendix C.3.3.3) and average inter-item correlations were .37 and .24 for homework feedback and quality, respectively (See Table C.10 in Appendix C.3.3.3).

3.3.5.2 Reliability of the subscales in teacher homework scale in pilot study

Cronbach alpha reliabilities of the subscales along with the number of items were given in Table 3.24. The reliabilities of the subscales ranged from .68 to .92.

Table 3.24 Reliabilities of the subscales

	Number of items	Cronbach alpha
Mastery goal orientation	5	.77
Performance goal orientation	4	.75
Deep learning strategy use support	4	.68
Management strategy use support	13	.92
Quality of homework	6	.68
Feedback on homework	6	.77

3.3.5.3 Confirmatory factor analyses for teacher homework scale in main study data

After conducting exploratory factor analyses and reliability analyses in the pilot study, the teacher homework scale was administrated to 344 Science and Technology teachers in Turkey. The hypothesized factor structures were tested through confirmatory factor analyses. Firstly, preliminary data analyses were conducted; the data were screened through descriptive statistics and missing data analysis was performed. Then, confirmatory factor analysis was conducted for each section of the scale to test the proposed model fit to the data.

3.3.5.3.1 Data screening

The minimum and maximum values, means, standard deviations, number of missing cases, skewness, and kurtosis values were inspected for the quantitative variables that would be subjected to factor analyses later. The minimum and maximum values, means, and standard deviations of each of the variables were reasonable and within expected values. Percent of missing cases was low; missing values ranged from 0.0% to 2.6%. Skewness index ranged from -1.868 to 0.179 while kurtosis index was within the range of -0.893 and 4.629. Skewness index greater than 3.0 and kurtosis index greater 10 may suggest a problem for univariate normality (Kline, 2005). Therefore, there seems to be no serious problem with univariate normality. Percent of missing cases and descriptive statistics for each item were presented in Appendix C.4 in Table C.11 and C.12, respectively.

As seen in Table B1, maximum missing case was 2.6% in the variables. Missing values were replaced by multiple imputation with expected maximization (EM). After imputation, skewness index were in the range of -1.868 to 0.179 while kurtosis index ranged from -0.888 to 4.436 (See Table C.13, in Appendix C.4).

3.3.5.3.2 Confirmatory factor analyses results

Multivariate normality assumption requires (1) univariate normality of each variable, (2) bivariate normality of any pair of the variables, and (3) linearity of bivariate scatterplots and homoscadasticity of residuals. Violations of multivariate normality can be detected from examining univariate normality (Kline, 2005). There is no item with extreme skewness and kurtosis values (See Table C.13, in Appendix C.4). Thus, there seems to be no violation of multivariate normality. In order to detect multivariate outliers, Mahalanobis distance was examined. Cases which exceed the critical chi-square value are treated as outliers and suggested to be deleted (Kline, 2005). Accordingly, before conducting confirmatory factor analysis, multivariate outliers were deleted from the data.

3.3.5.3.2.1 Confirmatory factor analyses with goal orientation

Confirmatory factor analysis with maximum likelihood (ML) estimation was conducted using LISREL 8.8 (Jöreskog & Sörbom, 2007) to investigate how well the 9 items fit to the proposed 2 latent factors of mastery and performance goal orientation. The chi-square test was significant ($\chi^2_{(26)}$= 103.302, $p<$ .05), however; chi-square test is sensitive to sample size (Kline, 2005). It is recommended to use various fit indices, because each indices measures particular aspect of model fit (Kline, 2005). Fit indices (RMSEA= .0945, CFI= .895, S-RMR= .0711, and GFI= .936) suggested reasonable model fit. All items loaded significantly on their intended factors. Completely standardized solutions (Lambda-X estimates) for the latent factors of mastery and performance goal orientation were presented in Table 3.25.

Table 3.25 Lambda-X estimates for mastery and performance goal orientations

	Indicator	Lambda-X
Teacher mastery goal orientation	t_goal 1	.586
	t_goal 3	.584
	t_goal 4	.742
	t_goal 6	.257
	t_goal 8	.593

Table 3.25 (Continued)

	Indicator	Lambda-X
Teacher performance goal orientation	t_goal 2	.658
	t_goal 5	.348
	t_goal 7	.344
	t_goal 9	.744

3.3.5.3.2.2 Confirmatory factor analysis with teacher support for student's strategy use during homework

Confirmatory factor analysis results revealed good model fit for the teacher support for students' strategy use section (RMSEA= .0763, CFI= .970, S-RMR= .0504, GFI= .884). All items loaded significantly on their intended factors. Lambda-X estimates for the latent factors of management strategy use and deep learning strategy use are presented in Table 3.26.

Table 3.26 Lambda-X estimates for teacher support for management strategy use and deep learning strategy use

	Indicator	Lambda-X
Teacher support for management strategy use	t_man 1	0.575
	t_man 2	0.687
	t_man 3	0.701
	t_man 4	0.731
	t_man 5	0.610
	t_man 6	0.736
	t_man 7	0.738
	t_man 8	0.786
	t_man 9	0.760

Table 3.26 (Continued)

	Indicator	Lambda-X
Teacher support for management strategy use	t_man 10	0.687
	t_man 11	0.822
	t_man 12	0.793
	t_man 13	0.782
	t_man 14	0.462
Teacher support for deep learning strategy use	t_deep 1	0.537
	t_deep 2	0.710
	t_deep 3	0.642
	t_deep 4	0.551

3.3.5.3.2.3 Confirmatory factor analysis with quality of homework and feedback on homework

Confirmatory factor analysis results supported two factor structure of homework quality and feedback (RMSEA= .0724, CFI= .956, S-RMR= .0545, GFI= .932). All items loaded significantly on their intended factors. Lambda-X estimates for quality of homework and feedback on homework latent factors are presented in Table 3.27.

Table 3.27 Lambda-X estimates for quality of homework and feedback on homework

	Indicator	Lambda-X
Quality of homework	t_quality 1	0.629
	t_quality 2	0.639
	t_quality 3	0.365
	t_quality 4	0.566
	t_quality 6	0.538
	t_quality 7	0.451

Table 3.27 (Continued)

	Indicator	Lambda-X
Feedback on homework	t_ feed 1	0.552
	t_ feed 2	0.669
	t_ feed 3	0.808
	t_ feed 4	0.734
	t_ feed 5	0.399
	t_ feed 6	0.618

3.3.5.3.3 Reliability of the subscales in teacher homework scale in main study

In the main study, Cronbach alpha reliabilities of the subscales ranged from .60 to .93 (See Table 3.28).

Table 3.28 Cronbach alpha reliabilities of the subscales in the main study

	Number of items	Cronbach alpha
Mastery goal orientation	5	.64
Performance goal orientation	4	.60
Deep learning strategy support	4	.70
Management strategy support	14	.93
Quality of homework	6	.69
Feedback on homework	6	.79

3.4 Assumptions of the Study

It was assumed that all instruments were administrated under standard conditions and students did not interact with each other during the administration of instruments. Furthermore, participants of the study assumed to respond to the items of the instruments sincerely. Lastly, it was assumed that characteristics of the sample were representative of the population.

CHAPTER IV

RESULTS

This chapter includes descriptive statistics and hierarchical linear modeling analyses results.

4.1 Descriptive Statistics

Firstly, descriptive statistics for student homework scale are presented and then descriptive statistics for teacher homework scale are given in the following sections.

4.1.1 Descriptive statistics for student scales

Descriptive statistics for student scales include time spend on science homework and students' perceptions of homework quality, feedback on homework, and homework self-regulation.

4.1.1.1 Time spend on science homework

Students' responses to time spend on science homework in a week revealed that 16.5% of the students spend less than 30 minutes, almost half of the students (47.3%) spend between 30 minutes and 1 hour, 27.4% of the students spend between 1 hour to 2 hour, and 8.8% of the students spend more than 2 hour to complete their science homework (See Figure 4.1).

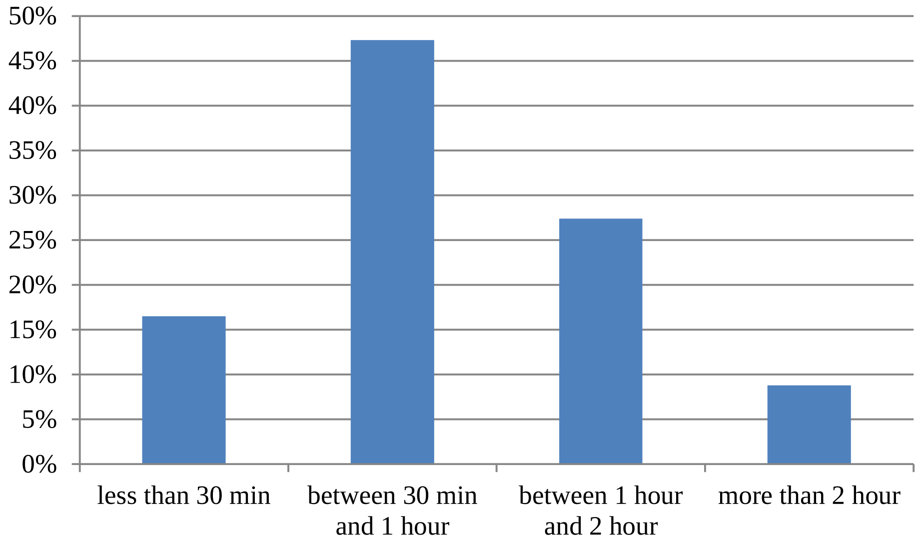

Figure 4.1 Time spend on science homework in a week

4.1.1.2 Students' perceptions of homework quality, feedback on homework, and homework self-regulation

Descriptive statistics on students' perceptions of homework quality, feedback on homework, and homework self-regulation are presented in Table 4.1. Students perceived their homework of high *quality* (*M*= 4.23, *SD*= 0.70). Students reported that science homework makes them think on science concepts, varies in difficulty, helps them understand the material, improves knowledge and skills, and resolves deficiencies in the subject matter.

Students reported that they get *feedback* on their science homework (*M*= 4.16, *SD*= 0.79). Their homework is regularly controlled, evaluated in a short time period, in-class discussions are hold about homework, and they are informed about the correct and incorrect parts of their homework.

Concerning strategies component of homework self-regulation, students reported frequent use of *homework management strategies* (*M*= 4.12, *SD*= 0.68); such as, preparing materials they need for homework, doing homework at a time that they can concentrate, and try to make homework more enjoyable for themselves. Similarly, students seem to use *deep learning strategies* often (*M*= 4.05, *SD*= 0.75); while doing homework, they appeared to go over the material that they did not understand well, gather information from different sources, question the trustworthiness of the knowledge acquired from different sources, and ask questions to themselves in order to be sure that they are on the right track.

Related to goal orientations component of homework self-regulation, students seemed to be concerned with learning new things and consolidate newly learned material (*mastery goal orientation*) (*M*= 4.47, *SD*= .66). Students also appeared to give importance to get teacher, peer and parent appreciation (*performance goal orientation*) (*M*= 4.45, *SD*= .70). On the other hand, students seem to be less concerned with completing homework with little effort and finishing homework as easily as possible (*work avoidance goal orientation*) (*M*= 2.89, *SD*= 1.22).

Students' responses to *procrastination* items revealed that students has low tendency to make excuses not to finish homework, not to devote sufficient time to complete homework, and not to complete homework in time (*M*= 1.94, *SD*= 1.05).

Table 4.1 Descriptive statistics on students' perceptions of homework quality, feedback on homework, and homework self-regulation variables

	M	*SD*
Perceived homework quality	4.23	.70
Perceived feedback on homework	4.16	.79
Management strategy use	4.12	.68
Deep learning strategy use	4.05	.75
Mastery goal orientation	4.47	.66
Performance goal orientation	4.45	.70
Work avoidance goal orientation	2.89	1.22
Procrastination	1.94	1.05

4.1.2 Descriptive statistics for teacher homework scale

In the following sections, descriptive statistics for the first and second part of the teacher homework scale are presented.

4.1.2.1 Descriptive statistics for the first part of teacher homework scale

Approximately half of the teachers (51.8%) thought that they were given sufficient education during pre-service education while the other half (48.2%) thought that they were not given sufficient education. Majority of the teachers (91.7%) did not take any in-service teacher education about homework.

About 63.5% of the teachers thought that science program gives clear information about appropriate homework they should assign, 22.9% of the teachers were undecided, while 13.6% of the teachers were disagree with the statement. About half of the participants (52.6%) agreed that it takes too much time to prepare homework in line with the science program, about one quarter of the teachers (23.7%) were undecided whereas the other quarter (23.7%) were disagree with the statement.

4.1.2.1.1 Frequency of assigning homework

Teachers reported to assign homework very frequently; 86.5% of the teachers indicated that they give homework either once a week or at the end of every lesson (See Table 4.2).

Table 4.2 Frequency of assigning homework

	Frequency	*Percent (%)*
No homework	0	0
Once a term	5	1.6
Once a month	14	4.6
Twice a month	22	7.2
Once a week	129	42.4
At the end of every lesson	134	44.1

4.1.2.1.2 Percent of students completing homework regularly

Teachers were asked about the percent of students in their class who complete homework regularly (Figure 4.2). Almost half of the participants (n= 139, 42.6%) reported that between 50% and 75% of the students do homework regularly.

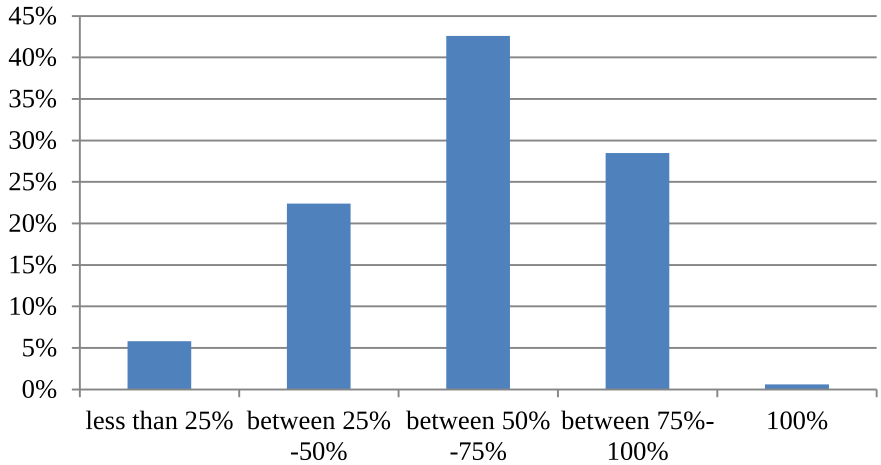

Figure 4.2 Percent of students who complete homework regularly

4.1.2.1.3 Resourced used when preparing homework

Teachers were asked about the resources they use when preparing homework. The most frequently used resources were student study book (*M*= 4.43, *SD*= 0.82), course book (*M*= 4.21, *SD*= 0.91), teacher guide book (*M*= 4.21, *SD*= 0.91), test books (*M*= 3.20, *SD*= 1.13), and internet (*M*= 3.10, *SD*= 1.07), in order.

4.1.2.1.4 Types of homework teachers assign

Teachers tended to assign individual homework (*M*= 4.21, *SD*= 0.79) more frequently than group homework (*M*= 3.06, *SD*= 0.79). Besides, teachers were asked about different types of homework they give (See Table 4.3). The most frequently assigned homework types in order were problem solving (*M*= 4.09, *SD*= 0.80), research homework (*M*= 3.88, *SD*= 0.84), poster preparation (*M*= 3.54, *SD*= 0.88), setting up an experiment (*M*= 3.23, *SD*= 0.91), reading homework (*M*= 3.17, *SD*= 1.19), completing concept map (*M*= 3.02, *SD*=0.97), oral presentation (*M*= 3.01, *SD*= 0.98), and portfolio (*M*= 2.94, *SD*= 1.18). The least frequently assigned homework types were knowledge/formula memorization (*M*= 2.28, *SD*= 1.10) and summarizing the topic (*M*= 2.27, *SD*= 1.23).

Table 4.3 Frequency of assigning different types of homework

Homework type	*Never*	*Rarely*	*Sometimes*	*Often*	*Routinely*	*M*
Making summaries	109 (34.2%)	92 (28.8%)	64 (20.1%)	30 (9.4%)	24 (7.5%)	2.27
Reading homework	24 (7.5%)	80 (24.8%)	90 (28.0%)	74 (23.0%)	54 (16.8%)	3.17
Problem solving	3 (0.9%)	6 (1.9%)	54 (16.7%)	157 (48.5%)	104 (32.1%)	4.09
Memorization of information/formulas	92 (29.2%)	100 (31.7%)	77 (24.4%)	35 (11.1%)	11 (3.5%)	2.28
Making research	-	16 (4.5%)	89 (27.3%)	140 (42.9%)	81 (24.8%)	3.88
Poster preparation	2 (0.6%)	34 (10.6%)	119 (37.0%)	122 (37.9%)	45 (14.0%)	3.54
Oral presentation	19 (6.0%)	71 (22.3%)	139 (43.6%)	68 (21.3%)	22 (6.9%)	3.01
Portfolio	36 (11.3%)	85 (26.6%)	101 (31.7%)	57 (17.9%)	40 (12.5%)	2.94
Concept maps	18 (5.6%)	72 (22.4%)	137 (42.7%)	72 (22.4%)	22 (6.9%)	3.02
Setting up an experiment	13 (4.0%)	43 (13.4%)	148 (46.0%)	94 (29.2%)	24 (7.5%)	3.23

4.1.2.1.5 Reasons for assigning homework

Teachers' main reasons for assigning homework were to make students practice knowledge and skills learned in the class (*M*= 4.63, *SD*= 0.55) and to improve students' sense of responsibility in learning (*M*= 4.55, *SD*= 0.61) (See Table 4.4).

Table 4.4 Reasons for assigning homework

	M	*SD*
To complete unfinished school work	2.40	1.32
To practice knowledge and skills learned in the class	4.63	.55
To identify students' deficiencies in subject matter knowledge	4.30	.76
To improve students' sense of responsibility in learning	4.55	.61
To increase academic achievement	4.41	.73
To prepare students for the class	4.39	.70
To help students remedy their deficiencies in the subject matter knowledge	4.37	.75
To improve students' study discipline	4.50	.62
To make students more independent in their own learning	4.28	.77
To contribute to the development of students' knowledge and skills	4.52	.56
To improve students' time management skills	4.35	.72
To improve students' research skills	4.51	.64
To inform parents about student progress	3.71	1.09

4.1.2.2 Descriptive statistics for the second part of the teacher homework scale

Descriptive statistics on teachers' perceptions of quality of homework, feedback on homework, support for students to use management and deep learning strategies, and goal orientations are provided in Table 4.5. Concerning teachers' responses to *quality* of homework items (*M*= 3.75, *SD*= .58), they appeared to prepare homework considering students' characteristics, such as prior knowledge, developmental level, interest areas and utilize different resources. They also seemed to assign homework that varies in difficulty, provide alternatives among which students can choose, and prepare homework that leads students critically think on the science concepts.

Related to *feedback* provided to students on homework (*M*= 4.00, *SD*= .58), teachers reported to check homework regularly, make in-class discussions with students about the homework, inform students about the correct and incorrect parts of the homework, give students opportunity to correct mistakes in their homework, and evaluate homework in a short time. Teachers also addressed that the evaluated homework helps students figure out their weaknesses in the subject matter.

Teachers reported to support students about use of various *homework management strategies* most of the time (*M*= 4.02, *SD*= .65). For instance, they recommend students to do homework regularly, relate homework with their personal interests, make changes in the environment so that it is suitable to do homework, do homework at a time that they can concentrate better, and do not deal with unrelated things when doing homework. Teachers were also found to expect their students to use *deep learning strategies* (*M*= 4.22, *SD*= .53). For example, they expect students to gather information from different resources, relate learning from science course with learning from other courses, relate newly learned material with previous knowledge, and inquiry about reliability of the knowledge they get, such as information from internet sources.

Teacher tended to be highly *mastery goal* oriented in assigning homework (*M*= 4.55, *SD*= .39): They appreciate students who make effort and who show progress in their homework, want students to gain different perspectives while doing homework, and view mistakes as a part of learning. To a lesser extent, teachers are also oriented toward *performance goals* (*M*= 3.73, *SD*= .71): They announce students who get high points on the homework and who did not perform well on the homework in the class and compare students in terms of their performance on the homework.

Table 4.5 Descriptive statistics for teacher homework scale

	M	*SD*
Quality of homework	3.75	.58
Feedback on homework	4.00	.58
Support for students' management strategy use	4.02	.65
Support for students' deep learning strategy use	4.22	.53
Mastery goal orientation	4.55	.39
Performance goal orientation	3.73	.71

4.2 Hierarchical Linear Modeling

In the present study, students are grouped within classes and thus there is a hierarchical data structure. When dealing with a hierarchical data structure, it is essential to use multilevel techniques (Raudenbush & Bryk, 2002). HLM allows studying more than one unit simultaneously (Lee, 2000). In the present study, level-1 units are students and level-2 units are classes. In the level-1 model, relationships among student-level variables (e.g., student gender and science achievement) are included while level-2 model capture influence of class level factors (e.g., teacher homework management support and teacher goal orientations).

Initially, between class differences in terms of homework self-regulation components and science achievement is investigated. Next, predictive power of learning environment and student characteristics on each component of homework self-regulation is tested. Then, achievement is specified as dependent variable. At the student level, two models are developed: In the first model, achievement is predicted by student level learning environment variables and student characteristics while in the second model, achievement is predicted by student level learning environment variables, student characteristics, and homework self-regulation components. In the final full model, class level learning environment variables were added to the model. The research questions addressed are given in Section 1.3 of the dissertation (See pages 11-13).

Before conducting HLM analyses, all continuous variables are standardized (M= 0, SD= 1) in order to enhance interpretability of regression coefficients while gender variable is retained in the original metric (Female= 1, Male= 0). Students' perceptions of homework quality and feedback on homework are aggregated at the class level to form indicators of students' shared assessment of their science teachers' homework practices and these variables are used as class level (level 2) predictors in the analyses. Aggregation of level 1 variables to generate indexes of learning environment is a standard procedure (e.g., Trautwein & Ludtke, 2009; Trautwein et al., 2006; Ryan, Gheen, & Midgley, 1998) and it is proposed that students' perceptions of the learning environment may provide important information because they rely on students' lived experiences (Rolland, 2012). In the present study, besides teachers' self-report of their homework practices (homework quality, feedback on homework, teacher support for student strategy use during homework, and teacher homework goals), predictive power of aggregated students' perceptions of quality of homework and feedback provided on homework are investigated. Gender is entered in the model as uncentered; student perceptions of homework quality and feedback on homework are group-mean centered; and rest of the variables are grand-mean centered. It is recommended to center students' ratings of the learning environment as group-mean because the construct is assessing aspects of learning environment (Trautwein & Ludtke, 2009).

Assumption tests for HLM analyses presented in Appendix D demonstrate that assumptions are tenable.

4.2.1 Predicting mastery goal orientation

In order to answer research question 1.a. (To what extend do students in different classes vary in homework mastery goal orientation?), one-way ANOVA with random effects model (null model) is run.

For i= 1, …, n_j students in class j, and j = 1, …, 342 classes, equations at two levels are:

Level 1 (Students level) Model:

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

Level 2 (Class level) Model:

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

where

Y_{ij} = homework mastery goal orientation for i^{th} students in j^{th} classroom

β_{0j} = the intercept (the mean homework mastery goal orientation for the j^{th} classroom)

r_{ij} = the level-1 error

γ_{00} = the grand mean

u_{0j} = the level-2 error

This model provides information about how much variation in mastery goal orientation lies within and between classes. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in Table 4.6.

Table 4.6 Final estimation of variance components for one-way ANOVA with mastey goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.088	341	1131.815	0.000
Level-1 Effect, r_{ij}	0.901			

The proportion of variance in mastery goal orientation between classes is calculated through *intraclass correlation* (ICC). Student level variance (σ^2) is found to be .901 and class level variance (τ_{00}) that is the variance of the true class means around the grand-mean is .088 (See Table 4.7). Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.901 / (0.088 + 0.901) = 0.089$$

which indicates that 8.9% of the total variance in mastery goal orientation is attributable to classes, while 91.1% (i.e., 100% - 8.9%) is attributable to students. This implies that majority of the variation in mastery goal orientation lies between students, but the variability between classes in their average mastery goal orientation (τ_{00}) is significantly greater than zero [$\chi^2(341)= 1131.815$, $p < .001$] which indicates that significant variation exists among classes in their mastery goal orientation.

In order to answer research question 2.a.1.[To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict homework mastery goal orientation?], the random coefficient model is conducted.

Equations at two levels are:

Level 1(Students level):

$$Y_{ij} = \beta_{0j} + \beta_{1j}\,(\text{FEMALE}) + \beta_{2j}\,(\text{PRIOR\_ACH}) + \beta_{3j}\,(\text{FEEDBACK}) + \beta_{4j}\,(\text{QUALITY}) + r_{ij}$$

Level 2(Class level:

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

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

where

Y_{ij} = homework mastery goal orientation of student *i* in class *j*

β_{0j} = the class mean on homework mastery goal orientation

β_{1j} = the differentiating effect of gender

β_{2j} = the differentiating effect of prior achievement

β_{3j} = the differentiating effect of feedback on homework

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

γ_{00} = the average of class means on homework mastery goal orientation across the population of classes

γ_{q0} = the average *q* variable-mastery goal orientation slope across those classes

u_{0j} = the unique increment to the intercept associated with school *j*

u_{qj} = the unique increment to the slope associated with school *j*

The purpose of conducting random coefficient model is to explain differences in students' mastery goal orientation in homework by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.7). Controlling for the other predictors in the model (this explanation is valid in all analyses, that is, when explaining effect of a predictor on the dependent variable, the effects of other predictors in the model are controlled), females report to be more mastery goal orientated than males (γ_{10}= .196, *se*= .017) and student with higher prior-achievement seem to be more mastery goal oriented than students with lower prior-achievement (γ_{20}= .092, *se*= .008). Students' perceptions of feedback on homework (γ_{30}=

.139, *se*= .015) and quality of homework (γ_{40}= .537, *se*= .017) are positively related to mastery goal orientation in homework.

Table 4.7 Random coefficient model with mastery goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MASTERY_GOAL, γ_{00}	-.096	.022	-4.262	.000
FEMALE, γ_{10}	.196	.017	11.220	.000
PRIOR_ACH, γ_{20}	.092	.008	11.141	.000
FEEDBACK, γ_{30}	.139	.015	9.465	.000
QUALITY, γ_{40}	.537	.017	32.044	.000

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.8. Variance among the class means τ_{00}= .134 with a chi-square statistic of 1526.937 is found to be statistically significant (p< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variances of the female slope τ_{11}= .025 (χ^2= 450.040, p< .001), the variance of the feedback slope τ_{33}= .029 (χ^2= 563.441, p< .001), and the variance of quality slope τ_{44}= .053 (χ^2= 864.253, p< .001) are found to be significantly different from zero. That is, slopes are much steeper in some classes than in other classes. This means that the relationship with mastery goal orientation is much stronger in some classes than in other classes. Class level variables will be used to explain these differences in the relationship between mastery goal orientation and gender, perceptions of homework feedback, and homework quality.

Table 4.8 Final estimation of variance components for random coefficient model with mastery goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.134	340	1526.937	0.000
FEMALE, u_{1j}	0.025	340	450.040	0.000
FEEDBACK, u_{3j}	0.029	340	563.441	0.000
QUALITY, u_{4j}	0.053	340	864.253	0.000
Level 1 Effect, r_{ij}	0.412			

In order to calculate how much of the within class variability (level-1 variance= σ^2) is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2 \text{ (ANOVA)} - \sigma^2 \text{ (Ran.Coef.)}}{\sigma^2 \text{ (ANOVA)}} = \frac{0.90137 - 0.41234}{0.90137} = 0.5425$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 54.25% of the student level variance in mastery goal orientation.

Then, with the aim of answering research question 2.a.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework mastery goal orientation?] intercepts and slopes as outcomes model is conducted.

Equations at two levels are:

Level 1(Students level):

$$Y_{ij} = \beta_{0j} + \beta_{1j} \text{ (FEMALE)} + \beta_{2j} \text{ (PRIOR\_ACH)} + \beta_{3j} \text{ (FEEDBACK)} + \beta_{4j} \text{ (QUALITY)} + r_{ij}$$

Level 2(Class level):

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

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

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

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

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

This model helps to explore why some classes have higher mastery goal orientation means than others. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, only aggregated student perceptions of homework quality (QUAL_MEAN) significantly predicted intercept - mastery goal orientation (γ_{01}= .260, *se*= .009) while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – female, and perceptions of homework feedback and quality slopes (See Table 4.9). Therefore, students in classes with higher average perceptions of homework quality adopted more mastery goals than students in other classes. It seemed that the higher students' shared perceptions of homework quality, the higher mastery goal oriented students.

Table 4.9 Intercepts and slopes as outcomes model with mastery goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MAST_GOAL, γ_{00}	-.093	.015	-6.161	.000
QUAL_MEAN, γ_{01}	.260	.009	28.154	.000
FEMALE, γ_{10}	.191	.017	11.088	.000
PRIOR_ACH, γ_{20}	.083	.008	10.504	.000
FEEDBACK, γ_{30}	.146	.015	9.828	.000
QUALITY, γ_{40}	.552	.017	33.362	.000

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.10.

Table 4.10 Final estimation of variance components for intercepts and slopes as outcomes model with mastery goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	.041	339	702.787	0.000
FEMALE, u_{1j}	.025	340	453.487	0.000
FEEDBACK, u_{3j}	.031	340	568.560	0.000
QUALITY, u_{4j}	.051	340	873.208	0.000
Level-1 Effect, r_{ij}	.640			

The proportion of variance explained in mastery goal orientation relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.13352 - 0.04059}{0.13352} = 0.6960$$

Therefore, it can be said that 69.60% of the variance in the between class differences in mean mastery goal orientation is accounted for by aggregated student perceptions of homework quality. However, significant differences in means mastery goal orientation still remains between classes [$\chi^2(339) = 702.787$, $p < .001$].

The results for predicting mastery goal orientation is summarized in Figure 4.3.

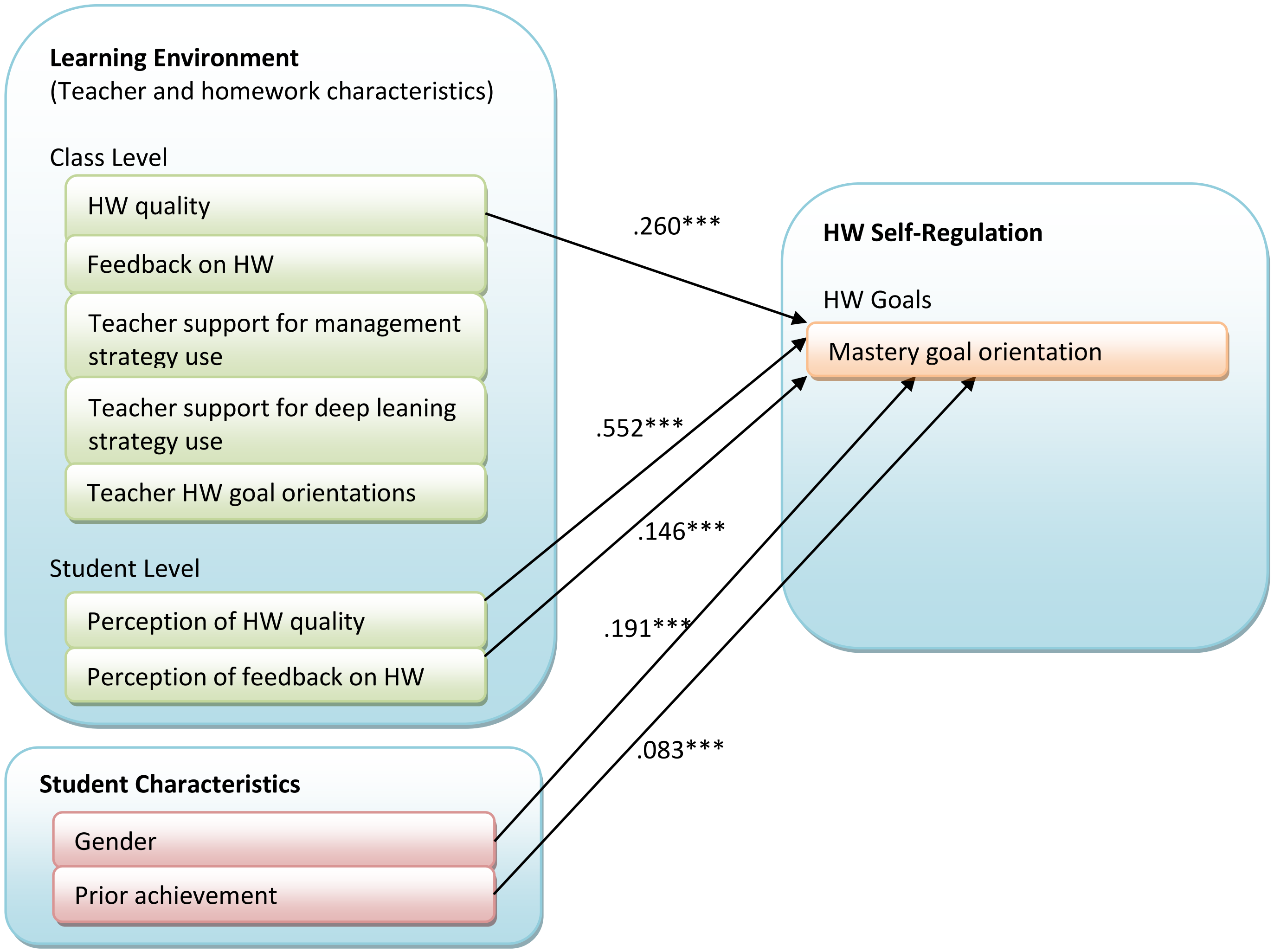

Figure 4.3 Predicting mastery goal orientation in homework

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

4.2.2 Predicting performance goal orientation

In order to answer research question 1.b. (To what extend do students in different classes vary in homework performance goal orientation?), one-way ANOVA with random effects model (null model) is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.11.

Table 4.11 Final estimation of variance components for one-way ANOVA with performance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.061	341	874.085	0.000
Level-1 Effect, r_{ij}	0.929			

Student level variance (σ^2) is .929 and class level variance (τ_{00}) is .061. Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.061 / (0.061 + 0.929) = 0.062$$

which indicates that 6.2% of the total variance in performance goal orientation is attributable to classes, while 93.8% (i.e., 100% - 6.2%) is attributable to students. This implies that majority of the variation in performance goal orientation lies between students, but the variability between classes in their average performance goal orientation (τ_{00}) is significantly greater than zero [$\chi^2(341)= 874.085$, $p < .001$] which indicates that significant variation exist among classes in their performance goal orientation.

In order to answer research question 2.b.1. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict homework performance goal orientation?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' performance goal orientation by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.12). Controlling for the other predictors in the model, females report to be more performance goal orientated than males (γ_{10}= .178, se= .020) and student with higher prior-achievement seem to be more performance goal oriented (γ_{20}= .071, se= .011). Students' perceptions of feedback on homework (γ_{30}= .110, se= .017) and quality of homework (γ_{40}= .410, se= .019) are positively related to performance goal orientation in homework.

Table 4.12 Random coefficient model with performance goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PERFOR_GOAL, γ_{00}	-.082	.021	-3.870	.000
FEMALE, γ_{10}	.178	.020	8.892	.000
PRIOR_ACH, γ_{20}	.071	.011	6.554	.000
FEEDBACK, γ_{30}	.110	.017	6.417	.000
QUALITY, γ_{40}	.410	.019	22.029	.000

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.13. Variance among the class means τ_{00}= .098 with a chi-square statistic of 891.387 is found to be statistically significant (p< .001). This significant difference (variability) between classes implies that there is need to incorporate class level variables into the model that might account for some of the differences. Similarly, the variances of the female slope τ_{11}= .026 (χ^2= 437.912, p< .001), the variance of the prior-achievement slope τ_{22}= .008 (χ^2= 441.030, p< .001), the variance of the feedback slope τ_{33}= .037 (χ^2= 548.792, p< .001), and the variance of quality slope τ_{44}= .060 (χ^2= 760.749, p< .001) are found to be significantly different from zero. Class level variables will used to explain these differences in the relationship between performance goal orientation and gender, prior-achievement, perceptions of homework feedback, and homework quality.

Table 4.13 Final estimation of variance components for random coefficient model with performance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.098	339	891.387	0.000
FEMALE, u_{1j}	0.026	339	437.912	0.000
PRIOR_ACH, u_{2j}	0.008	339	441.030	0.000
FEEDBACK, u_{3j}	0.037	339	548.792	0.000
QUALITY, u_{4j}	0.060	339	760.749	0.000
Level 1 Effect, r_{ij}	0.579			

In order to calculate how much of the within class variability (level-1 variance= σ^2) is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2\text{ (ANOVA) - }\sigma^2\text{ (Ran.Coef.)}}{\sigma^2\text{ (ANOVA)}} = \frac{0.92909 - 0.57872}{0.92909} = 0.3771$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 37.7% of the student level variance in performance goal orientation.

Then, with the aim of answering research question 2.b.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework performance goal orientation?] intercepts and slopes model is conducted. This model helps to explore why some classes have higher performance goal orientation means than others. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, only aggregated student perceptions of homework quality (QUAL_MEAN) significantly predicted performance goal orientation (γ_{01}= .184, *se*= .011) while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – female, prior-achievement, and perceptions of feedback and quality slopes (See Table 4.14). It seems that the higher the students' shared perceptions of homework quality, the higher performance goal oriented students.

Table 4.14 Intercepts and slopes as outcomes model with performance goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PERFOR_GOAL, γ_{00}	-.078	.017	-4.644	.000
QUAL_MEAN, γ_{01}	.184	.011	16.610	.000
FEMALE, γ_{10}	.170	.020	8.488	.000
PRIOR_ACH, γ_{20}	.062	.011	5.750	.000
FEEDBACK, γ_{30}	.116	.017	6.803	.000
QUALITY, γ_{40}	.427	.018	23.144	.000

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.15.

Table 4.15 Final estimation of variance components for intercepts and slopes as outcomes model with performance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.042	338	574.435	0.000
FEMALE, u_{1j}	0.029	339	438.882	0.000
PRIOR_ACH, u_{2j}	0.008	339	441.704	0.000
FEEDBACK, u_{3j}	0.037	339	550.266	0.000
QUALITY, u_{4j}	0.057	339	764.822	0.000
Level-1 Effect, r_{ij}	0.578			

The proportion of variance explained in performance goal orientation relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.09782 - 0.04171}{0.09782} = 0.5736$$

Therefore, it can be said that approximately 57.4% of the variance in the between class differences in mean performance goal orientation is accounted for by aggregated student perceptions of homework quality. However, significant differences in means performance goal orientation still remains between classes [$\chi^2(338) = 574.435$, $p < .001$].

The results for predicting performance goal orientation is summarized in Figure 4.4.

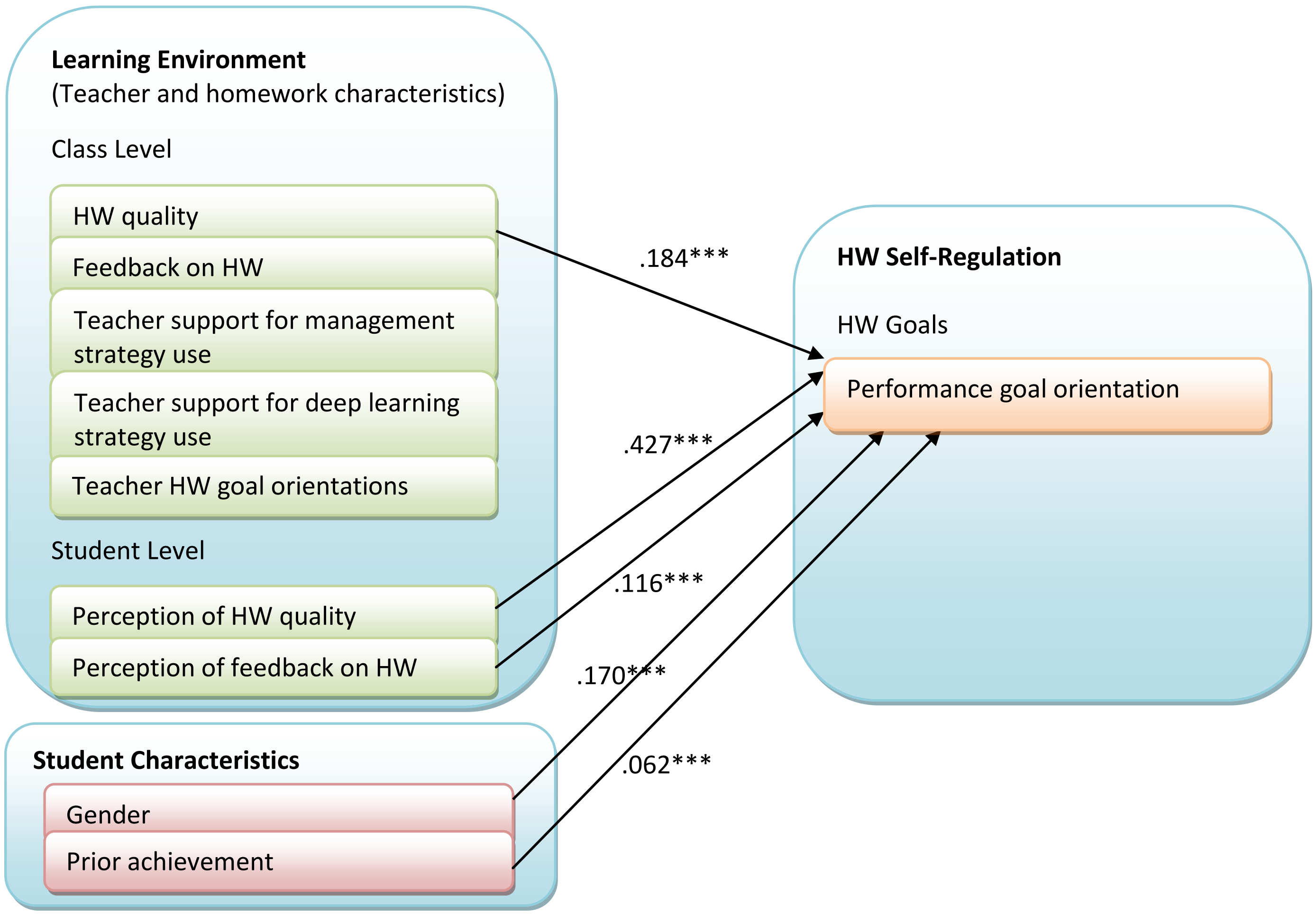

Figure 4.4 Predicting performance goal orientation in homework

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

4.2.3 Predicting work-avoidance goal orientation

In order to answer research question 1.c. (To what extend do students in different classes vary in homework avoidance goal orientation?), one-way ANOVA with random effects model (null model) is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.16.

Table 4.16 Final estimation of variance components for one-way ANOVA with work-avoidance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.097	341	1201.218	0.000
Level-1 Effect, r_{ij}	0.905			

Student level variance (σ^2) is .905 and class level variance (τ_{00}) is .097. Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.097 / (0.097 + .905) = 0.097$$

which indicates that 9.7% of the total variance in work avoidance goal orientation is attributable to classes, while 90.3% is attributable to students. This implies that majority of the variation in work-avoidance goal orientation lies between students, but the variability between classes in their average work-avoidance goal orientation (τ_{00}) is significantly greater than zero [$\chi^2(341)= 1201.218$, $p < .001$] which indicates that significant variation exist among classes in their work-avoidance goal orientation.

In order to answer research question 2.c.1. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict homework avoidance goal orientation?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' performance goal orientation by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.17). Controlling for the other predictors in the model, males report to be more work-avoidance goal orientated than females (γ_{10}= -445, *se*= .023) and student with lower prior-achievement seem to be more work-avoidance goal oriented (γ_{20}= -.154, *se*= .000). Students' perceptions of feedback on homework is negatively related to work avoidance goals (γ_{30}= -.040, *se*= .015) while perceptions of quality of homework is positively related to avoidance goal orientation in homework (γ_{40}= .044, *se*= .017).

Table 4.17 Random coefficient model with work-avoidance goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean AVOID_GOAL, γ_{00}	.225	.022	10.083	.000
FEMALE, γ_{10}	-.445	.023	-18.691	.000
PRIOR_ACH, γ_{20}	-.154	.012	-12.707	.000
FEEDBACK, γ_{30}	-.040	.015	-2.765	.006
QUALITY, γ_{40}	.044	.017	2.541	.012

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.18. Variance among the class means τ_{00}= .097 with a chi-square statistic of 738.656 is found to be statistically significant (*p*< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variances of the female slope τ_{11}= .048 (χ^2= 434.402, *p*< .001), the variance of the prior-achievement slope τ_{22}= .009 (χ^2= 413.025, *p*< .01), and the variance of quality slope τ_{44}= .030 (χ^2= 551.945, *p*< .001) are found to be significantly different from zero. Class level variables will used to explain these differences in the relationship between performance goal orientation and gender, prior-achievement, and perceptions of homework quality.

Table 4.18 Final estimation of variance components for random coefficient model with work-avoidance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.097	339	738.656	0.000
FEMALE, u_{1j}	0.048	339	434.402	0.001
PRIOR_ACH, u_{2j}	0.009	339	413.025	0.004
QUALITY, u_{4j}	0.030	339	551.945	0.000
Level 1 Effect, r_{ij}	0.787			

The proportion of variance explained at student level compared to variance estimates of one way ANOVA with random effects model is:

$$\frac{\sigma^2 \text{ (ANOVA)} - \sigma^2 \text{ (Ran.Coef.)}}{\sigma^2 \text{ (ANOVA)}} = \frac{0.90528 - 0.78688}{0.90528} = 0.1308$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 13.1% of the student level variance in work-avoidance goal orientation.

Then, with the aim of answering research question 2.c.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework avoidance goal orientation?] intercepts and slopes as outcomes model is conducted. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, only aggregated student perceptions of homework quality (QUAL_MEAN) significantly predicted work-avoidance goal orientation (γ_{01}= -.057, *se*= .017) while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – female, prior-achievement, and perceptions of homework quality slopes (See Table 4.19). It seems that the higher the students' shared perceptions of homework quality, the less work-avoidance goal oriented students adopt.

Table 4.19 Intercepts and slopes as outcomes model with work-avoidance goal orientation dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean AVOID_GOAL, γ_{00}	.225	.022	10.235	.000
QUAL_MEAN, γ_{01}	-.057	.017	-3.330	.001
FEMALE, γ_{10}	-.444	.024	-18.709	.000
PRIOR_ACH, γ_{20}	-.153	.012	-12.567	.000
FEEDBACK, γ_{30}	-.041	.015	-2.787	.006
QUALITY, γ_{40}	.048	.017	2.800	.006

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.20.

Table 4.20 Final estimation of variance components for intercepts and slopes as outcomes model with work-avoidance goal orientation dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.091	338	715.526	0.000
FEMALE, u_{1j}	0.047	339	434.424	0.001
PRIOR_ACH, u_{2j}	0.009	339	413.358	0.004
QUALITY, u_{4j}	0.029	339	550.925	0.000
Level-1 Effect, r_{ij}	0.787			

The proportion of variance explained in avoidance goal orientation relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.09657 - 0.09067}{0.09067} = 0.0611$$

Therefore, it can be said that approximately 6.1% of the variance in the between class differences in mean work-avoidance goal orientation is accounted for by aggregated student perceptions of homework quality. Significant differences between classes in means work-avoidance goal orientation still remains to be explained [$\chi^2(338)= 715.526$, $p< .001$].

The results for predicting performance goal orientation is summarized in Figure 4.5.

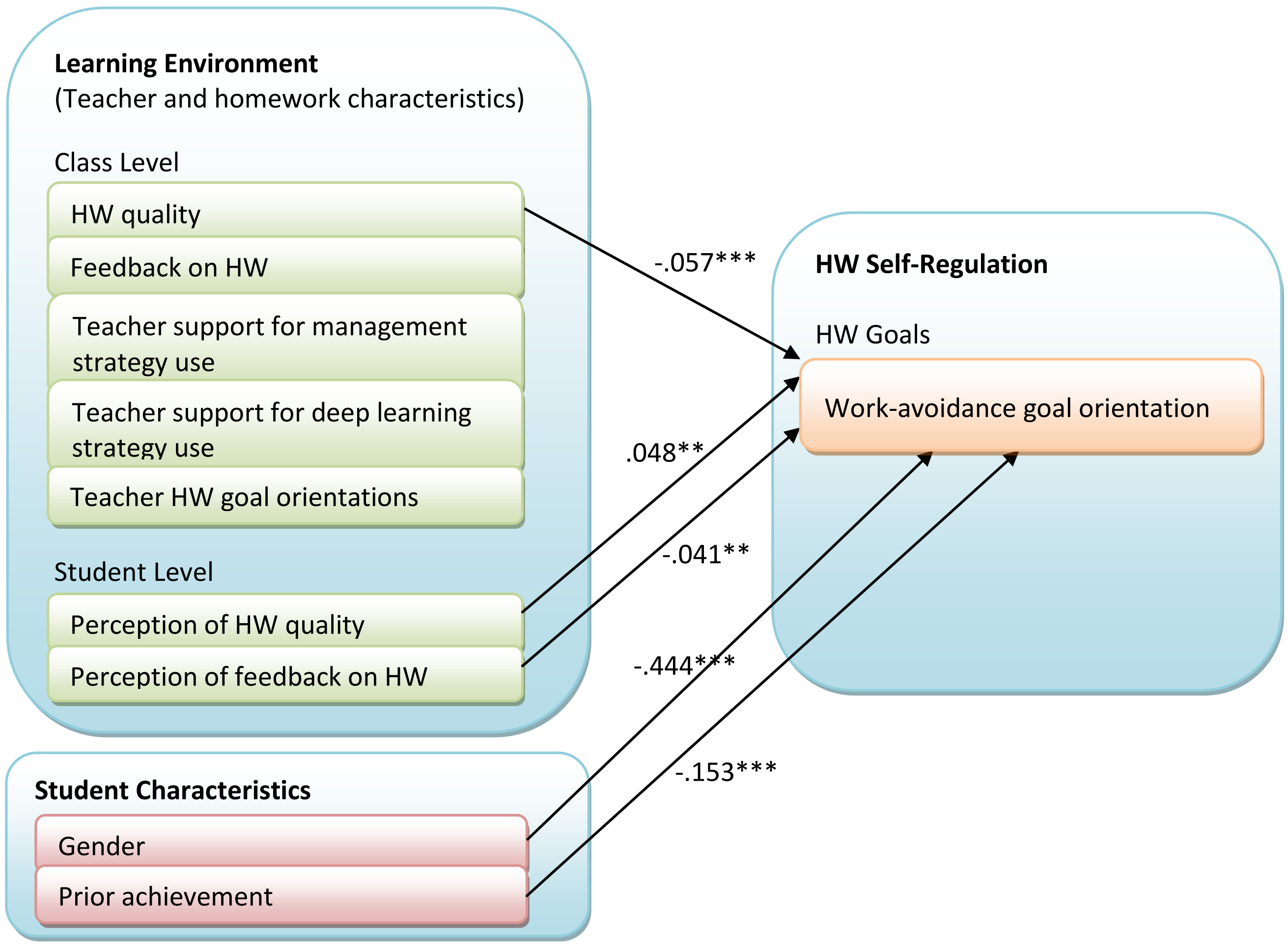

Figure 4.5 Predicting work-avoidance goal orientation in homework

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

4.2.4 Predicting homework procrastination

In order to answer research question 1.d. (To what extend do students in different classes vary in homework procrastination tendency?), one-way ANOVA with random effects model is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.21.

Table 4.21 Final estimation of variance components for one-way ANOVA with procrastination dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.124	341	1487.127	0.000
Level-1 Effect, r_{ij}	0.870			

Student level variance (σ^2) is .870 and class level variance (τ_{00}) is .124. Then, ICC is

$$\text{ICC} = \tau_{00} / (\tau_{00} + \sigma^2) = 0.124 / (0.124 + 0.870) = 0.125$$

which indicates that 12.5% of the total variance in homework procrastination is attributable to classes, while 87.5% is attributable to students. This implies that majority of the variation in homework procrastination lies between students, but the variability between classes in their average homework procrastination (τ_{00}) is significantly greater than zero [$\chi^2(341) = 1487.127$, $p < .001$] which indicates that significant variation exist among classes in their homework procrastination.

In order to answer research question 2.b.1. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict homework procrastination tendency?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' homework procrastination by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.22). Accordingly, controlling for the other predictors in the model, males tend to procrastinate homework more than females (γ_{10}= -.306, *se*= .023) and student with low prior-achievement are more likely to involve in homework procrastination (γ_{20}= -.199, *se*= .013). Students' perceptions of feedback on homework (γ_{30}= -.087, *se*= .017) and quality of homework (γ_{40}= -.152, *se*= .016) are negatively related to homework procrastination.

Table 4.22 Random coefficient model with procrastination dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PROCRAST, γ_{00}	.153	.026	5.884	.000
FEMALE, γ_{10}	-.306	.023	-13.375	.000
PRIOR_ACH, γ_{20}	-.199	.013	-15.825	.000
FEEDBACK, γ_{30}	-.087	.017	-5.253	.000
QUALITY, γ_{40}	-.152	.016	-9.357	.000

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.23. Variance among the class means τ_{00}= .162 with a chi-square statistic of 1040.350 is found to be statistically significant (*p*< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variances of the female slope τ_{11}= .045 (χ^2= 431.437, *p*< .001), the variance of the prior achievement slope τ_{22}= .015 (χ^2= 430.069, *p*< .001), the variance of the feedback slope τ_{33}= .022 (χ^2= 464.569, *p*< .001), and the variance of quality slope τ_{44}= .024 (χ^2= 487.229, *p*< .001) are found to be significantly different from zero. That is, slopes are much steeper in some classes than in other classes. This means that the relationship with procrastination is much stronger in some classes than in other classes. Class level variables will be used to explain these differences in the relationship between procrastination and gender, prior-achievement, and perceptions of homework feedback, and homework quality.

Table 4.23 Final estimation of variance components for random coefficient model with procrastination dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.162	339	1040.350	0.000
FEMALE, u_{1j}	0.045	339	431.437	0.001
PRIOR_ACH, u_{2j}	0.015	339	430.069	0.001
FEEDBACK, u_{3j}	0.022	339	464.569	0.000
QUALITY, u_{4j}	0.024	339	487.229	0.000
Level 1 Effect, r_{ij}	0.708			

In order to calculate how much of the within class variability (level-1 variance= σ^2) is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2\text{ (ANOVA) - }\sigma^2\text{ (Ran.Coef.)}}{\sigma^2\text{ (ANOVA)}} = \frac{0.86981 - 0.70790}{0.70790} = 0.1861$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 18.6% of the student level variance in homework procrastination.

Then, with the aim of answering research question 2.b.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict homework procrastination?]

intercepts and slopes as outcomes model is conducted. This model helps to explore why some classes have higher homework procrastination means than others. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, only aggregated student perceptions of homework quality (QUAL_MEAN) significantly and negatively predicted homework procrastination (γ_{01}= -.170, *se*= .016) while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – female, prior achievement, and perceptions of homework feedback and quality slopes (See Table 4.24). It seems that, students are less likely to involve in homework procrastination in classes where homework quality is high.

Table 4.24 Intercepts and slopes as outcomes model with procrastination dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PROCRAST, γ_{00}	.152	.024	6.344	.000
QUAL_MEAN, γ_{01}	-.170	.016	-10.509	.000
FEMALE, γ_{10}	-.304	.023	-13.131	.000
PRIOR_ACH, γ_{20}	-.197	.012	-15.853	.000
FEEDBACK, γ_{30}	-.086	.017	-5.169	.000
QUALITY, γ_{40}	-.144	.016	-8.913	.000

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.25.

Table 4.25 Final estimation of variance components for intercepts and slopes as outcomes model with procrastination dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.129	338	921.686	0.000
FEMALE, u_{1j}	0.050	339	432.075	0.001
PRIOR_ACH, u_{2j}	0.014	339	430.747	0.001
FEEDBACK, u_{3j}	0.022	339	465.131	0.000
QUALITY, u_{4j}	0.023	339	486.896	0.000
Level-1 Effect, r_{ij}	0.707			

The proportion of variance explained in homework procrastination relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.16169 - 0.12892}{0.16169} = 0.2027$$

Therefore, it can be said that approximately 20.3% of the variance in the between class differences in mean homework procrastination is accounted for by aggregated student perceptions of homework quality. However, significant differences in means homework procrastination still remains between classes [$\chi^2(338)= 715.526$, $p< .001$].

The results for predicting homework procrastination is summarized in Figure 4.6.

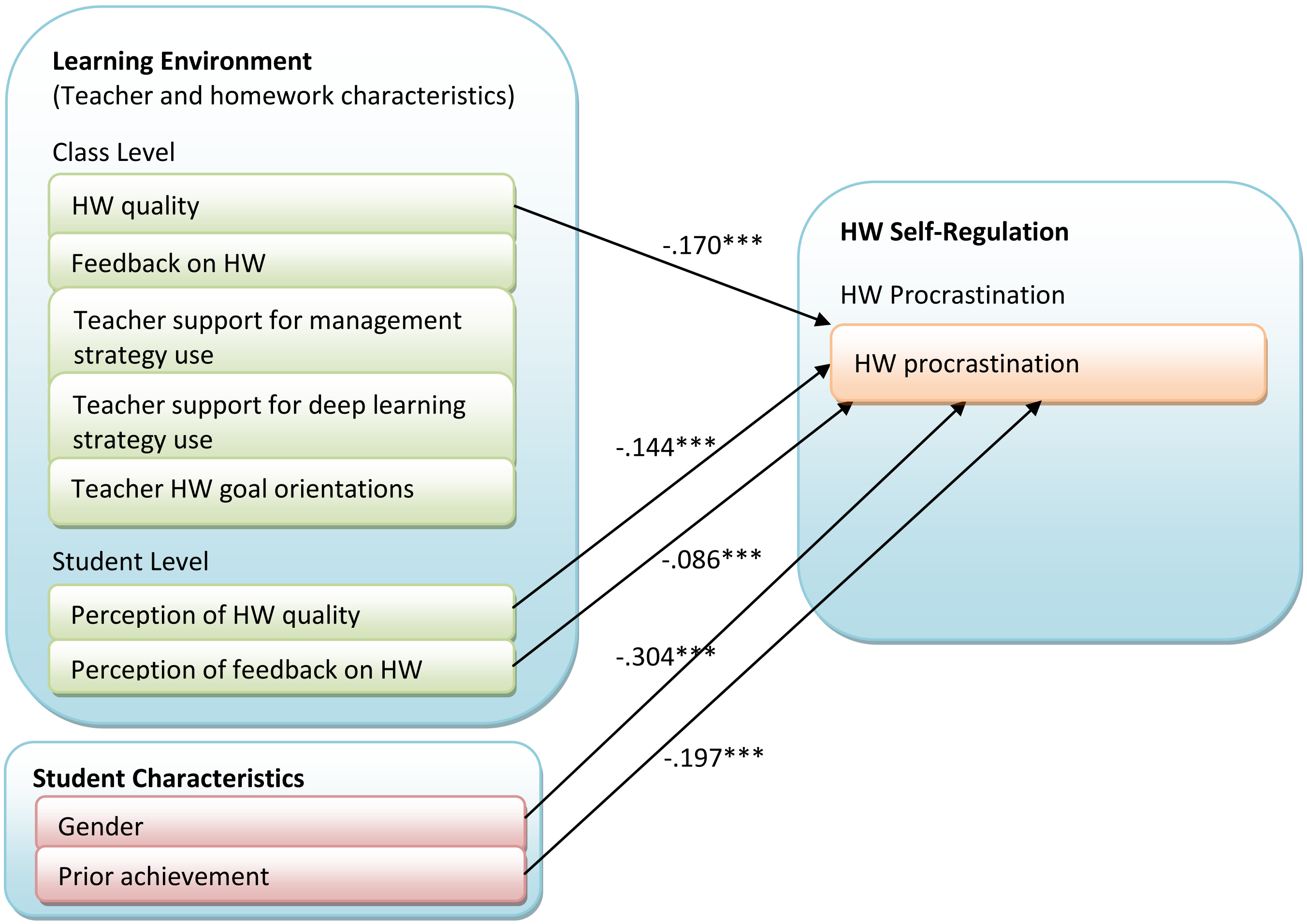

Figure 4.6 Predicting homework procrastination

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

4.2.5 Predicting homework deep learning strategy use

In order to answer research question 1.e. (To what extend do students in different classes vary in use of homework deep learning strategies?), one-way ANOVA with random effects model is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.26.

Table 4.26 Final estimation of variance components for one-way ANOVA with deep learning strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.093	341	1176.216	0.000
Level-1 Effect, r_{ij}	0.898			

Student level variance (σ^2) is .898 and class level variance (τ_{00}) is .093. Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.093 / (0.093 + 0.898) = 0.094$$

which indicates that 9.4% of the total variance in deep learning strategy use is attributable to classes, while 90.6% is attributable to students. This implies that majority of the variation in deep learning strategy use lies between students, but the variability between classes in their average homework procrastination (τ_{00}) is significantly greater than zero [$\chi^2(341)= 1176.216$, $p < .001$] which indicates that significant variation exist among classes in their deep learning strategy use during homework.

In order to answer research question 2.e.1. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict use of homework deep learning strategies?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' homework procrastination by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.27). Controlling for the other predictors in the model, females report to use deep learning strategies during homework more than males (γ_{10}= .088, se= .016) and student with high prior-achievement use more deep learning strategies during homework (γ_{20}= .154, se= .008). Students' perceptions of feedback on homework (γ_{30}= .315, se= .016) and quality of homework (γ_{40}= .423, se= .016) are positively related to homework deep learning strategy use.

Table 4.27 Random coefficient model with homework deep learning strategy use dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean DEEP, γ_{00}	-.040	.020	-1.977	.048
FEMALE, γ_{10}	.088	.016	5.620	.000
PRIOR_ACH, γ_{20}	.154	.008	18.209	.000
FEEDBACK, γ_{30}	.315	.016	19.585	.000
QUALITY, γ_{40}	.423	.016	26.634	.000

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.28. Variance among the class means τ_{00}= .097 with a chi-square statistic of 2115.834 is found to be statistically significant (p< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variance of the feedback slope τ_{33}= .040 (χ^2= 664.127, p< .001), and the variance of quality slope τ_{44}= .041 (χ^2= 720.782, p< .001) are found to be significantly different from zero. Class level variables will be used to explain these differences in the relationship between deep learning strategy use and perceptions of homework feedback, and homework quality.

Table 4.28 Final estimation of variance components for random coefficient model with deep learning strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.097	341	2115.834	0.000
FEEDBACK, u_{3j}	0.040	341	664.127	0.000
QUALITY, u_{4j}	0.041	341	720.782	0.000
Level 1 Effect, r_{ij}	0.441			

In order to calculate how much of the within class variability (level-1 variance= σ^2) is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2\,(\text{ANOVA}) - \sigma^2\,(\text{Ran.Coef.})}{\sigma^2\,(\text{ANOVA})} = \frac{0.89753 - 0.44088}{0.89753} = 0.5088$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 50.9% of the student level variance in homework deep learning strategy use.

Then, with the aim of answering research question 2.e.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict use of homework deep learning strategies?] intercepts and slopes as outcomes model is conducted. This model helps to explore why some classes have higher homework deep learning strategy use means than others. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, aggregated student perceptions of homework quality (QUAL_MEAN) (γ_{01}= .215, *se*= .021) and feedback provided on homework (FEED_MEAN) (γ_{02}= .072, *se*= .021) significantly and positively predict deep learning strategy use while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – perceptions of homework feedback and quality slopes (See Table 4.29). Students seem to use more deep leaning strategies in classes where quality of homework assigned is high and if they are provided feedback on their homework.

Table 4.29 Intercepts and slopes as outcomes model with deep learning strategy use dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean DEEP, γ_{00}	-.037	.014	-2.601	.010
QUAL_MEAN, γ_{01}	.215	.021	10.332	.000
FEED_MEAN, γ_{02}	.072	.021	3.460	.001
FEMALE, γ_{10}	.085	.015	5.465	.000
PRIOR_ACH, γ_{20}	.147	.008	17.811	.000
FEEDBACK, γ_{30}	.319	.016	19.940	.000
QUALITY, γ_{40}	.425	.016	26.921	.000

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.30.

Table 4.30 Final estimation of variance components for intercepts and slopes as outcomes model with deep learning strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.029	339	882.634	0.000
FEEDBACK, u_{3j}	0.039	341	666.152	0.000
QUALITY, u_{4j}	0.040	341	721.455	0.000
Level-1 Effect, r_{ij}	0.441			

The proportion of variance explained in deep learning strategy use relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.09717 - 0.02915}{0.09717} = 0.700$$

Therefore, it can be said that 70.0% of the variance in the between class differences in mean deep learning strategy use is accounted for by aggregated student perceptions of homework quality and feedback on homework. Although a large amount of variance is explained, significant differences in means deep learning strategy use still remains between classes [$\chi^2(339)= 882.634$, $p< .001$].

The results for predicting homework deep learning strategy use is summarized in Figure 4.7.

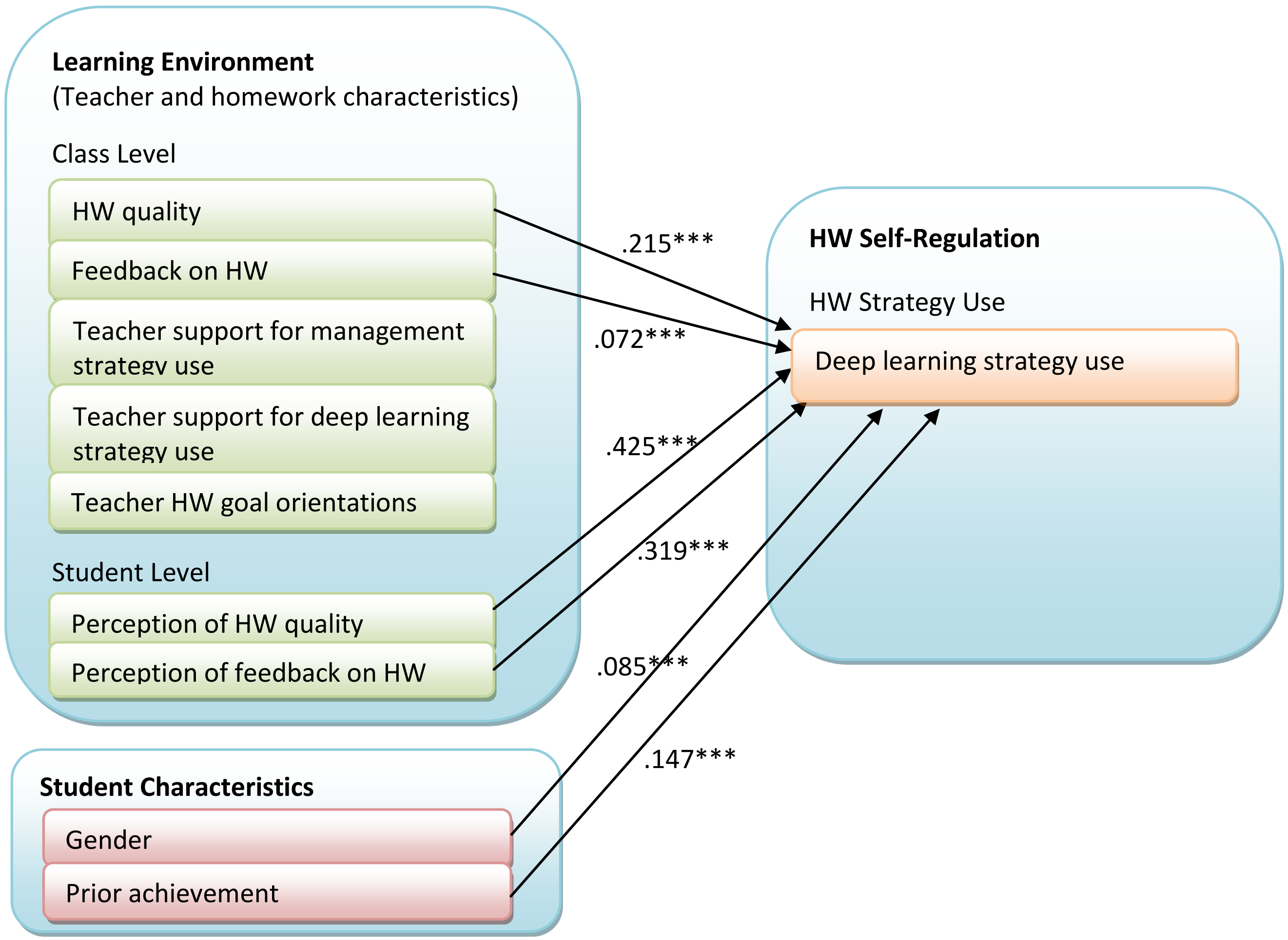

Figure 4.7 Predicting homework deep learning strategy use

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

4.2.6 Predicting homework management strategy use

In order to answer research question 1.f. (To what extend do students in different classes vary in use of homework management strategies?), one-way ANOVA with random effects model is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.31.

Table 4.31 Final estimation of variance components for one-way ANOVA with management strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.082	341	1063.677	0.000
Level-1 Effect, r_{ij}	0.908			

Student level variance (σ^2) is .908 and class level variance (τ_{00}) is .081. Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.082 / (0.082 + 0.908) = 0.082$$

which indicates that 8.2% of the total variance in homework management strategy use is attributable to classes, while 91.8% is attributable to students. This implies that majority of the variation in homework management strategy use lies between students, but the variability between classes in their average homework management strategy use (τ_{00}) is significantly greater than zero [$\chi^2(341)= 1063.677$, $p < .001$] which indicates that significant variation exist among classes in their homework management strategy use.

In order to answer research question 2.f.1. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict use of homework management strategies?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' homework management by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (See Table 4.32). Controlling for the other predictors in the model, females report to use more homework management strategies than males (γ_{10}= .239, se= .016) and student with high prior-achievement use more management strategies (γ_{20}= .167, se= .010). Students' perceptions of feedback on homework (γ_{30}= .301, se= .016) and quality of homework (γ_{40}= .366, se= .016) are positively related to students' use of homework management strategies.

Table 4.32 Random coefficient model with management strategy use dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MANAGE, γ_{00}	-.123	.019	-6.363	.000
FEMALE, γ_{10}	.239	.016	14.789	.000
PRIOR_ACH, γ_{20}	.167	.010	16.781	.000
FEEDBACK, γ_{30}	.301	.016	19.109	.000
QUALITY, γ_{40}	.366	.016	22.872	.000

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.33. Variance among the class means τ_{00}= .082 with a chi-square statistic of 1506.686 is found to be statistically significant (p< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variances of the prior-achievement slope τ_{22}= .007 (χ^2= 417.563, p< .01), the variance of the feedback slope τ_{33}= .033 (χ^2= 588.995, p< .001), and the variance of quality slope τ_{44}= .049 (χ^2= 652.829, p< .001) are found to be significantly different from zero. Class level variables will used to explain these differences in the relationship between management strategy use and prior-achievement, perceptions of homework feedback, and homework quality.

Table 4.33 Final estimation of variance components for random coefficient model with management strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.082	340	1506.686	0.000
PRIOR_ACH, u_{2j}	0.007	340	417.563	0.003
FEEDBACK, u_{3j}	0.033	340	588.995	0.000
QUALITY, u_{4j}	0.049	340	652.829	0.000
Level 1 Effect, r_{ij}	0.471			

In order to calculate how much of the within class variability (level-1 variance= σ^2) is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2\text{ (ANOVA) - }\sigma^2\text{ (Ran.Coef.)}}{\sigma^2\text{ (ANOVA)}} = \frac{0.90758 - 0.47090}{0.90758} = 0.4811$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 48.1% of the student level variance in homework management strategy use.

Then, with the aim of answering research question 2.f.2 [To what extend do class level variables (homework quality, feedback on homework, teacher support for strategy use during homework, and teacher homework goals) predict use of homework management strategies?] intercepts and slopes as outcomes model is conducted. This model helps to explore why some classes have higher homework management strategy use means than others. Student level equation remains unchanged as in the random coefficient model, while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, aggregated student perceptions of homework quality (QUAL_MEAN) (γ_{01}= .198, *se*= .021) and feedback provided on homework (FEED_MEAN) (γ_{02}= .047, *se*= .021) significantly and positively predict homework management while none of the level-2 predictors emerged as significant predictors for randomly varying slopes – prior achievement, and perceptions of homework feedback and quality slopes (See Table 4.34). Students seem to use more homework management strategies in classes where quality of homework is high and if they are provided feedback on their homework.

Table 4.34 Intercepts and slopes as outcomes model with management strategy use dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MANAGE, γ_{00}	-.120	.015	-8.134	.000
QUAL_MEAN, γ_{01}	.198	.021	9.422	.000
FEED_MEAN, γ_{02}	.047	.021	2.232	.026
FEMALE, γ_{10}	.236	.016	14.743	.000
PRIOR_ACH, γ_{20}	.157	.010	16.223	.000
FEEDBACK, γ_{30}	.303	.016	19.299	.000
QUALITY, γ_{40}	.375	.016	23.413	.000

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.35.

Table 4.35 Final estimation of variance components for intercepts and slopes as outcomes model with management strategy use dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.031	338	771.786	0.000
PRIOR_ACH, u_{2j}	0.006	340	415.745	0.003
FEEDBACK, u_{3j}	0.033	340	590.200	0.000
QUALITY, u_{4j}	0.040	340	656.395	0.000
Level-1 Effect, r_{ij}	0.471			

The proportion of variance explained in management strategy use relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.08225 - 0.03059}{0.08225} = 0.6281$$

Therefore, it can be said that 62.8% of the variance in the between class differences in mean management strategy use is accounted for by aggregated student perceptions of homework quality and feedback on homework. Although a large amount of variance is explained, significant differences between classes in means management strategy use still remains to be explained [$\chi^2(338)= 771.786$, $p< .001$].

The results for predicting homework management strategy use is summarized in Figure 4.8.

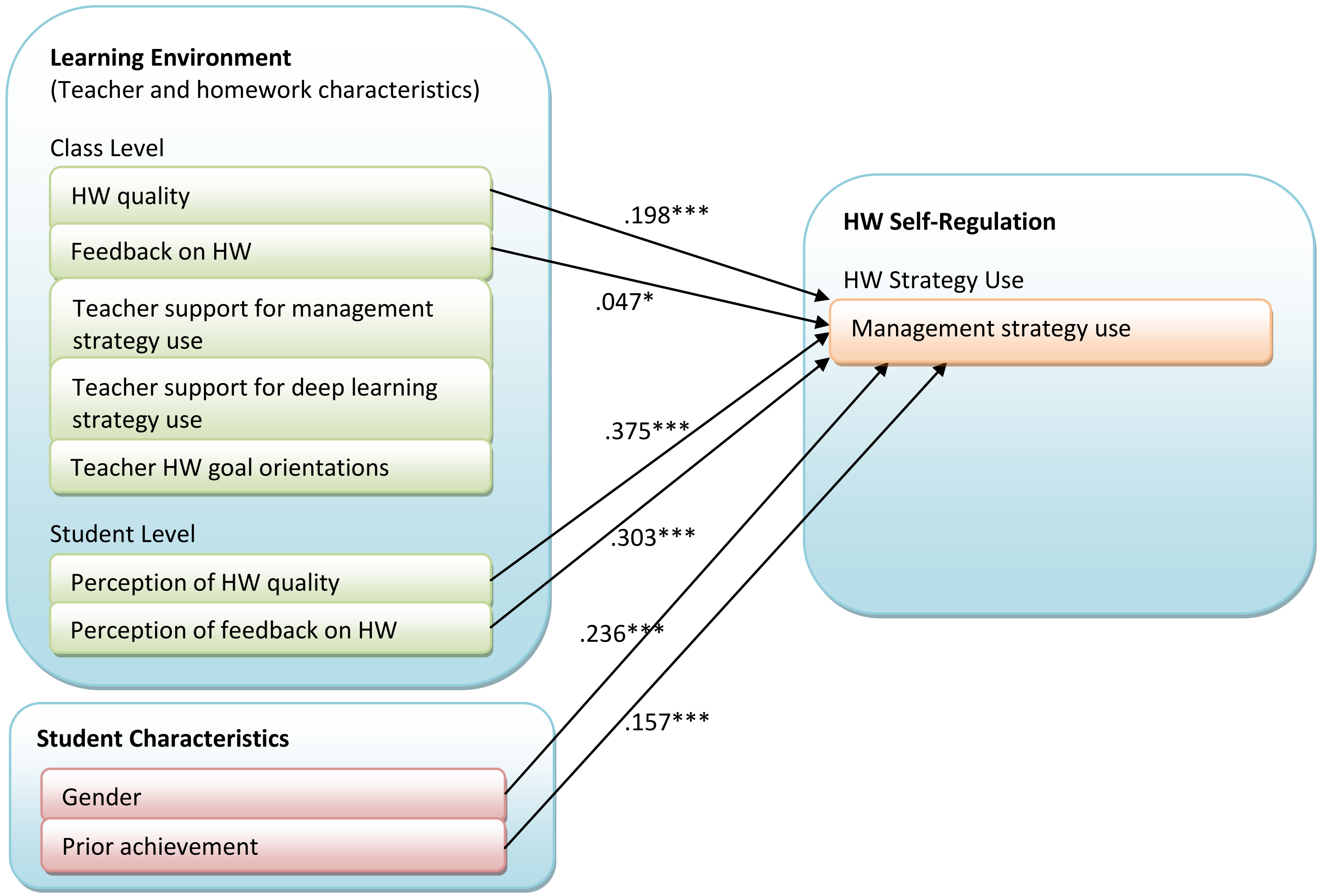

Figure 4.8 Predicting homework management strategy use

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

4.2.7 Predicting science achievement

In order to answer research question 1.g. (To what extend do students in different classes vary in science achievement?), one-way ANOVA with random effects model is run. The final estimation of variance components obtained from the one-way ANOVA with random effects model was given in the Table 4.36.

Table 4.36 Final estimation of variance components for one-way ANOVA with science achievement dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class Mean, u_{0j}	0.377	341	5089.137	0.000
Level-1 Effect, r_{ij}	0.630			

Student level variance (σ^2) is .630 and class level variance (τ_{00}) is .377. Then, ICC is

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.377 / (0.377 + 0.630) = 0.374$$

which indicates that 37.4% of the total variance in science achievement is attributable to classes, while 62.6% is attributable to students. This implies that majority of the variation in science achievement lies between students, but the variability between classes in their average science achievement (τ_{00}) is significantly greater than zero [$\chi^2(341)= 5089.137$, $p < .001$] which indicates that significant variation exist among classes in their science achievement.

In order to answer research question 3.a. [To what extend do student characteristics (gender and prior achievement) and student level learning environment variables (perceptions of homework quality and feedback on homework) predict science achievement?], the random coefficient model is conducted. The purpose of conducting random coefficient model is to explain differences in students' science achievement by means of level-1 predictors (gender, prior-achievement, perceptions of homework quality and feedback on homework) (Model 1 in Table 4.37). Controlling for the other predictors in the model, females outperform males in science achievement (γ_{10}= .085, *se*= .019) and students with higher prior-achievement score high on science achievement test (γ_{20}= .359, *se*= .011). Students' perceptions of feedback on homework (γ_{30}= .035, *se*= .013) and quality of homework (γ_{40}= .067, *se*= .013) are positively related to their science achievement.

Next, another random coefficient model is conducted in order to explain research question 3.b. [To what extend do student characteristics (gender and prior achievement), student level learning environment variables (perceptions of homework quality and feedback on homework), and homework self-regulation (homework goal orientations, procrastination tendency, and strategy use) predict science achievement?]. In this model, besides student characteristics and perceptions of learning environment characteristics, student homework self-regulation variables are entered in the model as predictors of science achievement (Model 2 in Table 4.37). Concerning the student characteristics variables, controlling for the other predictors in the model, gender is not a significant predictor of science achievement (γ_{10}= .016, *se*= .019). Students with high prior-achievement score high on science achievement test (γ_{20}= .318, *se*= .011).

Concerning the homework self-regulation variables, mastery goal orientation is a positive predictor (γ_{50}= .039, *se*= .014) and work-avoidance goal orientation is a negative predictor (γ_{70}= -.053, *se*= .009) of science achievement while performance goal orientation is not significantly related to science achievement (γ_{60}= -.004, *se*= .013). Students who report to involve in homework procrastination score low on science achievement test (γ_{80}= -.116, *se*= .011). Regarding strategy use variables, homework management is not found to be significantly associated with science achievement (γ_{90}= .003, *se*= .14) whereas deep learning strategy is a positive predictor of science achievement (γ_{100}= .033, *se*= .015).

Controlling for the other variables in the model, students' perceptions of feedback on homework (γ_{30}= .005, *se*= .012) and quality of homework (γ_{40}= .019, *se*= .013) are not significantly related to science achievement any more (These variables are significantly associated with science achievement in absence of homework self-regulation variables as shown in Model 1). Therefore, homework self-regulation variables seem to mediate the relationships between students' perceptions of feedback on homework and achievement, and between homework quality and achievement (Research question 3.c.[Does homework self-regulation (homework goal orientations, procrastination tendency, and strategy use) mediate the relationship between student level learning environment variables (perceptions of homework quality and feedback provided on homework) and science achievement?]).

Table 4.37 Random coefficient models with science achievement dependent variable

	Model 1		Model 2	
Fixed Effect	Coefficient	*SE*	Coefficient	*SE*
Overall mean ACH, γ_{00}	-.057	.033	-.023	.031
FEMALE, γ_{10}	.085***	.019	.017	.019
PRIOR_ACH, γ_{20}	.359***	.011	.318***	.012
FEEDBACK, γ_{30}	.035**	.013	.005	.013
QUALITY, γ_{40}	.067***	.013	.019	.013
MAST_GOAL, γ_{50}			.039**	.014
PERFOR_GOAL, γ_{60}			-.004	.013
AVOID_GOAL, γ_{70}			-.053***	.009
PROCRAST, γ_{80}			-.116***	.011
MANAGE, γ_{90}			.003	.014
DEEP, γ_{100}			.033*	.015

Note: *SE*= Standard Error, **p*< .05, ***p*<.01, ****p*< .001

The final estimation of variance components obtained from random coefficient model was displayed in Table 4.38. Variance among the class means τ_{00}= .283 with a chi-square statistic of 1677.096 is found to be statistically significant (p< .001). This significant difference (variability) between classes implies that there is need to incorporate class level (level-2) variables into the model that might account for some of the differences. Similarly, the variances of the female slope τ_{11}= .035 (χ^2= 480.783, p< .001), prior achievement slope τ_{22}= .016 (χ^2= 485.631, p< .001), the variance of the feedback slope τ_{33}= .005 (χ^2= 399.389, p< .05), the variance of performance goal orientation slope τ_{66}= .009 (χ^2= 467.914, p< .001), the variance of procrastination slope τ_{88}= .009 (χ^2= 420.414, p< .01), the variance of management strategy use slope τ_{99}= .012 (χ^2= 423.103, p< .001), and the variance of deep learning strategy use slope τ_{10}= .015 (χ^2= 397.139, p< .05) are found to be significantly different from zero. Class level variables will used to explain these differences in the randomly varying slopes.

Table 4.38 Final estimation of variance components for random coefficient model with science achievement dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.283	339	1677.096	0.000
FEMALE, u_{1j}	0.035	339	480.783	0.000
PRIOR_ACH, u_{2j}	0.016	339	485.631	0.000
FEEDBACK, u_{3j}	0.005	339	399.389	0.013
PERFOR_GOAL, u_{6j}	0.009	339	467.914	0.000
PROCRAST, u_{8j}	0.009	339	420.414	0.002
MANAGE, u_{9j}	0.012	339	423.103	0.001
DEEP, u_{10j}	0.015	339	397.139	0.016
Level 1 Effect, r_{ij}	0.429			

In order to calculate how much of the within class variability (level-1 variance= σ^2) in science achievement is explained by incorporating level-1 predictors into the model, σ^2 estimates of one way ANOVA with random effects model and the random coefficient model are compared. The proportion of variance explained at student level is:

$$\frac{\sigma^2 \text{ (ANOVA)} - \sigma^2 \text{ (Ran.Coef.)}}{\sigma^2 \text{ (ANOVA)}} = \frac{0.62957 - 0.42917}{0.62957} = 0.3183$$

Therefore, gender, prior achievement, perceived feedback provided on homework and quality of homework, and homework self-regulation variables account for about 31.8% of the student level variance in science achievement.

In order to answer research question 3.d. [To what extend do class level variables (homework quality, feedback on homework, teacher support for homework management and deep learning strategy use during homework, and teacher homework goals) predict science achievement?] intercepts and slopes as outcomes model is conducted. This model helps to explore why some classes have higher science achievement means than others. Student level equation remains unchanged as in the random coefficient model (Model 2), while the class level equation is extended to incorporate class level predictors. Among the class level predictors of interest, aggregated student perceptions of feedback provided on homework (FEED_MEAN) (γ_{01}= .158, *se*= .029) and teacher support for students' use of homework deep learning strategies (T_DEEP_SUPPORT) (γ_{02}= .060, *se*= .028) significantly and positively predict science achievement while none of the level-2 predictors emerge as significant predictors for randomly varying slopes (See Table 4.39). This indicates that students in classes where science teacher provide feedback on homework and support students to use homework deep learning strategies perform better than students in other classes on science achievement test.

Table 4.39 Intercepts and slopes as outcomes model with science achievement dependent variable

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean ACH, γ_{00}	-.023	.029	-.792	.429
FEED_MEAN, γ_{01}	.158	.029	5.532	.000
T_DEEP_SUPPORT, γ_{02}	.060	.028	2.163	.031
FEMALE, γ_{10}	.018	.019	.931	.353
PRIOR_ACH, γ_{20}	.319	.012	27.595	.000
FEEDBACK, γ_{30}	.004	.012	.313	.755
QUALITY, γ_{40}	.023	.013	1.791	.073
MASTERY, γ_{50}	.037	.014	2.561	.011
PERFOR, γ_{60}	-.005	.013	-.374	.709
AVOID, γ_{70}	-.052	.009	-5.732	.000
PROCRAST, γ_{80}	-.116	.011	-10.189	.000
MANAGE, γ_{90}	.002	.014	.173	.863
DEEP, γ_{100}	.030	.015	2.049	.041

The results of the final estimation of variance components obtained from the full final intercepts and slopes as outcomes model were presented in Table 4.40.

Table 4.40 Final estimation of variance components for intercepts and slopes as outcomes model with science achievement dependent variable

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
Class mean, u_{0j}	0.249	337	1565.676	0.000
FEMALE, u_{1j}	0.034	339	481.025	0.000
PRIOR_ACH, u_{2j}	0.016	339	485.605	0.000
FEEDBACK, u_{3j}	0.005	339	399.195	0.013

Table 4.40 (Continued)

Random Effect	*Variance Component*	*df*	*Chi-square*	*p-value*
PERFOR_GOAL, u_{6j}	0.009	339	467.679	0.000
PROCRAST, u_{8j}	0.009	339	420.387	0.002
MANAGE, u_{9j}	0.011	339	423.263	0.001
DEEP, u_{10j}	0.015	339	397.175	0.016
Level 1 Effect, r_{ij}	0.655			

The proportion of variance explained in science achievement relative to random coefficient model is:

$$\frac{\tau_{00}\text{ (Random Coeff.)} - \tau_{00}\text{ (Inter. and Slopes)}}{\tau_{00}\text{ (Random Coeff.)}} = \frac{0.28250 - 0.24929}{0.28250} = 0.1176$$

Therefore, it can be said that 11.8% of the variance in the between class differences in mean science achievement is accounted for by aggregated student perceptions of feedback on homework and teachers' support for students' use of homework deep learning strategies. However, significant differences in means science achievement between classes remains to be explained [$\chi 2(337)= 1565.675$, $p< .001$].

The models developed for predicting science achievement are summarized in Figure 4.9 and 4.10.

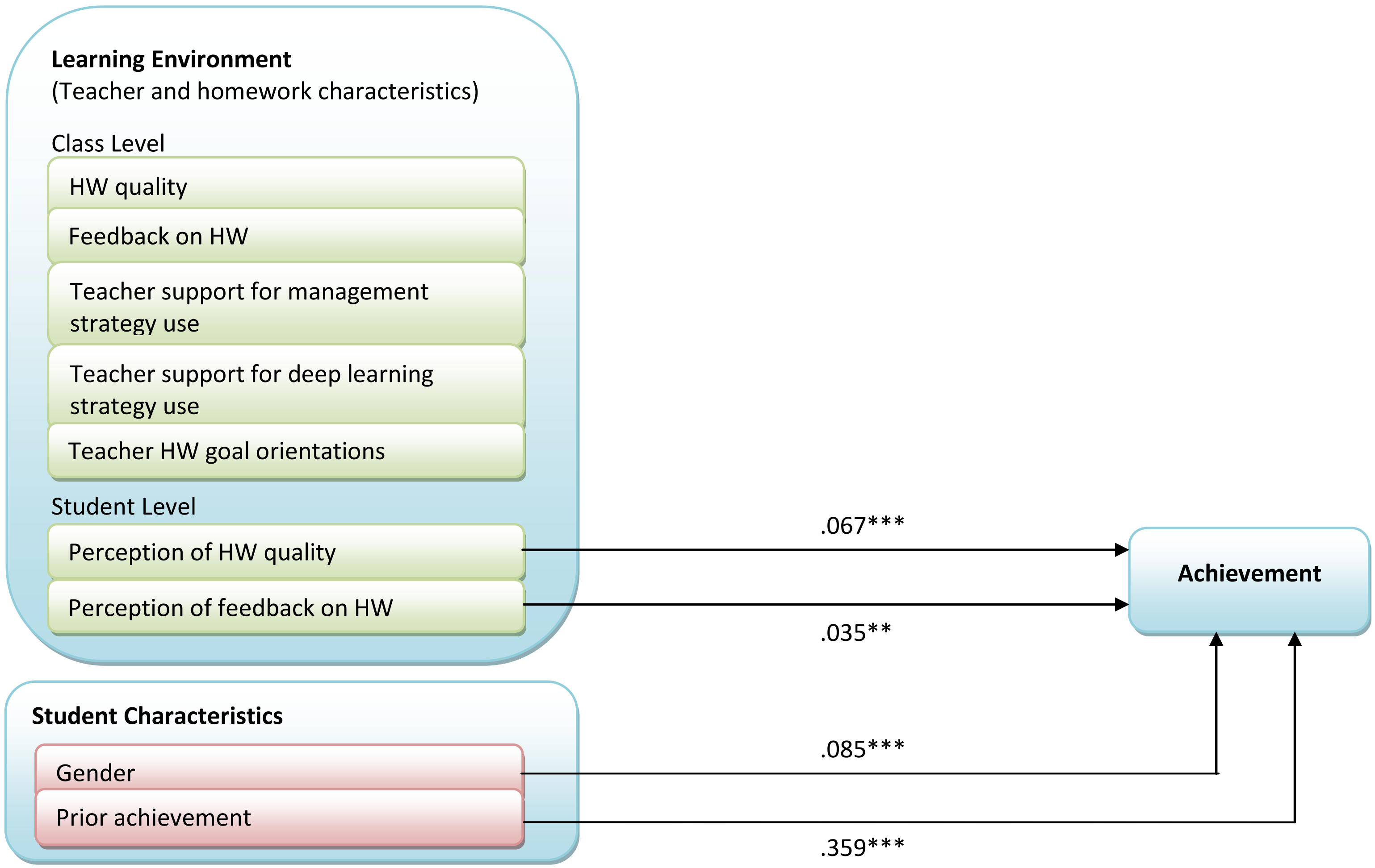

Figure 4.9 Predicting science achievement (model 1)

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

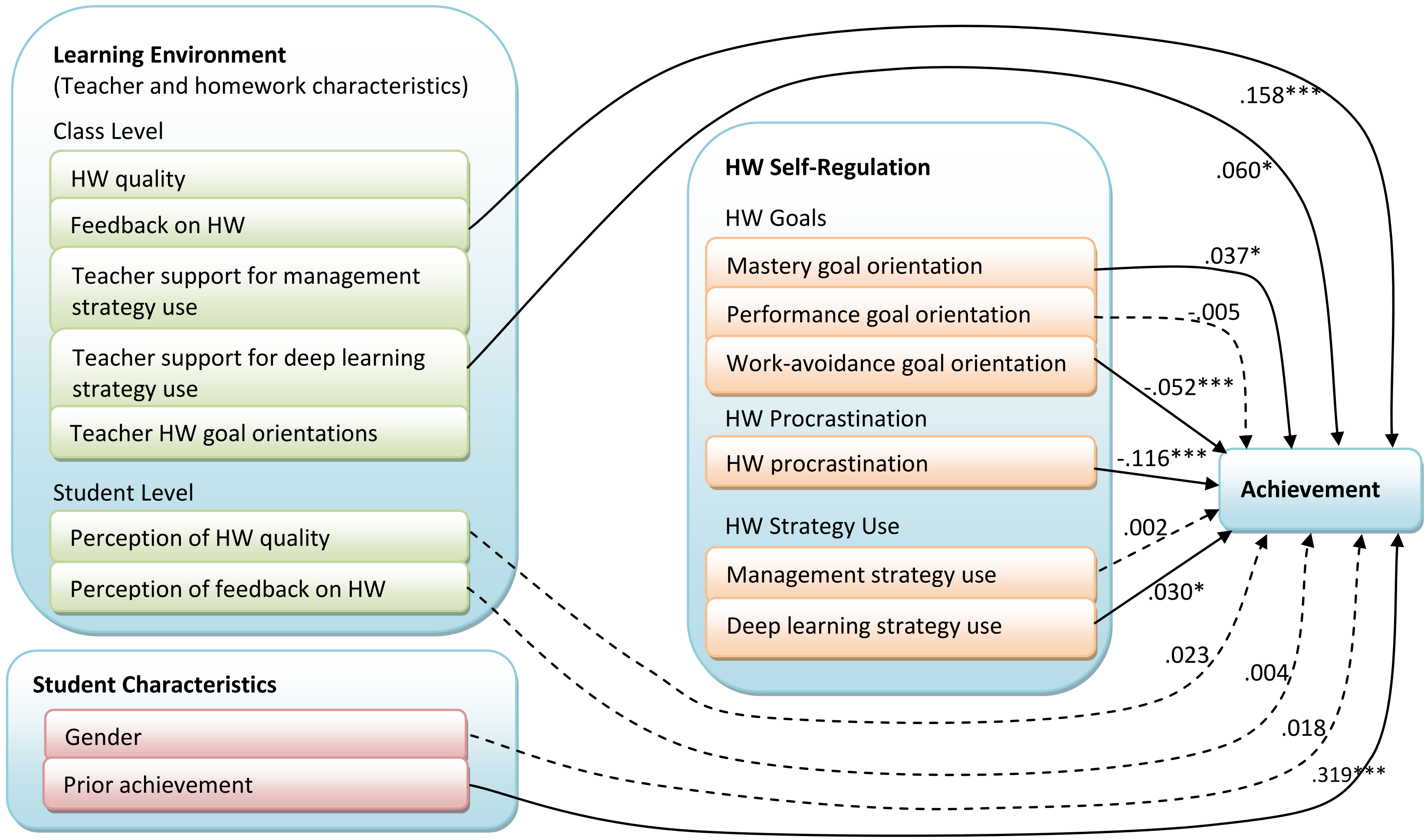

Figure 4.10 Predicting science achievement (final full model)

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

4.2.8 Summary

Analyses results are summarized in Table 4.41 and 4.42. The findings provide some support for the proposed homework model presented in Figure 1.1. Firstly, the effects of homework characteristics and teachers' homework practices on student homework self-regulation (i.e., goal orientations, procrastination, and strategy use) are examined while controlling for student gender and prior achievement. HLM analyses show that students' perceptions of quality of homework and feedback provided on homework are significant predictors of each of the homework self-regulation component. At the class level, aggregated student perceptions of homework quality is positively related to mastery goal orientation, performance goal orientation, deep learning strategy use, and management strategy use while negatively related to avoidance goal orientation and procrastination. Furthermore, aggregated student perceptions of feedback provided on homework predict deep learning and management strategy use significantly and positively. However, teacher goal orientations and teacher support for student strategy use are not related to any of the homework self-regulation components.

The current study also investigates the relationships between learning environment characteristics of interest (homework characteristics and teachers' homework practices), homework self-regulation and science achievement. Initially, science achievement is predicted by students' perceptions of homework quality and feedback. Both students' perceptions of homework quality and feedback are found to be positively and significantly related to science achievement. Then, predictive power of homework self-regulation variables (goal orientations, procrastination, and strategy use) on science achievement is examined. Students who are more mastery goal oriented and less work-avoidance goal oriented, who have low tendency to procrastinate homework, and who use more deep learning strategies during homework perform better on science achievement test. On the other hand, performance goal orientation and homework management strategy use are not significantly related to science achievement. After including homework self-regulation variables in the model, students' perceptions of homework quality and feedback are not related to science achievement anymore which can be interpreted that, homework self-regulation mediate the relationship between homework quality and feedback with science achievement. At the class level, aggregated student perceptions of feedback on homework and teacher support for deep learning strategy use during homework significantly positively related to science achievement. Therefore, it can be concluded that the quality of homework and feedback provided on homework may enhance students' homework self-regulation which in turn leads to increased science achievement. Furthermore, students whose teachers provide support for deep learning strategy use show higher science achievement.

Table 4.41 Models for homework self-regulation components

	Mastery Goal Orientation		Performance Goal Orientation		Work-Avoidance Goal Orientation		Procrastination	
	Coefficient	*SE*	Coefficient	*SE*	Coefficient	*SE*	Coefficient	*SE*
Class level								
QUAL_MEAN	.260***	.009	.184***	.011	-.057***	.017	-.170***	.016
Student level								
FEMALE	.191***	.017	.170***	.020	-.444***	.024	-.304***	.023
PRIOR_ACH	.083***	.008	.062***	.011	-.153***	.012	-.197***	.012
FEEDBACK	.146***	.015	.116***	.017	-.041**	.015	-.086***	.017
QUALITY	.552***	.016	.427***	.018	.048**	.017	-.144***	.016
Explained variance								
Class level	.696		.574		.061		.203	
Student level	.542		.377		.131		.186	

Note: *SE*= Standard Error, **p*< .05, ***p*<.01, ****p*< .001

Table 4.41 (Continued)

	Deep Learning Strategy Use		Management Strategy Use	
	Coefficient	*SE*	Coefficient	*SE*
Class level				
QUAL_MEAN	.215***	.021	.198***	.015
FEED_MEAN	.072***	.021	.047*	.021
Student level				
FEMALE	.085***	.015	.236***	.016
PRIOR_ACH	.147***	.008	.157***	.010
FEEDBACK	.319***	.016	.303***	.016
QUALITY	.425***	.016	.375***	.016
Explained variance				
Class level	.700		.628	
Student level	.509		.481	

Note: *SE*= Standard Error, *p< .05, **p<.01, ***p< .001

Table 4.42 Models for science achievement

	Model 1		Model 2		Final Full Model	
Fixed Effect	Coefficient	*SE*	Coefficient	*SE*	Coefficient	*SE*
Class level						
FEED_MEAN					.158***	.029
T_DEEP_SUPPORT					.060*	.029
Student level						
FEMALE	.085***	.019	.017	.019	.018	.019
PRIOR_ACH	.359***	.011	.318***	.012	.319***	.011
FEEDBACK	.035**	.013	.005	.013	.004	.013
QUALITY	.067***	.013	.019	.013	.023	.013
MASTERY_GOAL			.039**	.014	.037*	.015
PERFOR_GOAL			-.004	.013	-.005	.012
AVOID_GOAL			-.053***	.009	-.052***	.010
PROCRAST			-.116***	.011	-.116***	.011
MANAGE			.003	.014	.002	.014
DEEP			.033*	.015	.030*	.015
Explained variance						
Class level					.118	
Student level					.318	

Note: *SE*= Standard Error, **p*< .05, ***p*<.01, ****p*< .001

CHAPTER V

DISCUSSION

This chapter of the dissertation is devoted to discussion of the results, conclusions, implications, and limitations and recommendations.

5.1 Discussion of the Results

In the following sections, models predicting mastery goal orientation, performance goal orientation, work-avoidance goal orientation, procrastination, deep learning strategy use, management strategy use, and achievement are discussed.

5.1.1 Predicting mastery goal orientation

HLM analyses with mastery goal orientation as outcome variable revealed that significant variation did exist among science classrooms in their mastery goal orientation. Intraclass correlation coefficient showed that about 8.9% of the total variance in mastery goal orientation was between classes. At the student level, gender, prior achievement, perceived feedback on homework and quality of homework were significant predictors of mastery goal orientation and they accounted for about 54.25% of the student level variance in homework mastery goal orientation.

Analyses results revealed that *females* were more mastery goal orientated than males in doing science homework (γ_{10}= .196, *se*= .017). Although some previous research reported no gender difference in terms of students' mastery goal orientation (e.g., Anderman & Anderman, 1999; Middleton & Midgley, 1997), gender differences emerged in several other studies. When gender differences emerged, girls were more focused on learning and improving their skills than boys (e.g., Anderman & Midgley, 1997; Kayan Fadlelmula, 2011). Specific to homework, Xu and his colleagues (Xu, 2011; Xu & Wu, 2013) examined Grade 8 and Grade 11 students' reasons for doing homework. They found that girls did homework for learning-oriented reasons (e.g., to improve their understanding of the course material and practice skills learned in the class) more than did boys. Another finding of the present study was that students with higher *prior achievement* seemed to be more mastery goal oriented in doing science homework than students with lower prior achievement (γ_{20}= .092, *se*= .008). This finding is consistent with previous research (e.g., Araz & Sungur, 2007) which demonstrated that students who had higher prior achievement were more likely to engage in the academic tasks for learning and understanding purposes.

Additionally, current study revealed that students' *perceptions of feedback provided on homework* significantly and positively predict students' mastery goal orientation (γ_{30}= .139, *se*= .015). This positive relationship was anticipated because feedback which provides information about how well a task is accomplished helps learner assess their learning (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006). Furthermore, providing timely feedback (Gibbs & Simpson, 2004) and offering correction for errors and permitting resubmission of the assignment (Nicol & Macfarlane-Dick, 2006) is recommended for feedback to be effective. Indeed, the feedback items used in the present study attempted to address the such issues as whether homework is checked regularly, evaluated in a short time, and discussed in the class, whether students are informed about the right and wrong parts of their submitted work, whether evaluated homework helps them realize deficits in their learning, and whether students are given opportunity to correct errors in their homework. Such aspects of feedback like informing students about their deficiencies in the learning of the course material may support students to focus on self-improvement and increasing their competence. Supporting this ideas, recently, Xu and Wu (2013) found a positive correlation (*r*= .31) between the amount of homework that is monitored (e.g., collected and checked) by the teacher and students' doing homework for learning oriented reasons, such as improving understanding and developing study skills.

The other variable in the model which significantly and positively predicted students' orientation towards mastery goals in doing science homework was *quality of homework* (γ_{40}= .537, se= .017). Accordingly, as students' perceptions of quality of science homework (i.e., the extent to which their homework varies in difficulty, leads them to think on concepts, helps them improve understanding of the course material, and contributes to skill development) increases, students become more likely to do homework in order to develop their skills and knowledge. This positive relationship was expected, because researchers suggest that homework should have a specific purpose and students should be communicated about this purpose clearly (Cushman, 2010; Epstein & Van Voorhis, 2001); homework should be prepared considering students' strength and weaknesses, and should address skills that students need to improve (Cushman, 2010); and students should be given choices, such as selecting projects which may increase students' responsibility for their learning (Gentry & Springer, 2002). Therefore, high quality homework may lead students to be focused on improving their learning and developing their skills. No previous study has encountered which investigated the relationship between quality of homework and students' goal orientations in homework, but Trautwein and his friends (Dettmers et al., 2010; Trautwein & Ludtke, 2009) showed that students' perceptions of homework quality (i.e., how well their homework was prepared and interesting) was positively related to students' homework motivation, more specifically to their homework expectancy and value beliefs. Therefore, they suggested that students' perception of homework quality is an important characteristic of homework that may influence students' homework motivation. The present study contributes to the existing literature by providing empirical evidence about the association between quality of homework and students' goal orientation, which is a key motivational component of self-regulation (Pintrich, 2005).

At the class level, aggregated student perceptions of homework quality was the only significant predictor of mastery goal orientation and it accounted for about 69.60% of the variance in the between class differences in mean mastery goal orientation. Aggregated student perceptions of homework quality was significantly and positively related to mastery goal orientation (γ_{01}= .260, *se*= .009), implying that the higher students' perceptions of homework quality, the higher levels of mastery goals they adopted. This result is promising because students in science classes where well designed homework was given were more likely to focus on extending their understanding and improving their skills than students in other science classes. There is limited research which investigated students' perceptions of homework quality at the class level, but Trautwein and his colleagues (Dettmers et al., 2010; Trautwein & Ludtke, 2009) has demonstrated that aggregated students' perceptions of homework quality significantly and positively predicted students' homework expectancy and value beliefs. Therefore, the findings of the present study support previous research by providing evidence for positive predictive effect of students' shared perceptions of homework quality on homework motivation related outcomes.

5.1.2 Predicting performance goal orientation

HLM analyses with performance goal orientation as outcome variable revealed that significant variation existed among classrooms in their performance goal orientation. Intraclass correlation coefficient demonstrated that about 6.2% of the variance in performance goal orientation was between classes. According to the built model, gender, prior achievement, perceived feedback on homework and quality of homework were significant student level predictors of performance goal orientation in doing science homework. These factors accounted for about 37.7% of the student level variance in performance goal orientation.

Analyses results revealed that *females* were more performance goal orientated than males in doing science homework (γ_{10}= .178, *se*= .020). In other words, females were more concerned to show their competence to others (i.e., their peers, teachers, and parents), want to look smart and gain others' approval through homework. Therefore, they seemed to engage in homework with the purpose of demonstrating their abilities relative to others. Indeed, research on performance goal orientation has yielded somewhat mixed results in regard to differences by gender. Generally, males were reported to be more performance goal oriented than females (e.g., Anderman & Anderman, 1999; Anderman & Midgley, 1997; Middleton & Midgley, 1997; Roeser et al, 1996). However, there are some studies which did not support this result. For instance, Kayan Fadlelmula (2011) examining seventh grade Turkish students' (*n*= 1019) goal orientations in mathematics found no gender difference for performance-approach goal orientation and Tas (2008) studying with seventh grade Turkish students' (*n*= 1950) found that girls were more performance-approach goal focused than boys in science. Specific to homework, Xu and Wu (2013) and Xu (2011) also found that females engaged in homework for peer-oriented (e.g., to get approval from classmates) and adult-oriented (e.g., to get teacher approval) reasons more than did males. Items used to assess peer- and adult-oriented reasons for doing homework were somewhat close to items in performance goal orientation sub-scale used in the present study and thus support the analysis result. Besides, the present study found that students with *high prior-achievement* were more performance goal oriented than students with low prior-achievement (γ_{20}= .071, *se*= .011) indicating that students who had high science achievement in the previous year (sixth grade) engaged in homework task with the purpose of demonstrating their competence relative to others.

Another statistically significant predictor of performance goal orientation in homework was students' *perceptions of feedback on homework*. Students' perceptions of feedback provided on homework was significantly and positively related to their performance goals in homework (γ_{30}= .110, *se*= .017). Indeed, informing students about the parts that they completed correctly and incorrectly and discussions hold on homework in the class may lead students to concentrate on their homework performance and make comparisons among their peers. Therefore, a positive relationship between feedback on homework and performance goal orientation can be expected. Recently, Xu and Wu (2013) found that teacher feedback on homework was positively correlated with students' peer-oriented reasons for doing homework (r= .20) and with adult-oriented reasons for doing homework (r= .29).

The present study demonstrated that students' *perceptions of homework quality* was significantly and positively related to students' performance goal orientation in homework (γ_{40}= .410, *se*= .019). That is, students who perceived their science homework to be well-prepared, contributing to their understanding of the subject material and skill development pursued more performance goals. Although, no study has been encountered which investigated the association between quality of homework and students' reasons for doing homework, the observed relationship in the current study may be explained as follows: if the perceived quality of homework is high, then performing well on homework can be a way for students to demonstrate their abilities. Accordingly, they may focus on showing a good performance on the homework, being the best performer in the class, and completing it without error. However, this explanation is speculative and needs further investigation.

At the class level, aggregated student perceptions of homework quality was the only significant predictor of performance goal orientation and it accounted for about 57.36% of the variance in the between class differences in mean performance goal orientation. Aggregated student perceptions of homework quality was significantly and positively related to performance goal orientation (γ_{01}= .184, *se*= .011). Therefore, students in science classes with higher average perceptions of homework quality were oriented toward more performance goals than students in other science classes. Students' shared perceptions of the high quality of homework may lead students to concern about their performance on the homework.

5.1.3 Predicting work-avoidance goal orientation

HLM analyses with homework avoidance goal orientation as outcome variable revealed that significant variation did exist among classrooms in their homework avoidance goal orientation. Intraclass correlation coefficient showed that about 9.7% of the total variance in homework avoidance goal orientation was between classes. At the student level, gender, prior achievement, perceived feedback on homework and quality of homework were significant predictors of homework avoidance goal orientation in doing science homework and they accounted for about 13.1% of the student level variance in homework avoidance goal orientation.

According to analyses results, boys espoused to work-avoidance goals more than did girls (γ_{10}= -445, *se*= .023) and student with lower prior achievement seemed to be more work-avoidance goal oriented than students with higher prior achievement (γ_{20}= -.154, *se*= .000). This indicates that boys were more concerned to get homework done with little effort as possible and students who got lower science grades in the previous school year were more likely to pursue work-avoidance goals in science homework. Similarly, Meece and Miller (2001) reported that boys were more concerned with minimizing their effort than did girls.

Students' perceptions of feedback on homework was found to be a significant and negative predictor of students' homework avoidance goals (γ_{30}= -.040, *se*= .015). It seemed that students who received timely and continuous feedback and who were informed about their performance on science homework were low work-avoidance goal oriented. It appeared that if science teachers provided students with less feedback, students were more likely to be concerned with minimizing homework effort. Therefore, providing information on students' homework and doing homework follow-up (e.g., discussions on homework) may lead students to put more effort on their homework. The negative relationship between homework feedback and orientation towards work-avoidance goals is promising because previous research has showed that work-avoidance goal orientation was associated with negative academic outcomes, such as low self-efficacy, low perceived science ability, low intrinsic motivation, low science attitude, low active engagement, low science and mathematics achievement, and high superficial engagement and high anxiety (Meece et al., 1988; Meece & Holt, 1993; Skaalvik, 1997). No priori research has examined the predictive effect of homework feedback on students' homework-avoidance goal orientation.

On the other hand, students' perceptions of quality of homework was found to be a significant and positive predictor of avoidance goal orientation in homework (γ_{40}= .044, *se*= .017). In fact, this relationship was unexpected. When the items of homework quality is examined more closely (e.g., "Science and Technology homework really makes us think"), students might have also perceived that they were asked about whether homework is challenging and requires hard work on the part of the students. Kumar and Jagacinski (2011) conducted an experimental study with college students (*n*= 156) in order to examine changes in students' goal orientations as a function of task difficulty. They found that as individuals encountered with more difficult tasks, their perceived ability decreased and their endorsement of work-avoidance goals increased. Therefore, perceived ability mediated the effect of task difficulty on students' work-avoidance goal orientation. Previously, studying with high school students (*n*= 512), Seifert and O'Keefe (2001) found that a sense of incompetence (e.g., having trouble doing the work), may give rise to endorsement of more work-avoidance goals. We suggest that students' perceptions of homework quality items should be more thoroughly examined through student interviews (i.e., whether students perceive homework quality items also addressing *difficulty* of the assignment) in order to reveal the reason for the positive association between homework quality and work-avoidance goals.

At the class level, aggregated student perceptions of homework quality was the only significant predictor of homework avoidance goal orientation and it accounted for about

6.1% of the variance in the between class differences in mean work-avoidance goal orientation. Accordingly, students' shared perceptions of homework quality was significantly and negatively related to homework avoidance goals (γ_{01}= -.057, *se*= .017). This indicates that students in classes where high quality of homework was assigned were less concerned with putting forth less effort as possible in their homework than students in other classes. While students' perceptions of homework quality was a positive predictor of homework avoidance goal orientation at the student level as mentioned in the previous paragraph, students' shared perceptions of homework quality was a negative predictor at the class level. Therefore, differential effects of homework quality were observed. Previously, Dettmers et al. (2010) also reported that homework challenge, which was used as one of the indicators of homework quality, had differential effects on mathematics achievement at the student and class level; homework challenge was found to be a negative predictor of mathematics achievement at the student level, indicating that students who perceived homework assignments to be cognitively challenging scored lower than did their classmates; while students' shared perceptions of homework challenge positively predicted achievement at the class level, meaning that students in classes with higher perceptions of homework challenge performed better on the achievement test than students in other classes. The present study also supports differential effect of homework quality but on homework avoidance goal orientation outcome variable.

5.1.4 Predicting homework procrastination

HLM analyses with homework procrastination as outcome variable revealed that significant variation did exist among classrooms in their science homework procrastination. As indicated by intraclass correlation coefficient, 12.5% of the total variance in homework procrastination was attributable to classes. At the student level, gender, prior achievement, perceived feedback provided on homework and quality of homework accounted for about 18.6% of the student level variance in homework procrastination.

Analyses results revealed that boys were more likely to procrastinate science homework than girls (γ_{10}= -.306, *se*= .023). This indicated that boys were more tended to postpone their homework than did girls. Previous research on students' procrastination on academic tasks has yielded either no gender difference (e.g., Haycock et al., 1998; Solomon & Rothblum, 1984) or males' procrastinating more than females (e.g., Milgram et al., 1994; Prohaska et al, 2000; Senecal et al., 1995; Steel, 2007; Uzun Ozer et al., 2009). Besides, the present study found that students with *lower prior-achievement* were more likely to engage in homework procrastination than students with higher prior achievement (γ_{20}= -.199, *se*= .013).

Another finding of the present study was that students' perceptions of feedback on homework was a significant and negative predictor of homework procrastination (γ_{30}= -.087, *se*= .017). This result indicates that students who received timely feedback, whose homework assignment was followed up in the class through discussions, and who were given information about their performance on homework were less likely to postpone beginning or completing their science homework. Therefore, it seemed that if science teachers provided more feedback on homework, students were less tended to delay their homework. Ferrari (1991) explains that individuals procrastinate in order to protect their self-worth because they perceive that task performance is decisive for their ability. If they delay completing tasks, then their ability is not tested and thus they can maintain self-worth (Ferrari, 1991). Hattie and Timperley's (2007) review on feedback studies suggested that for feedback to be effective it should provide "little threat to the person at the self level" (p. 104). In the present study, feedback was conceptualized as not forming a threat for student at the person level; when the items of feedback subscale were examined, it is seen that items addressed the presentation of feedback (e.g., whether it is regularly checked and evaluated in a short time) and the formative content of feedback (e.g., whether it helps to identify deficiencies in the subject matter knowledge). Therefore, it seems reasonable to conclude that if teachers provided students with homework feedback (by checking homework regularly, evaluating it in a short time, holding discussions on homework in the class, and informing students about their performance on homework), students were less likely to delay their homework.

Regarding quality of homework and students' procrastination tendencies, the present study found that students' perceptions of homework quality was significantly and negatively related to science homework procrastination (γ_{40}= -.152, *se*= .016). This result indicates that students who perceived their homework high quality (i.e., varies in difficulty, leads them to think on concepts, helps them improve understanding of the material, and contributes to skill development) were less likely to delay or incomplete homework. This finding was expected because task characteristics may play a role in student' procrastination of the task (Ferrari et al., 2006; Ferrari & Scher, 2000). For instance, Ferrari et al. (2006), exploring college students (*n*= 120) task perceptions and their procrastination, found that procrastinators were more likely to delay tasks that they perceived difficult, not enjoyable, requiring greater effort, and when they lacked clarity for task completion. In homework situation, clarity of teachers' messages and expectations is suggested to contribute to students' personal investments to do homework (Epstein & Van Voorhis, 2001) and it is recommended that homework should have a specific purpose about which students should be communicated clearly (Cushman, 2010). Furthermore, Gentry and Springer (2002) pointed out that tasks should be meaningful for students for high quality classrooms. In terms of difficulty of homework, "right combination of challenge and skill" (Corno, 2000, p. 530) is recommended; while too complex assignments may cause frustration, too easy assignments may cause boredom. Homework quality subscale used in the present study attempted to address these issues by including related items (e.g., "Our Science and Technology teacher explains us purpose of assigning the particular homework", "Science and Technology homework helps us develop knowledge and skills", "Homework given in Science and Technology course varies in difficulty"). Therefore, it seems reasonable to conclude that assigning high quality homework may discourage students' homework procrastination.

At the class level, aggregated student perceptions of homework quality was the only significant predictor of homework procrastination and it accounted for about 20.3% of the variance in the between class differences in mean work-avoidance goal orientation. Accordingly, students' shared perceptions of homework quality was significantly and negatively related to homework procrastination (γ_{01}= -.170, *se*= .016). This result is promising because students in classes where high quality of homework was assigned were less likely to delay their homework than students in classes where lower quality of homework was assigned.

5.1.5 Predicting homework deep learning strategy use

HLM analyses with homework deep learning strategy use as outcome variable revealed that significant variation existed among classrooms in their deep learning strategy use in doing science homework. As indicated by intraclass correlation coefficient, 9.4% of the total variance in deep learning strategy use during homework was between classes. At the student level, gender, prior achievement, perceived feedback provided on homework and quality of homework variables accounted for about 50.9% of the student level variance in homework deep learning strategy use.

Analysis results revealed that girls used deep learning strategies during homework more than boys (γ_{10}= .088, se= .016). This result was expected because previous research has suggested that girls compared to boys used more learning strategies. For instance, in their survey study with Grade 7 and 8 students (*n*= 445), Patrick et al. (1999) found that girls use more cognitive strategies than boys. Besides, the present study showed that students with higher prior-achievement utilized deep learning strategies during homework more frequently than students with lower prior achievement (γ_{20}= .154, se= .008).

Another statistically significant predictor of deep learning strategy use was students' perceptions of feedback on homework. Students' perceptions of feedback on homework positively predicted students' deep learning strategy use (γ_{30}= .315, se= .016). This indicated that if homework was checked regularly, evaluated in a short time, discussed in the class, and students were informed about their performance on homework (e.g., feedback informing about correct and incorrect parts in their homework, and helping students to eliminate deficiencies in the subject matter knowledge), students were more likely to use cognitive and metacognitive strategies which leads to deeper processing of information. For instance, students who received more homework feedback, reported that when making reading for science homework, they tried to relate the material to what they already know and pulled together information from different sources when doing science homework, such as lectures, discussions, and readings. Therefore, it seemed that as students got more feedback, they used more deep learning strategies during homework. It is recommended that to be effective, feedback should include information about students' learning and enable learner identify problems in their learning (Nicol & Macfarlane-Dick, 2006; Sadler, 1998). The results of the present study suggested that informing students about their performance on homework and giving timely feedback on homework may promote students' use of deep learning strategies.

Regarding quality of homework, students' perceptions of quality of homework statistically significantly and positively predicted students' use of deep learning strategies during homework (γ_{40}= .423, se= .016). This implies that students who reported that their science homework varies in difficulty, leads them to think on concepts, helps them improve understanding of the material, and contributes to skill development utilized deep learning strategies more frequently than other students who reported lower levels of homework quality. Previously, Trautwein and Ludtke (2009) investigated predictive effect of Grade 8 and Grade 9 students' (*n*= 511) perceptions of homework quality on homework effort in six school subjects (German, English, history, biology, mathematics, and physics). Students' perceptions of how well their homework was prepared and interesting were found to be positively and statistically significantly related to homework effort measures of homework compliance and percentage of tasks attempted. Similarly, Dettmers et al. (2010), examining Grade 9 and 10 students (n= 3483) perceptions of mathematics homework quality, found that students who perceived that their homework was well selected (i.e., homework was appropriate and interesting), reported that they do their homework carefully and to the best of their ability. The present study contributes to related literature by providing evidence about the association between homework quality and students' deep learning strategy use during homework.

At the class level, aggregated student perceptions of homework quality and feedback provided on homework significantly predicted homework deep learning strategy use. These factors accounted for about 70.0% of the variance in the between class differences in mean deep learning strategy use. Accordingly, both students' shared perceptions of homework quality (γ_{01}= .215, se= .021) and students' shared perceptions of feedback on homework (γ_{02}= .072, se= .021) were positively related to deep learning strategy use. This result is promising because compared to students in classes where low quality of homework was assigned and low levels of feedback was provided, students in classes where high quality of homework was assigned and high levels of homework feedback was given were more likely to use cognitive and metacognitive strategies during homework, such as making connections between the homework readings and the concepts learned in the class, and questioning trustworthiness the information reached while doing homework. Similarly, Dettmers et al. (2010) found that students' shared perceptions of how well their homework was selected significantly and positively predicted students' homework effort at the class level. The results of the present study add to the literature by demonstrating the importance of designing high quality homework and providing feedback on homework for students' deep learning strategy use.

5.1.6 Predicting homework management strategy use

HLM analyses with homework management strategy use as outcome variable revealed that significant variation did exist among classrooms in their science homework management. As indicated by intraclass correlation coefficient, 8.2% of the total variance in homework management was between classes. At the student level, gender, prior achievement, perceived feedback provided on homework and quality of homework variables accounted for about 48.1% of the student level variance in homework management.

Analysis results revealed that girls used homework management strategies more than boys (γ_{10}= .239, *se*= .016). This result was expected because previous research has suggested that girls used more management strategies in homework compared to boys (e.g., Xu, 2006; Xu & Corno, 2006). For instance, Xu (2006), surveying high school students (*n*= 426) found that girls used homework management strategies of arranging environment, managing time, and controlling their emotion more than boys. Similarly, Xu and Corno (2006), studying with middle school students (*n*= 238), found that girls used homework management strategies of managing homework time, monitoring motivation, and controlling emotion more frequently than boys. Besides, the present study found that students with *higher prior-achievement* used more homework management strategies than students with lower prior-achievement (γ_{20}= .167, se= .010). Xu (2009b) reported a similar result with Grade 8 students (*n*= 633). Students were asked about their school grades across all subjects for the two previous years. From students' answers to this question, two groups of students were included in the study; students who reported "mostly A's", who were labeled as high-achieving, and "mostly C's or below" who were labeled as low-achievers. MANOVA results revealed that high-achieving students arranged environment, managed time, handled distractions, monitored motivation, and emotion more frequently than low-achieving students.

Regarding feedback, analysis results revealed that students' perceptions of feedback provided on science homework significantly and positively predicted students' use of homework management strategies (γ_{30}= .301, *se*= .016). This result implies that students who were given timely feedback, whose homework assignment was followed up in the class through discussions, and who were given information about their performance on homework arranged their study place, managed time, reduced distractions, and regulated their motivation and emotion more frequently than students who did not receive such feedback. This result is consistent with previous study findings. For instance, Xu (2009), examining predictive effect of teacher feedback on homework among Grade 8 and Grade 11 students (*n*= 1895), found that teacher feedback was significantly and positively related to students' homework management. However, feedback items used in Xu's study addressed solely the amount of feedback received on homework (i.e., how much of the homework is 'discussed/ collected/ checked/ graded/ counted in overall grade'). On the other hand, the present study utilized feedback items which also include information about students' task performance (e.g., "We are informed about the correct and incorrect parts of our Science and Technology homework"). Therefore, the present study contributes to literature by providing empirical evidence about the relationship between homework management strategies and feedback which is formative.

According to the built model, another statistically significant predictor of homework management was students' perceptions of homework quality. Homework quality was positively related to students' use of homework management strategies (γ_{40}= .366, *se*= .016). This finding implies that homework which leads students to think on science concepts, varies in difficulty, and helps them improve understanding of the material, and contributes to skill development may facilitate students to manage their homework more effectively. If homework is well designed, then students may find homework more interesting, meaningful, and challenging (Gentry & Springer, 2002) so that students' investment in homework may increase (Epstein & Van Voorhis, 2001) and they may use more management strategies. Therefore, it seems important that teachers prepare high quality homework to promote students' use of strategies during homework.

At the class level, aggregated student perceptions of homework quality and feedback provided on homework both statistically significantly predicted homework management. These factors accounted for about 62.8% of the variance in the between class differences in mean homework management strategy use. Accordingly, both students' shared perceptions of homework quality (γ_{01}= .198, *se*= .021) and students' shared perceptions of feedback on homework (γ_{02}= .047, *se*= .021) were positively related to homework management. These results are promising because students in classes where high quality of homework was assigned and where they received feedback on homework were more likely to arrange their study place, manage time, reduce distractions, and regulate their motivation and emotion than students in other classes.

5.1.7 Predicting science achievement

HLM analyses with science achievement as outcome variable revealed that significant variation did exist among classrooms in their science achievement. As indicated by intraclass correlation coefficient, 37.4% of the total variance in science achievement was between classes. At the student level, two models were developed. *In the first model*, the predictive effect of student characteristics (i.e., gender and prior achievement) and student level learning environment variables (i.e., perceptions of homework quality and feedback on homework) were examined.

According to analysis results, girls outperformed boys in science achievement test (γ_{10}= .085, *se*= .019) and students with higher prior achievement scored higher on science achievement test than students with lower prior achievement (γ_{20}= .359, *se*= .011). Although some of the previous research pointed out that boys were more successful than girls in science (e.g., Cavallo et al., 2004; Mau & Lynn, 2000), the finding of the present study is in line with other previous research which found that girls demonstrate higher science achievement than boys (e.g., Britner & Pajares, 2006; Hacieminoglu et al., 2009). The positive relationship between students' previous year (Grade 6) science grades and science achievement tests scores was expected because previous research found that prior achievement was an important predictor of subsequent achievement (e.g., Araz & Sungur, 2007; Roeser et al., 1996; Reynolds & Walberg, 1991; Reynolds & Walberg, 1992; Trautwein et al., 2002; Zimmerman & Kitsantas, 2005).

Another statistically significant predictor of science achievement was students' perceptions of feedback on homework; students' perceptions of feedback on homework was positively related to students' science achievement (γ_{30}= .035, *se*= .013). This means that students whose homework was checked regularly, evaluated in a short time, discussed in the class and who were informed about their performance on homework performed better on the science achievement test. Regarding the relationship between feedback and learning outcomes, previous research has suggested positive impact of feedback on student learning and performance. A meta-analysis over 250 studies of feedback (Black & Wiliam, 1998) revealed that feedback can lead to significant learning gains. Although specific to homework, no study was encountered investigating the linkage between teacher feedback on homework and student achievement at the student level, the findings of the present study was in line with findings from literature on feedback studies in general.

Another statistically significant predictor of science achievement was students' perceptions of quality of homework; students' perceptions of quality of homework was positively related to students' science achievement (γ_{40}= .067, *se*= .013). This means that students who were given homework which leaded to think on science concepts, varied in difficulty, and helped to improve understanding of the course material, and contributed to skill development performed better on the science achievement test. This finding was expected because homework is suggested to contribute to students' retention of information, understanding of the course material, critical thinking, and development of study skills (Cooper, 2007; Cooper & Valentine, 2001). However, little empirical research investigated quality of homework in relation to student achievement (Dettmers et al., 2010). Dettmers et al. (2010) surveyed 3483 students in Grade 9 and 10 and examined the relationship between students' perceptions of how well-prepared and interesting their mathematics homework assignment (i.e., perceived quality of homework task selection) and their mathematics achievement measured through an achievement test. HLM analyses results revealed a nonsignificant relationship between the two variables at the student level. The researchers suggested further studies to examine different aspects of homework quality, such as variation in the assigned tasks, opportunities for students to apply various strategies, and generate new ideas. The homework quality items utilized in the present study attempted to address students' perceptions of the extent to which their homework varies in difficulty, leads them to think on concepts, helps them improve understanding of the material, and contributes to skill development.

In the second model, besides student characteristics (i.e., gender and prior achievement) and student level learning environment variables (i.e., perceptions of homework quality and feedback on homework), the predictive effect of homework self-regulation variables (i.e., homework goal orientations, procrastination tendency, and strategy use) on students' science achievement was investigated.

Regarding homework self-regulation variables, orienting towards *mastery goals* positively predicted students' science achievement test scores (γ_{50}= .039, *se*= .014). This indicates that students who did homework with the purpose of improving their knowledge and skills were more successful in the achievement test than other students. Literature on achievement goal orientation has suggested that endorsement of mastery goals and achievement was either positively related to each other (e.g., Hsieh, Sullivan, & Guerra, 2007; Kaplan & Maehr, 1999; Wolters, et al., 1996) or not related (e.g., Barron & Harackiewicz, 2001; Roeser et al., 1996; Skaalvik, 1997; Wolters, 2004).

Theoretically, the positive relationship between mastery goals and achievement can be expected because mastery goal oriented learners, being concerned with improving their understanding and developing their skills, are more likely to work hard, persist longer on the given tasks, and make more cognitive engagement (Ames, 1992; Maehr & Midgley, 1991; Meece et al., 1988). The present study supports the positive relationship between achievement and mastery goal orientation and extend the findings to homework situation. According to the analysis results, *work avoidance goal orientation* was a statistically significant and negative predictor of science achievement (γ_{70}= -.053, *se*= .009). This means that students who were concerned with minimizing their homework effort (i.e., desiring to "put forth as little effort as possible and get away with it" [Nolen, 1988, p. 271]) were more likely to get lower scores on the achievement test. This finding is consistent with the literature on the relationship between work-avoidance goal orientation and achievement (e.g., Ainley, 1993; Meece et al., 1988). According to analysis results of the present study, *performance goal orientation* in homework, that is students' purposes of doing homework in order to demonstrate competence relative to others and gaining approval of peers, teachers, and parents, did not emerge as a significant predictor of science achievement (γ_{60}= -.004, *se*= .013). The present study suggested that doing homework with the purpose of demonstrating ability and gaining social approval does not seem to contribute to middle school students' science achievement. Literature on the relationship between goal orientation and achievement has revealed somewhat inconsistent results; while some research found a null relationship between performance / performance-approach goal orientation and achievement (e.g., Kaplan & Maehr, 1999; Pintrich, 2000b, Roeser et al., 1996; Tas, 2008; Wolters et al., 1996), others demonstrated that performance-approach goal orientation was positively related to achievement (e.g., Barron & Harackiewicz, 2001; Elliot & McGregor, 2001; Skaalvik, 1997; Wolters, 2004). Wolters (2004) pointed out that the found positive relationship was more consistent for older students and when normative standards were used in evaluation processes. For instance, Barron and Harackiewicz (2001) and Elliot and McGregor (2001) sampled undergraduate students, and Wolters (2004) used high school subjects. Studying with Grade 5-8 Turkish students (*n*= 1776), Iflazoglu and Hong (2012) also found that perceived homework achievement (e.g. "I finish the homework that is assigned to me every time") was unrelated to parent-motivated (e.g., "I like to do my homework well so that my parents will be proud of me") and teacher motivated (e.g., "I like to do my homework well so that my teacher will be proud of me) sources of motivation.

Another finding of the present study was that students who reported to *procrastinate* science homework scored low on science achievement test (γ_{80}= -.116, *se*= .011). This indicated that students who delayed their homework performed poorly in the achievement test than other students. Several studies have documented a negative relationship between academic procrastination and achievement (e.g., Akkaya, 2007; Moore, 2008; Prohaska et al., 2000). A recent meta-analysis on procrastination (Steel, 2007) revealed that procrastination was negatively correlated with overall GPA (*r*= -.16), course GPA (*r*= -.25), scores on final exam (*r*= -.17), and assignment grades (*r*= -.21). Therefore, majority of research yielded a negative relationship between procrastination and academic achievement.

Regarding homework strategy use variables, the present study revealed that homework *management strategy use* was not a significant predictor of science achievement (γ_{90}= .003, *se*= .14). This indicated that students' arranging homework space, managing time, reducing distractions, and controlling emotion and motivation were not significantly related to their science achievement. This finding is in line with Xu and Corno's (2003) findings. They examined the relations between homework management strategies and student achievement as measured by standardized achievement test scores. Totally 121 Grade 6-8 students in an urban public school participated in the study. Pearson correlations between student achievement and the five features of homework management (i.e., structuring study environment, managing time, reducing distractions, and monitoring emotion and motivation) ranged from -.11 to .11, and correlations were not statistically significant. The researchers asserted that the low correlation between achievement and features of homework management could be due to assessing achievement through standardized achievement test scores. They suggested that alternative assessments which resemble more real-life situations, such as requiring students to deal with distractions rather than controlled test situation might be useful to understand the underlying relations more thoroughly. In the present study, items were also selected from standardized tests; therefore results did not provide insight about authors' argument and there is a need for further studies. The other homework strategy use variable of interest of the present study was *deep learning strategy use* during homework. Analysis result revealed that students' use of deep learning strategies during homework (e.g., pulling together information from different sources when doing science homework, such as lectures, discussions, and readings; when making reading for science homework, trying to relate the material to what they already know; and questioning the trustworthiness of the information they reached while doing science homework) statistically significantly and positively predicted students' science achievement (γ_{100}= .033, *se*= .015). This result was expected because relevant literature suggests that higher levels of strategy use is associated with higher levels of achievement (e.g., Pintrich & De Groot; Zimmerman & Martinez-Pons, 1986; Zimmerman & Martinez-Pons, 1990). For instance, Pintrich and De Groot (1990), studying with Grade 7 students (*n*= 173), found that usage of cognitive strategies (rehearsal, elaboration, and organization strategies) and self-regulation strategies (metacognitive and effort management strategies) were statistically significantly and positively related to student achievement in English and science. The present study extended the positive relation between achievement and deep learning strategy use in homework context.

After entering homework self-regulation variables (i.e., goal orientations, procrastination, and strategy uses) into the model, in regard to the student characteristics variables, gender was not a significant predictor of science achievement (γ_{10}= .016, *se*= .019) while prior achievement was a significant and positive predictor of science achievement (γ_{20}= .318, *se*= .011). Controlling for the other variables in the model, students' perceptions of feedback on homework (γ_{30}= .005, *se*= .012) and quality of homework (γ_{40}= .019, *se*= .013) were not significantly related to science achievement any more (These variables were significantly associated with science achievement in the absence of homework self-regulation variables as shown in Model 1). Therefore, homework self-regulation variables seemed to mediate the relationships between students' perceptions of feedback on homework and achievement, and between students' perceptions of homework quality and achievement. The predictors included in the model account for about 31.8% of the student level variance in science achievement.

At the class level, aggregated student perceptions of feedback provided on homework and teacher support for students' use of homework deep learning strategies both significantly predicted science achievement. These factors accounted for about 11.8% of the variance in the between class differences in mean science achievement. Accordingly, students' shared perceptions of feedback on homework (γ_{01}= .158, *se*= .029) was positively related to science achievement. Students in classes with higher average perception of homework feedback outperformed students in other classes on the science achievement test. Previously, Trautwein et al. (2002) examined predictive effect of teacher's monitoring of homework completion on students' achievement in mathematics. Totally, 1976 seventh grade students participated to the study. Students were asked about "How often does your math teacher monitor homework completion?" (p. 34) and achievement was measured through a standardized mathematics achievement test. Multilevel analyses results revealed no statistically significant relationship between frequency of homework monitoring and achievement at the class level. However, the homework feedback items utilized in the present study were more comprehensive than the one item used in Trautwein et al.'s (2002) study and may provide my information about teachers' homework feedback practices. Regarding teacher support for students' use of homework deep learning strategies, students' shared perceptions of teacher support for students' use of homework deep learning strategies statistically significantly and positively predicted science achievement (γ_{02}= .060, *se*= .028). Students in classes where science teacher emphasized use of cognitive and metacognitive strategies leading to deeper processing of information performed better on science achievement test than students in other classes. It seemed that science teacher's assigning homework which required students to make connections between new learning and previous learning, to make connections between learning from other subjects and science subject, to bring information from different sources like class discussions and readings, and question trustworthiness of the information acquired from different sources contributed to students' science learning. Several studies have suggested positive influences of teacher support for student strategy use on student outcomes (e.g., Hamman et al., 2000; Kistner et al., 2010; Lan, 1996) and the present study revealed that students in classes with higher average perception of teacher support for students use of homework strategies were more successful on the science achievement test than students in other classes.

5.2 Conclusions

The present study examined seventh grade students' science homework self-regulation and science achievement in relation to some student level and class level variables. Gender and prior achievement were included in the models to control for possible confounding effects. Students' perceptions of homework quality was found to positively predict students' homework goal orientations of mastery, performance, and work-avoidance and also homework strategy use variables of management strategies and deep learning strategies, but negatively predicted students' homework procrastination. Furthermore, students who get homework feedback reported higher levels of mastery goal orientation, performance goal orientation, management strategy use, and deep learning strategy use during homework while lower levels of work-avoidance goal orientation and procrastination than did other students. Students in classes with higher average perceptions of homework quality were espoused to more mastery and performance goals while less work-avoidance goals; were less likely to delay their homework; and used more homework management and deep learning strategies than students in other classes. Besides, students in classes with higher average perceptions of homework feedback used more deep learning and management strategies than students in other classes. However, teacher goal orientations and teacher support for student strategy use were unrelated to any of the homework self-regulation components.

In regard to science achievement, two models were developed. The first model revealed that students who perceived homework assignments to be leading to think on concepts, helping to improve understanding of the material, and contributing to skill development (that is given high quality homework) and whose homework was checked regularly, evaluated in a short time, discussed in the class, and who were informed about their performance on homework (that is provided homework feedback) performed better on the science achievement test than did other students. Then, in the second model homework self-regulation components were entered into the model. Accordingly, orienting towards high mastery and low work-avoidance goals, having low tendency to procrastinate homework, and using more deep learning strategies during homework positively predicted science achievement. On the other hand, espousing performance goal orientation and using homework management strategies were unrelated to students' science achievement. After including homework self-regulation variables in the model, students' perceptions of homework quality and feedback were not related to science achievement anymore which indicated that homework self-regulation mediated the relationships between homework quality and achievement, and between homework feedback and achievement. Furthermore, students in classes with higher average perceptions of feedback on homework and teacher support for deep learning strategy use performed better on the science achievement test than did students in other classes.

In essence, providing students with high quality homework assignments and feedback on homework may enhance students' homework self-regulation which in turn appears to increase science achievement. Additionally, teacher support for students to use homework deep learning strategies seem to increase science achievement.

5.3 Implications

The present study investigated middle school students' science homework self-regulation (i.e., goal orientations in homework, tendency to procrastinate homework, and usage of homework strategies) in relation to teachers' homework practices and science achievement. It was found that teachers' homework practices have potential to influence students' homework self-regulation and achievement. Students' perceptions of homework quality and feedback provided on homework significantly predicted students' goal orientations in homework, homework procrastination, homework strategy use, and science achievement. Consequently, the present study calls teachers attention to be aware of that if they provide students with high quality homework and feedback on homework, students are

- more likely to do their homework with the purpose of improving understanding of the course material and developing skills,
- more likely to do their homework to demonstrate their abilities relative to others and gain others' approval,
- more likely to use cognitive and metacognitive strategies during homework which leads to deeper processing of information,
- more likely to structure homework environment, manage time, reduce distructions, and regulate their motivation and emotions during homework,
- less likely to be concerned with minimizing their homework effort (i.e., getting homework done with little effort as possible), and
- less likely to postpone their homework.

Therefore, it is important for science teachers to design high quality homework that is, homework which varies in difficulty, leads students to think on science concepts, helps students improve understanding of the science material, and contributes to skill development. Likewise, it is important for science teachers to give homework feedback that is, checking homework regularly, evaluating homework in a short time, doing homework follow-up in the class such as holding class discussions on homework, and informing students about their performance on homework.

In regard to the relationships between science achievement and homework self-regulation components, it was found that students who wanted to enhance their learning and develop their skills through homework (i.e., high mastery goal oriented), who were less concerned with the effort they put forth in their homework (i.e., low work-avoidance goal oriented), who had low tendency to delay their homework (i.e., low homework procrastination), and who used more cognitive and metacognitive strategies during homework (i.e., high deep learning strategy use) demonstrated higher science achievement. Therefore, science teachers may try to support their students' to pursue high levels of mastery goals and low levels of work-avoidance goals, not to procrastinate homework, and to use more deep learning strategies during homework. In order to do so, teachers may communicate purposes of giving particular homework, address issues in the homework that students' need to improve, and design homework which is interesting and relevant for students. They may emphasize that understanding the material, making effort, persisting on the task, and self-improvement is important. Homework which facilitates students to use more cognitive and metacognitive strategies may be beneficial, as well.

Additionally, it was found that if science teachers provided more support for deep learning strategy use, students performed better on science achievement test. This indicates that assigning homework which requires students to make connections between new learning and previous learning, to make connections between learning from other subjects and science subject, to bring information from different sources like class discussions and readings, and to question trustworthiness of the information acquired from different sources while doing homework may contribute to students' science learning.

The current study has some implications for teacher education programs as well: It may be beneficial for teacher education programs to provide pre-service teachers with education about how to prepare high quality homework, how to provide more effective homework feedback to their students, and how to support their students' homework strategy use. This education can be integrated into method courses given in the pre-service education programs. For instance, pre-service teachers may be trained about providing timely and informative feedback; designing homework which varies in difficulty, leads students to think on science concepts, helps students improve understanding of the science material, and contributes to students' skill development; and emphasis on students' use of cognitive and metacognitive strategies leading to deeper processing of information. Furthermore, in-service teacher training on homework may be given to teachers in order to improve quality of homework, teacher feedback on homework, and teacher support for students' strategy use during homework. Increasing teachers' awareness about potential influences of their homework practices on students' self-regulation and achievement, addressing deficiencies in students' homework self-regulation, and supporting students to improve homework self-regulatory strategies seem to be important.

In summary, the present study mainly suggests restructuring teachers' homework practices (e.g., by designing high quality homework and providing students with effective feedback) so as to maximize opportunities for students' homework self-regulation, which may in turn increase students' science achievement.

5.4 Limitations and Recommendations

The present study has some limitations that should be acknowledged. First, the data were collected through students' and teachers' self-reports. Other types of data collection like diary writing and think aloud protocols can be useful to deepen our understanding of the students' homework self-regulation. Additionally, classroom observation can be beneficial for better understanding of teachers' homework practices, like discussions hold in the class on homework. The data of the present study were collected at one time-point that is cross-sectional. Longitudinal studies can be conducted to explore students' homework self-regulation over time. Longitudinal studies can be also informative about influences of teachers' homework practices on students' homework self-regulation and achievement. Another limitation is issue of causation; being correlational in nature, the study findings helps to understand underlying relations between variables of interest but does not enable to make cause-effect relationships. Other variables, such as parental homework help and parent homework monitoring may influence students' homework practices according to relevant literature (e.g., Cooper, Lindsay, & Nye, 2000; Xu & Corno, 2003), may also influence variables investigated in the present study. Since these parental homework involvement variables were not in the scope of the present study, they were not included. Influence of parental homework involvement variables on students' homework self-regulation can be examined in the future studies. An additional limitation that should be acknowledged is that science achievement test used in the present study addressed units of Body Systems and Force and Motion. Therefore, science achievement was unit based science achievement and this should be taken into account when making conclusions.

Another recommendation is asking students about their perceptions of teacher / classroom goal structure and teacher support for strategy use. Only teachers rated their own classroom goal structures (e.g., "I appreciate the student who shows improvement in his/her homework" and "I announce the student who gets the highest grade from homework in the class") and their support for students' strategy use during homework (e.g., "I tell students to manage their time efficiently when doing homework" and "I expect students to gather knowledge he/she has learned from different sources"). As in the case of feedback and quality sub-scales, besides asking teachers, students can also be asked to report their own perceptions of the teacher support for strategy use and teacher's goal structure. According to the developed models, teachers' own reports of homework quality and feedback were not significantly related to students' homework self-regulation variables and achievement while students' shared perceptions of the homework quality and feedback were statistically significant predictors. Ryan et al. (1998) similarly found that while teachers' report of their classroom goal structure was not related to students' avoidance of help seeking - the outcome variable of interest, aggregated students' perceptions of the classroom goal structure emphasized in the class was significantly related to avoidance of help seeking. The researchers suggested that teachers' reports might not be consistent with their classroom practices; they might respond in a socially desirable way or they might not always act in line with their beliefs in the classroom. What students perceive might play a more critical role than what teachers' are trying to do. Therefore, students' perceptions are important (Ames, 1992) and they can provide rich information about students' "felt experiences" (Rolland, 2012, p. 399). Similarly, Dettmers et al. (2010) suggest that "students' ratings are the most appropriate source of data for assessing the learning environment: A given student's behavior is likely to be more affected by his or her interpretation of the classroom context than by any objective indicator of that context" (p. 469). Therefore, besides teacher ratings, predictive power of *students' perceptions of* teacher goal structure and teacher support for strategy use on students' homework self-regulation and achievement can be investigated.

The last recommendation is about administration of Science Homework Scale to student populations at greater grade span (e.g., Grades 4-8), in private schools, and from different cultures. Cross-cultural studies can enable to investigate whether there are differences in students' homework self-regulation across different contexts.

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APPENDICES

APPENDIX A

STUDENT HOMEWORK SCALE

A.1 Homework Goal Orientation Scale

	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1. Fen ve Teknoloji ödevlerimi yaparken, yeni şeyler öğrenmek benim için önemlidir. **(M)**	1	2	3	4	5
2. Fen ve Teknoloji ödevlerimi yaparken, derste öğrendiğim becerileri pekiştirmek benim için önemlidir. **(M)**	1	2	3	4	5
3. Fen ve Teknoloji ödevlerini olabildiğince kolay yoldan yapmak isterim, böylece çok çalışmak zorunda kalmam. **(A)**	1	2	3	4	5
4. Fen ve Teknoloji ödevimi iyi yapmak isterim çünkü büyüklerimin (öğretmen, anne-baba, vb.) takdirini kazanmak benim için önemlidir. **(P)**	1	2	3	4	5
5. Fen ve Teknoloji ödevlerimi yaparken mümkün olduğunca çok şey öğrenmek isterim. **(M)**	1	2	3	4	5
6. Fen ve Teknoloji dersinde arkadaşlarımın ödevlerimi iyi yaptığımı düşünmelerini isterim. **(P)**	1	2	3	4	5
7. Fen ve Teknoloji ödevlerinde sadece benden istenen kadarını yapıp teslim ederim. **(A)**	1	2	3	4	5
8. Fen ve Teknoloji ödevimi, diğer öğrencilerden daha iyi yapmak isterim. **(P)**	1	2	3	4	5
9. Fen ve Teknoloji ödevlerimi yaparım çünkü ödev yapmak çalışma disiplinimi geliştirir. **(M)**	1	2	3	4	5
10. Fen ve Teknoloji ödevlerini çok çaba göstermeden yapıp kurtulmak isterim. **(A)**	1	2	3	4	5

11. Fen ve Teknoloji ödevlerimi yaparım çünkü ödev yapmak sorumluluk duygumu geliştirmeme yardımcı olur. **(M)**	1	2	3	4	5
12. Fen ve Teknoloji ödevlerini mümkün olduğunca az çaba göstererek tamamlamak isterim. **(A)**	1	2	3	4	5
13. Fen ve Teknoloji ödevlerimi iyi yapmak isterim çünkü çevremdekilerin benim zeki olduğumu düşünmeleri benim için önemlidir. **(P)**	1	2	3	4	5
14. Fen ve Teknoloji ödevlerimi yaparken çalışma becerilerimi geliştirmek isterim. **(M)**	1	2	3	4	5
15. Fen ve Teknoloji ödevlerini yapmak zorunda olmamayı isterdim. **(A)**	1	2	3	4	5

Note 1: M= Mastery goal orientation, P= Performance goal orientation, A= Work-avoidance goal orientation

Note 2: Item 7 in homework goal orientation scale is dropped from the scale.

A.1.1 Item-total statistics and inter-item correlations for homework goal orientation scale

Table A.1 Item-total statistics for mastery goal orientation

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
goal 1	21.6556	11.746	.622	.810
goal 2	21.7273	11.964	.644	.806
goal 5	21.7203	11.796	.611	.812
goal 9	21.8217	11.621	.602	.814
goal 11	21.7657	11.458	.628	.808
goal 14	21.7290	12.082	.575	.819

Table A.2 Item-total statistics for work-avoidance goal orientation

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
goal 3	12.8748	20.510	.508	.743
goal 7	12.6643	23.063	.323	.795
goal 10	13.4383	17.146	.684	.679
goal 12	13.4904	17.508	.668	.685
goal 15	13.3826	18.529	.548	.731

Table A.3 Item-total statistics for performance goal orientation

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
goal 4	12.9359	5.348	.553	.681
goal 6	13.1421	4.924	.569	.668
goal 8	13.0399	5.219	.524	.694
goal 13	13.1664	4.868	.516	.702

Table A.4 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
mastery goal orientation (6 items)	.464	.388	.555	.167	1.432	.002
work-avoidance goal orientation (5 items)	.396	.234	.686	.452	2.930	.020
performance goal orientation (4 items)	.425	.389	.469	.080	1.205	.001

A.2 Homework Strategy Use Scale

A.2.1 Deep Learning Strategy Use Scale

	Hiç bir zaman	Nadiren	Bazen	Genellikle	Her zaman
1. Fen ve Teknoloji ödevini yaparken anlamadığım kısımların üzerinden tekrar giderim.	1	2	3	4	5
2. Fen ve Teknoloji ödevini yaparken, farklı kaynaklardan (derste anlatılanlar, tartışılanlar ve okumalar gibi) edindiğim bilgileri bir araya getiririm.	1	2	3	4	5
3. Fen ve Teknoloji ödevlerini, ders sırasında öğrendiklerim ve okuduklarım arasında bağlantılar kurarak yapmaya çalışırım.	1	2	3	4	5
4. Fen ve Teknoloji ödevimi yaparken ödevimden ne öğrenmem gerektiğini düşünürüm.	1	2	3	4	5

5. Fen ve Teknoloji ödeviyle ilgili bir şeyler okurken, o anda okuduklarımla daha önceki bilgilerim arasında bağlantı kurmaya çalışırım.	1	2	3	4	5
6. Fen ve Teknoloji ödevini yaparken ulaştığım bilgilerin ne kadar güvenilir olduğunu sorgularım.	1	2	3	4	5
7. Fen ve Teknoloji ödevimi yaparken doğru yolda ilerleyip ilerlemediğimden emin olmak için kendi kendime sorular sorarım.	1	2	3	4	5

A.2.2 Management Strategy Use Scale

	Hiç bir zaman	**Nadiren**	**Bazen**	**Genellikle**	**Her zaman**
1. Fen ve Teknoloji ödevini yapmaya başlamadan önce, ödevimde ihtiyaç duyacağım araç-gereçleri hazır ederim.	1	2	3	4	5
2. Fen ve Teknoloji ödevlerimi aksatmadan yaparım.	1	2	3	4	5
3. Fen ve Teknoloji ödevimi yaparken, dikkatimi ödeve vermem gerektiğini, kendime söylerim.	1	2	3	4	5
4. Fen ve Teknoloji ödevini yaparken kendimi tamamen ödeve veririm.	1	2	3	4	5
5. Fen ve Teknoloji ödevimi iyi odaklanabildiğim bir zaman diliminde (yemek yedikten sonra, akşam uykum gelmeden önce, vb.) yapmaya gayret ederim.	1	2	3	4	5
6. Fen ve Teknoloji ödevimi yaparken, ödevi daha ilgi çekici hale getirmenin yollarını bulurum.	1	2	3	4	5
7. Kendime Fen ve Teknoloji ödevini başarıyla tamamlaya-bileceğimi söyleyerek, kendi kendimi motive ederim.	1	2	3	4	5
8. Çalıştığım ortamda, ödevime odaklanmamı sağlayacak değişiklikler (televizyonu kapatırım, masadaki gereksiz şeyleri kaldırırım, vb.) yaparım.	1	2	3	4	5
9. Fen ve Teknoloji ödevini yaparken başka şeylerle **oyalanmam**.	1	2	3	4	5

A.2.3 Item-Total Statistics and Inter-Item Correlations for Homework Strategy Use Scale

Table A.5 Item-total statistics for deep learning strategy use scale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
deep1	24.1602	18.893	.606	.783
deep2	24.0282	20.101	.499	.800
deep3	24.0563	19.799	.543	.794
deep4	24.2430	18.823	.563	.790
deep5	24.2465	19.050	.576	.788
deep6	24.4296	18.545	.545	.794
deep7	24.3891	18.129	.561	.791

Table A.6 Item-total statistics for homework management strategy use scale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
man1	31.1490	27.012	.415	.717
man2	31.6250	26.578	.433	.713
man3	31.8647	24.954	.353	.730
man4	31.4075	25.175	.580	.691
man5	31.5993	26.227	.340	.728
man6	31.7517	25.991	.352	.726
man7	31.7209	25.097	.465	.706
man8	31.4983	24.792	.445	.710
man9	31.3699	25.791	.422	.714

Table A.7 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
deep learning strategy use (7 items)	.390	.285	.461	.176	1.616	.003
management strategy use (9 items)	.249	.123	.435	.312	3.542	.005

A.3 Homework Procrastination Scale

	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1. Önemli olsa bile Fen ve Teknoloji ödevlerimi yapmayı gereksiz yere ertelerim.	1	2	3	4	5
2. Yapmaktan hoşlanmadığım Fen ve Teknoloji ödevlerine başlamayı ertelerim.	1	2	3	4	5
3. Fen ve Teknoloji ödevlerinin teslim edilmesi gereken bir tarih olduğunda, son dakikaya kadar beklerim.	1	2	3	4	5
4. Fen ve Teknoloji ödev yapma alışkanlıklarımı geliştirmeyi ertelerim.	1	2	3	4	5
5. Fen ve Teknoloji ödevlerimi **yapmamak** için bahane bulmayı başarırım.	1	2	3	4	5
6. Bana sıkıcı gelen Fen ve Teknoloji ödevlerini yapmaya zaman **ayırmam**.	1	2	3	4	5
7. Fen ve Teknoloji dersinde verilen ödevler üstesinden gelinemeyecek kadar zor ise, onu ertelemek gerektiğine inanırım.	1	2	3	4	5
8. Kendime Fen ve Teknoloji ödevimi yapacağıma dair söz versem bile ödevimi yapmayı ağırdan alırım.	1	2	3	4	5
9. Fen ve Teknoloji ödevlerimle ilgili bir plan yapsam bile bu plana **uymam**.	1	2	3	4	5
10. Fen ve Teknoloji ödevimi yapmaya **başlayamadığımda** kendimden nefret ederim, ama yine de bu beni harekete geçirmez.	1	2	3	4	5
11. Önemli olsa bile Fen ve Teknoloji ödevlerimi vaktinde **tamamlamam**.	1	2	3	4	5
12. Fen ve Teknoloji ödevlerimi yapmaya başlamanın ne kadar önemli olduğunu bilmeme rağmen bir türlü **başlayamam**.	1	2	3	4	5

A.3.1 Item-Total Statistics and Inter-Item Correlations for Homework Procrastination Scale

Table A.8 Item-total statistics for homework procrastination subscale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
proc1	24.0726	172.018	.779	.962
proc2	23.9239	170.911	.787	.961
proc3	23.6602	170.508	.727	.963
proc4	23.9841	168.413	.863	.959
proc5	24.1044	169.090	.841	.960
proc6	24.1292	169.840	.846	.960
proc7	23.7363	169.744	.774	.962
proc8	23.9097	168.582	.851	.960
proc9	24.0283	168.240	.854	.960
proc10	23.9150	170.805	.781	.962
proc11	24.1611	169.625	.836	.960
proc12	23.9717	168.148	.842	.960

Table A.9 Inter-item correlations for homework procrastination subscale

Mean	Min	Max	Range	Max / Min	Variance
.691	.570	.794	.223	1.391	.003

A.4 Perception of Homework Quality and Feedback on Homework Scales

A.4.1 Perceptions of Homework Quality Scale

	Kesinlikle Katılmıyorum	**Katılmıyorum**	**Kararsızım**	**Katılıyorum**	**Kesinlikle Katılıyorum**
1. Fen ve Teknoloji ödevlerimiz, derste gördüğümüz konuları anlamamıza yardımcı olur.	1	2	3	4	5
2. Fen ve Teknoloji ödevlerimiz, iyi hazırlanmış ödevlerdir.	1	2	3	4	5
3. Fen ve Teknoloji ödevlerimiz, bizim derste gördüğümüz konular üzerinde düşünmemizi sağlar.	1	2	3	4	5

4. Fen ve Teknoloji dersinde, zorluk düzeyi farklı ödevler verilir.	1	2	3	4	5
5. Fen ve Teknoloji öğretmenimiz, ödevleri bize ne amaçla verdiğini açıklar.	1	2	3	4	5
6. Fen ve Teknoloji ödevlerimiz, bilgi ve becerilerimizi geliştirmemize yardımcı olur.	1	2	3	4	5
7. Fen ve Teknoloji ödevlerimiz, konulardaki eksiklerimizi gidermemize yardımcı olur.	1	2	3	4	5
8. Fen ve Teknoloji öğretmenimiz, arasından seçim yapabileceğimiz farklı ödevler verir.	1	2	3	4	5

Note: Item 8 in perceptions of homework quality scale is dropped from the scale.

A.4.2 Perceptions of Feedback on Homework Scale

	Hiç bir zaman	**Nadiren**	**Bazen**	**Genellikle**	**Her zaman**
1. Fen ve Teknoloji dersinde ödevlerimiz düzenli olarak kontrol edilir.	1	2	3	4	5
2. Fen ve Teknoloji ödevlerimiz kısa bir süre içerisinde değerlendirilir.	1	2	3	4	5
3. Fen ve Teknoloji ödevlerimizdeki doğru ve yanlışlarımız hakkında bilgilendiriliriz.	1	2	3	4	5
4. Fen ve Teknoloji dersinde değerlendirilen ödevler, nerelerde eksiklerimiz olduğunu görmemizi sağlar.	1	2	3	4	5
5. Fen ve Teknoloji dersinde, ödevlerde yaptığımız yanlışların üzerinde durulur.	1	2	3	4	5
6. Fen ve Teknoloji dersinde, yaptığımız ödevler üzerinde tartışırız.	1	2	3	4	5
7. Fen ve Teknoloji ödevlerimizde yaptığımız hataları düzeltmemiz için bize fırsat verilir.	1	2	3	4	5

A.4.3 Item-total statistics and inter-item correlations for perceptions of homework quality scale and feedback on homework scale

Table A.10 Item-total statistics for perception of homework feedback subscale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
feed1	23.9521	21.008	.447	.755
feed2	24.1383	21.139	.419	.761
feed3	23.9078	19.871	.547	.736
feed4	23.7429	21.182	.505	.746
feed5	24.0922	19.491	.588	.727
feed6	24.3369	19.350	.529	.739
feed7	24.3085	19.397	.460	.756

Table A.11 Item-total statistics for perception of homework quality subscale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
qual1	28.2455	21.834	.608	.750
qual2	28.5860	21.414	.556	.754
qual3	28.3477	21.951	.539	.758
qual4	28.7437	22.381	.377	.782
qual5	28.6398	21.154	.481	.766
qual6	28.3925	21.018	.603	.747
qual7	28.3907	21.984	.527	.759
qual8	29.1953	20.624	.378	.794

Table A.12 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
homework quality (7 items)	.369	.202	.538	.336	2.667	.009
homework feedback (7 items)	.333	.191	.490	.300	2.570	.006

A.5 Screening Data from Pilot Study-2

Table A.13 Valid and missing cases

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
goal1	742	97.9%	16	2.1%	758	100.0%
goal2	739	97.5%	19	2.5%	758	100.0%
goal3	737	97.2%	21	2.8%	758	100.0%
goal4	741	97.8%	17	2.2%	758	100.0%
goal5	737	97.2%	21	2.8%	758	100.0%
goal6	730	96.3%	28	3.7%	758	100.0%
goal8	728	96.0%	30	4.0%	758	100.0%
goal9	734	96.8%	24	3.2%	758	100.0%
goal10	729	96.2%	29	3.8%	758	100.0%
goal11	730	96.3%	28	3.7%	758	100.0%
goal12	730	96.3%	28	3.7%	758	100.0%
goal13	736	97.1%	22	2.9%	758	100.0%
goal14	738	97.4%	20	2.6%	758	100.0%
goal15	734	96.8%	24	3.2%	758	100.0%
deep1	740	97.6%	18	2.4%	758	100.0%
deep2	736	97.1%	22	2.9%	758	100.0%
deep3	740	97.6%	18	2.4%	758	100.0%
deep4	728	96.0%	30	4.0%	758	100.0%
deep5	733	96.7%	25	3.3%	758	100.0%
deep6	727	95.9%	31	4.1%	758	100.0%
deep7	729	96.2%	29	3.8%	758	100.0%
man1	757	99.9%	1	0.1%	758	100.0%
man2	753	99.3%	5	0.7%	758	100.0%
man3	750	98.9%	8	1.1%	758	100.0%
man4	754	99.5%	4	0.5%	758	100.0%
man5	753	99.3%	5	0.7%	758	100.0%
man6	754	99.5%	4	0.5%	758	100.0%
man7	753	99.3%	5	0.7%	758	100.0%
man8	756	99.7%	2	0.3%	758	100.0%
man9	756	99.7%	2	0.3%	758	100.0%
proc1	752	99.2%	6	0.8%	758	100.0%
proc2	751	99.1%	7	0.9%	758	100.0%
proc3	748	98.7%	10	1.3%	758	100.0%
proc4	746	98.4%	12	1.6%	758	100.0%
proc5	741	97.8%	17	2.2%	758	100.0%
proc6	744	98.2%	14	1.8%	758	100.0%
proc7	748	98.7%	10	1.3%	758	100.0%
proc8	747	98.5%	11	1.5%	758	100.0%
proc9	747	98.5%	11	1.5%	758	100.0%
proc10	749	98.8%	9	1.2%	758	100.0%

Table A.13 (Continued)

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
proc11	748	98.7%	10	1.3%	758	100.0%
proc12	751	99.1%	7	0.9%	758	100.0%
qual1	750	98.9%	8	1.1%	758	100.0%
qual2	740	97.6%	18	2.4%	758	100.0%
qual3	746	98.4%	12	1.6%	758	100.0%
qual4	736	97.1%	22	2.9%	758	100.0%
qual5	729	96.2%	29	3.8%	758	100.0%
qual6	738	97.4%	20	2.6%	758	100.0%
qual7	739	97.5%	19	2.5%	758	100.0%
feed1	743	98.0%	15	2.0%	758	100.0%
feed2	730	96.3%	28	3.7%	758	100.0%
feed3	731	96.4%	27	3.6%	758	100.0%
feed4	732	96.6%	26	3.4%	758	100.0%
feed5	728	96.0%	30	4.0%	758	100.0%
feed6	728	96.0%	30	4.0%	758	100.0%
feed7	735	97.0%	23	3.0%	758	100.0%

Table A.14 Descriptive statistics

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
goal1	742	4.00	1.00	5.00	4.2480	1.10475	-1.562	1.654
goal2	739	4.00	1.00	5.00	4.2625	.98020	-1.333	1.258
goal3	737	4.00	1.00	5.00	3.6106	1.38472	-.664	-.837
goal4	741	4.00	1.00	5.00	4.4130	.99025	-1.830	2.782
goal5	737	4.00	1.00	5.00	4.3066	1.01798	-1.618	2.146
goal6	730	4.00	1.00	5.00	4.3123	1.01348	-1.622	2.164
goal8	728	4.00	1.00	5.00	4.3063	1.00801	-1.515	1.709
goal9	734	4.00	1.00	5.00	4.2112	1.05139	-1.390	1.354
goal10	729	4.00	1.00	5.00	2.9602	1.56448	.019	-1.531
goal11	730	4.00	1.00	5.00	4.1986	1.07356	-1.402	1.302
goal12	730	4.00	1.00	5.00	2.9301	1.58501	.051	-1.553
goal13	736	4.00	1.00	5.00	4.1603	1.15534	-1.303	.733
goal14	738	4.00	1.00	5.00	4.3482	.98806	-1.673	2.336
goal15	734	4.00	1.00	5.00	3.1008	1.62959	-.121	-1.590
deep1	740	4.00	1.00	5.00	4.1095	1.07759	-1.299	1.174
deep2	736	4.00	1.00	5.00	4.1739	1.05091	-1.318	1.133
deep3	740	4.00	1.00	5.00	4.1662	.98881	-1.247	1.254
deep4	728	4.00	1.00	5.00	4.0151	1.11562	-1.121	.640
deep5	733	4.00	1.00	5.00	4.0709	1.05213	-1.165	.875
deep6	727	4.00	1.00	5.00	3.8817	1.15936	-.975	.188
deep7	729	4.00	1.00	5.00	3.9081	1.16310	-.918	-.004

Table 4.14 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
man1	757	4.00	1.00	5.00	4.2338	.97428	-1.265	1.022
man2	753	4.00	1.00	5.00	3.8871	1.00887	-.622	-.300
man3	750	4.00	1.00	5.00	3.6547	1.33434	-.662	-.765
man4	754	4.00	1.00	5.00	4.0637	1.00129	-.979	.445
man5	753	4.00	1.00	5.00	3.9296	1.13531	-.933	.073
man6	754	4.00	1.00	5.00	3.6247	1.26385	-.625	-.634
man7	753	4.00	1.00	5.00	3.7450	1.18560	-.769	-.253
man8	756	4.00	1.00	5.00	3.9484	1.26856	-1.008	-.128
man9	756	4.00	1.00	5.00	4.0873	1.10041	-1.160	.594
proc1	752	4.00	1.00	5.00	2.0878	1.41148	1.012	-.403
proc2	751	4.00	1.00	5.00	2.3609	1.44185	.597	-1.073
proc3	748	4.00	1.00	5.00	2.4826	1.50980	.518	-1.201
proc4	746	4.00	1.00	5.00	2.1783	1.38704	.816	-.720
proc5	741	4.00	1.00	5.00	2.0661	1.41219	1.029	-.390
proc6	744	4.00	1.00	5.00	2.0887	1.39126	1.005	-.377
proc7	748	4.00	1.00	5.00	2.4184	1.44975	.549	-1.114
proc8	747	4.00	1.00	5.00	2.2825	1.42149	.743	-.813
proc9	747	4.00	1.00	5.00	2.1124	1.40878	.936	-.551
proc10	749	4.00	1.00	5.00	2.2417	1.40056	.776	-.739
proc11	748	4.00	1.00	5.00	1.9893	1.36210	1.100	-.190
proc12	751	4.00	1.00	5.00	2.1598	1.42960	.892	-.642
feed1	743	4.00	1.00	5.00	4.0162	1.20187	-1.003	-.120
feed2	730	4.00	1.00	5.00	4.0192	1.09978	-1.056	.412
feed3	731	4.00	1.00	5.00	4.1272	1.23042	-1.341	.685
feed4	732	4.00	1.00	5.00	4.2473	1.09360	-1.503	1.439
feed5	728	4.00	1.00	5.00	3.8791	1.28228	-.951	-.210
feed6	728	4.00	1.00	5.00	3.6593	1.32561	-.668	-.676
feed7	735	4.00	1.00	5.00	3.8000	1.36599	-.857	-.577
qual1	750	4.00	1.00	5.00	4.2733	1.05456	-1.556	1.765
qual2	740	4.00	1.00	5.00	3.9716	1.05620	-.966	.441
qual3	746	4.00	1.00	5.00	4.1984	1.06603	-1.435	1.472
qual4	736	4.00	1.00	5.00	3.7867	1.20966	-.852	-.113
qual5	729	4.00	1.00	5.00	3.7888	1.32467	-.841	-.445
qual6	738	4.00	1.00	5.00	4.1165	1.14129	-1.317	.956
qual7	739	4.00	1.00	5.00	4.1719	1.07268	-1.383	1.333

Table A.15 Descriptive statistics after imputation

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
goal1	758	4.00	1.00	5.00	4.2414	1.10051	-1.544	1.620
goal2	758	4.00	1.00	5.00	4.2559	.97142	-1.319	1.275
goal3	758	4.00	1.00	5.00	3.6148	1.37226	-.670	-.803
goal4	758	4.00	1.00	5.00	4.4037	.98768	-1.801	2.702
goal5	758	4.00	1.00	5.00	4.2982	1.01026	-1.594	2.119
goal6	758	4.00	1.00	5.00	4.3061	1.00526	-1.596	2.123
goal8	758	4.00	1.00	5.00	4.2995	1.00791	-1.503	1.691
goal9	758	4.00	1.00	5.00	4.2045	1.04288	-1.369	1.336
goal10	758	4.00	1.00	5.00	2.9578	1.54315	.023	-1.497
goal11	758	4.00	1.00	5.00	4.1913	1.06168	-1.383	1.307
goal12	758	4.00	1.00	5.00	2.9274	1.56540	.054	-1.522
goal13	758	4.00	1.00	5.00	4.1557	1.14568	-1.296	.749
goal14	758	4.00	1.00	5.00	4.3456	.97893	-1.668	2.380
goal15	758	4.00	1.00	5.00	3.1095	1.61233	-.131	-1.562
deep1	758	4.00	1.00	5.00	4.1082	1.07027	-1.293	1.190
deep2	758	4.00	1.00	5.00	4.1715	1.04059	-1.314	1.171
deep3	758	4.00	1.00	5.00	4.1623	.98270	-1.234	1.250
deep4	758	4.00	1.00	5.00	4.0092	1.10298	-1.102	.649
deep5	758	4.00	1.00	5.00	4.0792	1.03903	-1.186	.983
deep6	758	4.00	1.00	5.00	3.8760	1.14725	-.961	.198
deep7	758	4.00	1.00	5.00	3.9037	1.15048	-.912	.023
man1	758	4.00	1.00	5.00	4.2335	.97368	-1.265	1.025
man2	758	4.00	1.00	5.00	3.8839	1.00710	-.614	-.304
man3	758	4.00	1.00	5.00	3.6544	1.32820	-.664	-.748
man4	758	4.00	1.00	5.00	4.0633	.99865	-.981	.462
man5	758	4.00	1.00	5.00	3.9261	1.13306	-.925	.067
man6	758	4.00	1.00	5.00	3.6240	1.26106	-.624	-.627
man7	758	4.00	1.00	5.00	3.7441	1.18241	-.768	-.244
man8	758	4.00	1.00	5.00	3.9459	1.26782	-1.002	-.136
man9	758	4.00	1.00	5.00	4.0858	1.09967	-1.156	.589
proc1	758	4.00	1.00	5.00	2.0910	1.40800	1.008	-.402
proc2	758	4.00	1.00	5.00	2.3681	1.44027	.588	-1.077
proc3	758	4.00	1.00	5.00	2.4828	1.50177	.520	-1.185
proc4	758	4.00	1.00	5.00	2.1821	1.38251	.811	-.722
proc5	758	4.00	1.00	5.00	2.0765	1.40558	1.008	-.414
proc6	758	4.00	1.00	5.00	2.0989	1.39331	.989	-.408
proc7	758	4.00	1.00	5.00	2.4248	1.44435	.540	-1.115
proc8	758	4.00	1.00	5.00	2.2916	1.41634	.731	-.814
proc9	758	4.00	1.00	5.00	2.1135	1.40213	.936	-.537
proc10	758	4.00	1.00	5.00	2.2493	1.39913	.768	-.748
proc11	758	4.00	1.00	5.00	1.9908	1.35747	1.097	-.186
proc12	758	4.00	1.00	5.00	2.1623	1.42401	.890	-.632
feed1	758	4.00	1.00	5.00	4.0185	1.19319	-1.009	-.082

Table A.15 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
feed2	758	4.00	1.00	5.00	4.0237	1.08525	-1.067	.492
feed3	758	4.00	1.00	5.00	4.1306	1.21640	-1.346	.743
feed4	758	4.00	1.00	5.00	4.2454	1.08207	-1.497	1.473
feed5	758	4.00	1.00	5.00	3.8918	1.26696	-.972	-.134
feed6	758	4.00	1.00	5.00	3.6544	1.30816	-.662	-.643
feed7	758	4.00	1.00	5.00	3.8087	1.35373	-.870	-.531
qual1	758	4.00	1.00	5.00	4.2718	1.05466	-1.549	1.736
qual2	758	4.00	1.00	5.00	3.9683	1.05543	-.951	.401
qual3	758	4.00	1.00	5.00	4.1939	1.06617	-1.422	1.426
qual4	758	4.00	1.00	5.00	3.7823	1.19835	-.849	-.086
qual5	758	4.00	1.00	5.00	3.7876	1.31489	-.834	-.441
qual6	758	4.00	1.00	5.00	4.1069	1.13916	-1.286	.879
qual7	758	4.00	1.00	5.00	4.1662	1.07146	-1.375	1.327

A.6 Data Screening with Main Study Data

Table A.16 Missing cases

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
man1	8275	99.5%	43	0.5%	8318	100.0%
man2	8262	99.3%	56	0.7%	8318	100.0%
man3	7951	95.6%	367	4.4%	8318	100.0%
man4	8234	99.0%	84	1.0%	8318	100.0%
man5	8120	97.6%	198	2.4%	8318	100.0%
man6	8175	98.3%	143	1.7%	8318	100.0%
man7	8184	98.4%	134	1.6%	8318	100.0%
man8	8237	99.0%	81	1.0%	8318	100.0%
man9	8230	98.9%	88	1.1%	8318	100.0%
feed1	8252	99.2%	66	0.8%	8318	100.0%
feed2	8215	98.8%	103	1.2%	8318	100.0%
feed3	8004	96.2%	314	3.8%	8318	100.0%
feed4	8157	98.1%	161	1.9%	8318	100.0%
feed5	8180	98.3%	138	1.7%	8318	100.0%
feed6	8175	98.3%	143	1.7%	8318	100.0%
feed7	8151	98.0%	167	2.0%	8318	100.0%
deep1	8246	99.1%	72	0.9%	8318	100.0%
deep2	8159	98.1%	159	1.9%	8318	100.0%
deep3	8230	98.9%	88	1.1%	8318	100.0%
deep4	8222	98.8%	96	1.2%	8318	100.0%
deep5	8080	97.1%	238	2.9%	8318	100.0%
deep6	8221	98.8%	97	1.2%	8318	100.0%

Table A.16 (Continued)

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
deep7	8227	98.9%	91	1.1%	8318	100.0%
qual1	8210	98.7%	108	1.3%	8318	100.0%
qual2	8209	98.7%	109	1.3%	8318	100.0%
qual3	8110	97.5%	208	2.5%	8318	100.0%
qual4	8183	98.4%	135	1.6%	8318	100.0%
qual5	8157	98.1%	161	1.9%	8318	100.0%
qual6	8154	98.0%	164	2.0%	8318	100.0%
qual7	8154	98.0%	164	2.0%	8318	100.0%
goal1	8239	99.1%	79	0.9%	8318	100.0%
goal2	8147	97.9%	171	2.1%	8318	100.0%
goal3	8174	98.3%	144	1.7%	8318	100.0%
goal4	8200	98.6%	118	1.4%	8318	100.0%
goal5	8193	98.5%	125	1.5%	8318	100.0%
goal6	8180	98.3%	138	1.7%	8318	100.0%
goal8	8190	98.5%	128	1.5%	8318	100.0%
goal9	8184	98.4%	134	1.6%	8318	100.0%
goal10	8154	98.0%	164	2.0%	8318	100.0%
goal11	8155	98.0%	163	2.0%	8318	100.0%
goal12	8153	98.0%	165	2.0%	8318	100.0%
goal13	8180	98.3%	138	1.7%	8318	100.0%
goal14	8175	98.3%	143	1.7%	8318	100.0%
goal15	8183	98.4%	135	1.6%	8318	100.0%
proc1	8167	98.2%	151	1.8%	8318	100.0%
proc2	8131	97.8%	187	2.2%	8318	100.0%
proc3	8002	96.2%	316	3.8%	8318	100.0%
proc4	8130	97.7%	188	2.3%	8318	100.0%
proc5	8091	97.3%	227	2.7%	8318	100.0%
proc6	8022	96.4%	296	3.6%	8318	100.0%
proc7	8034	96.6%	284	3.4%	8318	100.0%
proc8	8119	97.6%	199	2.4%	8318	100.0%
proc9	8074	97.1%	244	2.9%	8318	100.0%
proc10	8021	96.4%	297	3.6%	8318	100.0%
proc11	8084	97.2%	234	2.8%	8318	100.0%
proc12	8113	97.5%	205	2.5%	8318	100.0%

Table A.17 Descriptive statistics

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
man1	8275	4	1	5	4.40	.917	-1.653	2.346
man2	8262	4	1	5	4.18	.947	-1.101	.782
man3	7951	4	1	5	4.01	1.218	-1.155	.354
man4	8234	4	1	5	4.29	.928	-1.369	1.569
man5	8120	4	1	5	4.02	1.133	-1.070	.365
man6	8175	4	1	5	3.82	1.136	-.777	-.138
man7	8184	4	1	5	3.93	1.108	-.903	.113
man8	8237	4	1	5	4.18	1.111	-1.336	.953
man9	8230	4	1	5	4.26	1.074	-1.550	1.729
feed1	8252	4	1	5	4.26	1.085	-1.499	1.474
feed2	8215	4	1	5	4.09	1.065	-1.135	.651
feed3	8004	4	1	5	4.32	1.024	-1.576	1.833
feed4	8157	4	1	5	4.36	.984	-1.614	2.038
feed5	8180	4	1	5	4.14	1.094	-1.274	.906
feed6	8175	4	1	5	3.92	1.162	-.929	.024
feed7	8151	4	1	5	4.08	1.144	-1.174	.527
deep1	8246	4	1	5	4.18	1.008	-1.248	1.087
deep2	8159	4	1	5	4.17	.985	-1.133	.773
deep3	8230	4	1	5	4.13	.970	-1.043	.647
deep4	8222	4	1	5	4.11	.993	-1.082	.733
deep5	8080	4	1	5	4.06	1.001	-.956	.400
deep6	8221	4	1	5	3.85	1.107	-.759	-.147
deep7	8227	4	1	5	3.86	1.127	-.792	-.130
qual1	8210	4	1	5	4.46	.917	-1.993	3.870
qual2	8209	4	1	5	4.21	.925	-1.256	1.452
qual3	8110	4	1	5	4.36	.900	-1.540	2.257
qual4	8183	4	1	5	3.83	1.149	-.898	.127
qual5	8157	4	1	5	4.09	1.105	-1.171	.649
qual6	8154	4	1	5	4.34	.932	-1.553	2.191
qual7	8154	4	1	5	4.35	.916	-1.599	2.484
goal1	8239	4	1	5	4.58	.843	-2.468	6.335
goal2	8147	4	1	5	4.41	.860	-1.630	2.647
goal3	8174	4	1	5	3.35	1.459	-.392	-1.219
goal4	8200	4	1	5	4.59	.827	-2.382	5.687
goal5	8193	4	1	5	4.53	.824	-2.088	4.606
goal6	8180	4	1	5	4.41	.918	-1.814	3.169
goal8	8190	4	1	5	4.46	.902	-1.875	3.274
goal9	8184	4	1	5	4.42	.912	-1.790	3.063
goal10	8154	4	1	5	2.63	1.592	.354	-1.466
goal11	8155	4	1	5	4.42	.917	-1.811	3.116
goal12	8153	4	1	5	2.69	1.597	.301	-1.500
goal13	8180	4	1	5	4.34	1.014	-1.669	2.238
goal14	8175	4	1	5	4.50	.857	-2.030	4.194

Table A.17 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
goal15	8183	4	1	5	2.87	1.634	.110	-1.598
proc1	8167	4	1	5	1.84	1.282	1.406	.691
proc2	8131	4	1	5	2.00	1.300	1.065	-.133
proc3	8002	4	1	5	2.31	1.485	.697	-.994
proc4	8130	4	1	5	1.90	1.275	1.267	.350
proc5	8091	4	1	5	1.74	1.240	1.571	1.166
proc6	8022	4	1	5	1.81	1.269	1.425	.722
proc7	8034	4	1	5	2.18	1.372	.838	-.610
proc8	8119	4	1	5	1.98	1.314	1.135	-.008
proc9	8074	4	1	5	1.84	1.273	1.393	.656
proc10	8021	4	1	5	1.97	1.306	1.136	.022
proc11	8084	4	1	5	1.73	1.240	1.601	1.257
proc12	8113	4	1	5	1.90	1.295	1.289	.384

Table A.18 Descriptive statistics after imputation

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
man1	8318	4.00	1.00	5.00	4.4032	.91595	-1.652	2.350
man2	8318	4.00	1.00	5.00	4.1815	.94529	-1.096	.780
man3	8318	4.00	1.00	5.00	4.0081	1.19940	-1.149	.405
man4	8318	4.00	1.00	5.00	4.2848	.92578	-1.362	1.556
man5	8318	4.00	1.00	5.00	4.0151	1.12478	-1.062	.378
man6	8318	4.00	1.00	5.00	3.8200	1.12934	-.774	-.120
man7	8318	4.00	1.00	5.00	3.9225	1.10368	-.893	.107
man8	8318	4.00	1.00	5.00	4.1820	1.10919	-1.332	.952
man9	8318	4.00	1.00	5.00	4.2558	1.07143	-1.546	1.732
feed1	8318	4.00	1.00	5.00	4.2581	1.08222	-1.499	1.487
feed2	8318	4.00	1.00	5.00	4.0849	1.06040	-1.134	.668
feed3	8318	4.00	1.00	5.00	4.3163	1.01574	-1.555	1.810
feed4	8318	4.00	1.00	5.00	4.3545	.98134	-1.600	2.007
feed5	8318	4.00	1.00	5.00	4.1361	1.09080	-1.264	.898
feed6	8318	4.00	1.00	5.00	3.9133	1.15653	-.922	.028
feed7	8318	4.00	1.00	5.00	4.0753	1.13811	-1.165	.526
deep1	8318	4.00	1.00	5.00	4.1770	1.00638	-1.240	1.071
deep2	8318	4.00	1.00	5.00	4.1649	.98221	-1.122	.762
deep3	8318	4.00	1.00	5.00	4.1300	.96783	-1.037	.645
deep4	8318	4.00	1.00	5.00	4.1046	.99167	-1.073	.719
deep5	8318	4.00	1.00	5.00	4.0535	.99386	-.945	.409
deep6	8318	4.00	1.00	5.00	3.8453	1.10329	-.758	-.138
deep7	8318	4.00	1.00	5.00	3.8544	1.12374	-.789	-.126
qual1	8318	4.00	1.00	5.00	4.4541	.91610	-1.984	3.847
qual2	8318	4.00	1.00	5.00	4.2062	.92378	-1.249	1.439

Table A.18 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
qual3	8318	4.00	1.00	5.00	4.3543	.89747	-1.526	2.228
qual4	8318	4.00	1.00	5.00	3.8286	1.14330	-.898	.150
qual5	8318	4.00	1.00	5.00	4.0814	1.10024	-1.157	.635
qual6	8318	4.00	1.00	5.00	4.3311	.93147	-1.540	2.160
qual7	8318	4.00	1.00	5.00	4.3424	.91564	-1.579	2.416
goal1	8318	4.00	1.00	5.00	4.5775	.84207	-2.460	6.306
goal2	8318	4.00	1.00	5.00	4.4079	.85662	-1.617	2.616
goal3	8318	4.00	1.00	5.00	3.3470	1.44876	-.395	-1.198
goal4	8318	4.00	1.00	5.00	4.5933	.82444	-2.374	5.676
goal5	8318	4.00	1.00	5.00	4.5251	.82234	-2.077	4.569
goal6	8318	4.00	1.00	5.00	4.4103	.91549	-1.800	3.134
goal8	8318	4.00	1.00	5.00	4.4568	.89928	-1.867	3.264
goal9	8318	4.00	1.00	5.00	4.4154	.90925	-1.782	3.054
goal10	8318	4.00	1.00	5.00	2.6338	1.58129	.351	-1.452
goal11	8318	4.00	1.00	5.00	4.4172	.91350	-1.798	3.094
goal12	8318	4.00	1.00	5.00	2.6975	1.58753	.297	-1.489
goal13	8318	4.00	1.00	5.00	4.3379	1.00993	-1.663	2.244
goal14	8318	4.00	1.00	5.00	4.4998	.85525	-2.014	4.141
goal15	8318	4.00	1.00	5.00	2.8788	1.62418	.104	-1.586
proc1	8318	4.00	1.00	5.00	1.8447	1.27514	1.396	.687
proc2	8318	4.00	1.00	5.00	2.0087	1.29154	1.057	-.124
proc3	8318	4.00	1.00	5.00	2.3269	1.46763	.685	-.975
proc4	8318	4.00	1.00	5.00	1.9042	1.26897	1.249	.328
proc5	8318	4.00	1.00	5.00	1.7508	1.23349	1.543	1.113
proc6	8318	4.00	1.00	5.00	1.8150	1.25619	1.418	.744
proc7	8318	4.00	1.00	5.00	2.1937	1.35698	.826	-.596
proc8	8318	4.00	1.00	5.00	1.9859	1.30451	1.124	-.002
proc9	8318	4.00	1.00	5.00	1.8437	1.26375	1.378	.649
proc10	8318	4.00	1.00	5.00	1.9826	1.29624	1.114	.002
proc11	8318	4.00	1.00	5.00	1.7400	1.23321	1.577	1.212
proc12	8318	4.00	1.00	5.00	1.9083	1.28817	1.270	.360

APPENDIX B

SCIENCE ACHIEVEMENT TEST

1. Aşağıdakilerden hangisi burnumuzun görevi değildir?

A) Koku alma
B) Alınan havayı süzme
C) Alınan nemli havayı kurutma
D) Alınan soğuk havayı ısıtma

2. Derinin aşağıdakilerin hangisinde görevi yoktur?

A) Sıcaklık hissetmede
B) Solunumda
C) Boşaltımda
D) Sindirimde

3. Göze gelen ışık ışınları ilk önce aşağıdakilerin hangisinden geçer?

A) Sarı benekten
B) Göz merceğinden
C) İristen
D) Korneadan

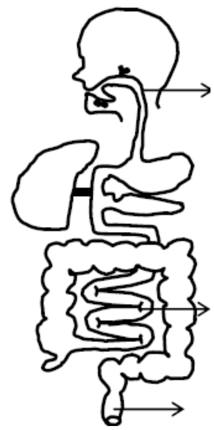
4. Aşağıdaki bezlerden hangisi insülin hormonu salgılar?

A) Pankreas B) Tiroid
C) Epifiz D) Hipofiz

5. Aşağıdakilerden hangisi diğer iç salgı bezlerinin çalışmasını denetler ve düzenler?

A) Böbrek üstü bezi B) Hipofiz bezi
C) Tiroit bezi D) Yumurtalık

6.



Şekilde sindirim sisteminin bazı organları okla gösterilmiştir.

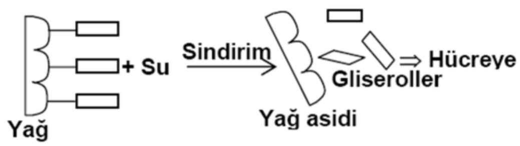
Aşağıda verilen olaylardan hangisi okla gösterilen organlardan birinin görevi değildir?

A) Atık maddelerin vücuttan uzaklaştırılması
B) Besinlerin ağızdan yemek borusuna iletilmesi
C) Besinlerin bulamaç hâline getirilmesi
D) Besinlerin kana geçirilmesi

7. 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

8.

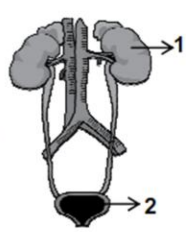


Yağlar, şekilde de görüldüğü gibi sindirim sisteminde sindirilerek yağ asidi ve gliserole ayrılır.
Bu bilgilere göre aşağıdakilerden hangisine <u>ulaşılamaz</u>?

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

9.

Öğretmen:
Şekildeki boşaltım sisteminde verilen 1 ve 2 numaralı organların isim ve görevlerini söyler misin?

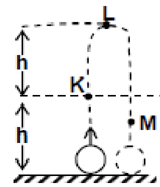


Öğrenci:
1 numaralı organ böbrektir, idrarı depo eder.
2 numaralı organ idrar kesesidir, kanı süzer.

Bu açıklamalara göre öğrenci ile ilgili olarak aşağıdakilerden hangisi söylenebilir?

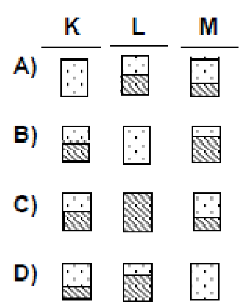
A) Boşaltım sistemi organlarını bilmiyor.
B) Boşaltım sistemi organları ile diğer sistemlerin organlarını ayırt edemiyor.
C) Boşaltım sistemi organlarının şeklini biliyor, ancak görevlerini birbirine karıştırıyor.
D) Boşaltım sistemi organlarını ve görevlerini çok iyi biliyor.

10.



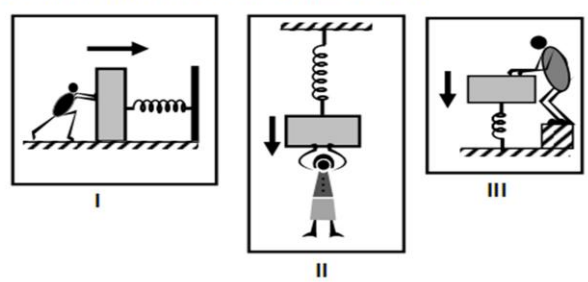
Şekilde düşey doğrultuda yukarı doğru atılan bir topun izlediği yol görülmektedir. Buna göre; topun K, L, M noktalarındaki potansiyel enerji ve kinetik enerji dağılımları hangisindeki gibi olur?

: Potansiyel enerji **: Kinetik enerji**
Sürtünmeler önemsenmeyecek.



11.

Üç öğrenci I, II, III'teki yaylara oklarla gösterilen yönlerdeki kuvvetleri uyguluyorlar.

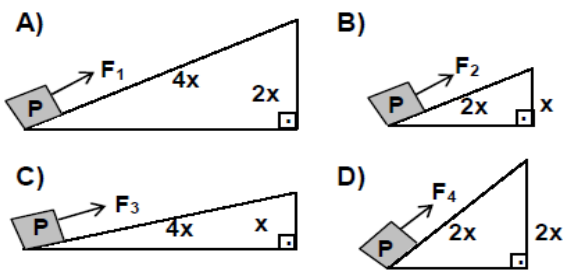


Yayların bu kişilere uyguladıkları kuvvetlerin yönleri hangi seçenekte doğru olarak verilmiştir?

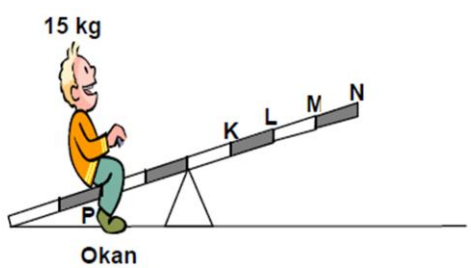
	I	II	III
A)	→	↓	↓
B)	←	↑	↓
C)	←	↑	↑
D)	→	↓	↑

12.

Sürtünmesiz eğik düzlemler üzerinde sabit hızlarla çekilen P ağırlıklı cisme uygulanan kuvvetlerden hangisi <u>en küçüktür</u>?



13.



Şekildeki eşit bölmeli tahterevallinin P noktasında oturan 15 kg ağırlığındaki Okan denge konumuna getirilmek istenmektedir. Buna göre aşağıdakilerin hangisinde denge <u>sağlanmaz</u>?

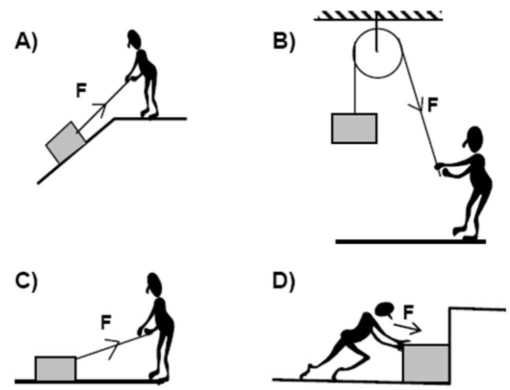
A) K'ye 30 kg ağırlığındaki Ziya oturduğunda
B) L'ye 15 kg ağırlığındaki Göktuğ oturduğunda
C) M'ye 10 kg ağırlığındaki Selim oturduğunda
D) N'ye 20 kg ağırlığındaki Hakan oturduğunda

14. Fiziksel anlamda iş yapılabilmesi için;

- Kuvvet uygulanmalı
- Kuvvet etkisindeki cisim yol

almalıdır.

Buna göre aşağıdakilerden hangisinde <u>kesinlikle</u> iş <u>yapılamaz</u>?



APPENDIX C

TEACHER HOMEWORK SCALE

C.1 Teacher Homework Goal Orientations Scale

	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1. Ödevlerinde ilerleme gösteren öğrenciyi takdir ederim. **(M)**	1	2	3	4	5
2. Ödevden en yüksek not alan öğrencileri sınıfta duyururum. **(P)**	1	2	3	4	5
3. Öğrencilerin, ödevlerini yaparken farklı bakış açıları kazanmalarını isterim. **(M)**	1	2	3	4	5
4. Ödevlerini yaparken emek harcayan öğrencileri takdir ederim. **(M)**	1	2	3	4	5
5. Ödevlerini iyi yapmayan öğrencileri sınıfta duyururum. **(P)**	1	2	3	4	5
6. Öğrendikleri sürece öğrencilerin ödevlerinde yaptıkları hataları anlayışla karşılarım. **(M)**	1	2	3	4	5
7. Ödevdeki performanslarına göre öğrenciler arasında karşılaştırma yaparım. **(P)**	1	2	3	4	5
8. Öğrencilerin ödevlerini ezbere değil, anlayarak yapmalarını isterim. **(M)**	1	2	3	4	5
9. Ödevden yüksek not alan öğrencileri sınıfa örnek gösteririm. **(P)**	1	2	3	4	5

Note: M= Teacher mastery goal orientation, P= Teacher performance goal orientation

C.1.1 Item-Total Statistics and Inter-Item Correlations for Teacher Homework Goal Orientation Scale

Table C.1 Item-total statistics for teacher mastery goal orientation in homework

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_goal1	18.6352	3.183	.590	.720
t_goal3	18.7673	3.192	.503	.747
t_goal4	18.5220	3.213	.626	.711
t_goal6	18.8931	2.970	.433	.790
t_goal8	18.5409	3.098	.658	.699

Table C.2 Item-total statistics for teacher performance goal orientation in homework

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_goal2	9.6358	9.550	.527	.714
t_goal5	11.0988	7.518	.539	.708
t_goal7	11.2222	7.814	.561	.689
t_goal9	9.8395	8.372	.603	.668

Table C.3 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
teacher mastery goal orientation (5 item)	.430	.246	.554	.308	2.250	.008
teacher performance goal orientation (4 item)	.444	.331	.575	.244	1.737	.007

C.2 Teacher Support in Strategy Use for Homework Scale

C.2.1 Teacher support for students' use of management strategies scale

	Hiç bir zaman	Nadiren	Bazen	Çoğu zaman	Her zaman
1. Öğrencilere, ödevde geçen konuları, kişisel olarak ilgi duydukları şeylerle ilişkilendirmelerini tavsiye ederim.	1	2	3	4	5
2. Öğrencilere, ödev yapmaya başlamadan önce, ödevlerine rahatlıkla odaklanabilecekleri bir çalışma ortamı hazırlamalarını tavsiye ederim.	1	2	3	4	5
3. Öğrencilere, ödevlerini iyi odaklanabilecekleri bir zaman diliminde (yemek yedikten sonra, akşam uykusu gelmeden önce, vb.) yapmalarını öneririm.	1	2	3	4	5
4. Öğrencilere, ödev yaparken zorlandıklarında paniğe kapılmamaları gerektiğini söylerim.	1	2	3	4	5
5. Öğrencilere, ödevlerini iyi yaptıklarında kendileriyle övünmeleri gerektiğini söylerim.	1	2	3	4	5
6. Öğrencilere ödev yaparken başka şeylerle uğraşmamaları gerektiğini söylerim.	1	2	3	4	5
7. Öğrencilere ödev yaparken zamanlarını iyi kullanmalarını söylerim.	1	2	3	4	5
8. Öğrencilere, ödev yapmaya başlamadan önce, ödevlerinde ihtiyaç duyacakları araç-gereçleri hazır etmelerini öneririm.	1	2	3	4	5
9. Öğrencilere, ödevin zor olduğu hissine kapılsalar bile, ödevi başarıyla tamamlayabileceklerine inanmalarını öğütlerim.	1	2	3	4	5
10. Öğrencilere ödevde geçen konuları bilmenin, kendilerine hangi durumlarda yardımcı olabileceği üzerine düşünmelerini isterim.	1	2	3	4	5
11. Öğrencilerden ödevlerini sakin bir şekilde yapmalarını isterim.	1	2	3	4	5
12. Öğrencilerden ödevi kendileri için eğlenceli bir hale getirebilmenin yollarını bulmalarını isterim.	1	2	3	4	5
13. Öğrencilere ödev yaparken dikkatlerini ödeve vermeleri gerektiğini söylerim.	1	2	3	4	5

C.2.2 Teacher support for students' use of deep learning strategies scale

	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1. Ödev yaparken öğrencinin, farklı kaynaklardan (derste anlatılanlar, tartışılanlar ve okumalar gibi) edindiği bilgileri bir araya getirmesini beklerim.	1	2	3	4	5
2. Öğrencinin mümkün olduğunca Fen ve Teknoloji dersinde öğrendikleriyle diğer derslerde öğrendikleri arasında bağlantı kurabileceği ödevler veririm.	1	2	3	4	5
3. Öğrencinin daha önceki öğrenmeleri ile bağlantı kurmasını gerektiren ödevler veririm.	1	2	3	4	5
4. Öğrencinin ödevini yaparken ulaştığı bilgilerin, mesela internet kaynaklı bilgilerin, güvenilirliğini sorgulamasını isterim.	1	2	3	4	5

C.2.3 Item-total statistics and inter-item correlations for teacher support in strategy use for homework scale

Table C.4 Item-total statistics for teacher management strategy support

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_man1	47.6815	71.398	.485	.916
t_man2	47.6497	67.139	.682	.909
t_man3	47.7643	67.899	.612	.912
t_man4	47.7389	66.322	.716	.907
t_man5	48.1656	67.126	.516	.917
t_man6	47.6497	66.678	.708	.908
t_man7	47.5860	67.385	.724	.907
t_man8	47.7389	67.130	.667	.909
t_man9	47.6051	66.830	.715	.908
t_man10	47.6561	69.266	.642	.911
t_man11	47.7516	66.239	.696	.908
t_man12	47.7962	68.292	.591	.912
t_man13	47.4713	67.148	.702	.908

Table C.5 Item-total statistics for teacher deep learning strategy support

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_deep1	12.5597	2.678	.492	.605
t_deep2	13.1887	2.268	.475	.620
t_deep3	12.9371	2.388	.545	.565
t_deep4	12.5409	2.946	.372	.673

Table C.6 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
teacher management strategy support (13 items)	.464	.216	.716	.500	3.315	.010
teacher deep learning strategy support (4 items)	.353	.228	.460	.231	2.012	.006

C.3 Teacher Perception of Homework Quality and Feedback on Homework Scale

C.3.1 Teacher Perception of Homework Quality Scale

	Hiç bir zaman	Nadiren	Bazen	Çoğu zaman	Her zaman
1. Ödev hazırlarken farklı kaynaklardan faydalanırım.	1	2	3	4	5
2. Zorluk düzeyi farklı ödevler veririm.	1	2	3	4	5
3. Öğrencilerime aralarından seçim yapabileceği farklı ödevler veririm.	1	2	3	4	5
4. Ödev hazırlarken öğrenci özelliklerini (ön bilgi, gelişim düzeyi, ilgi alanı vb.) göz önüne alırım.	1	2	3	4	5
5. Öğrencilerin derste gördüğü konuları anlamasına yardımcı olacak ödevler veririm.	1	2	3	4	5

6. Öğrencilerin derste gördükleri konular üzerinde eleştirel düşünmelerini sağlayacak ödevler hazırlarım.	1	2	3	4	5
7. Ödev hazırlarken zümredeki meslektaşlarımla görüş alışverişinde bulunurum.	1	2	3	4	5

Note: Item 5 in teacher perception of homework quality scale is dropped from the scale.

C.3.2 Teacher perception of feedback on homework scale

	Hiç bir zaman	**Nadiren**	**Bazen**	**Çoğu zaman**	**Her zaman**
1. Ödevleri düzenli olarak kontrol ederim.	1	2	3	4	5
2. Derste, öğrencilerin yaptıkları ödevler üzerinde tartışırız.	1	2	3	4	5
3. Öğrencileri, ödevlerindeki doğru ve yanlışlar hakkında bilgilendiririm.	1	2	3	4	5
4. Öğrencilere ödevlerinde yaptıkları hataları düzeltmeleri için fırsat veririm.	1	2	3	4	5
5. Ödevleri kısa bir süre içerisinde değerlendiririm.	1	2	3	4	5
6. Değerlendirdiğim ödevler, öğrencilerin eksiklerini görmelerine yardımcı olur.	1	2	3	4	5

C.3.3 Item-Total Statistics and Inter-Item Correlations for Teacher Perception of Homework Quality and Feedback on Homework Scale

Table C.7 Factor loadings of teacher perception of homework quality and feedback items after deleting t_quality 5

Item	Factor 1	Factor 2
t_feed 6	.748	
t_feed 3	.679	
t_feed 2	.630	
t_feed 1	.628	
t_feed 4	.438	
t_feed 5	.419	
t_quality 3	-.420	.742
t_quality 6		.547
t_quality 4		.495
t_quality 7		.436
t_quality 1		.417
t_quality 2		.335

Table C.8 Item-total statistics for feedback on homework

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_feed 1	20.5769	8.155	.560	.720
t_feed 2	21.0513	7.584	.552	.724
t_feed 3	20.6090	8.149	.666	.698
t_feed 4	20.8397	8.497	.421	.758
t_feed 5	20.6859	9.120	.331	.778
t_feed 6	20.6603	8.510	.598	.716

Table C.9 Item-total statistics for quality of homework

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
t_quality 1	18.2469	11.839	.428	.637
t_quality 2	18.2160	12.146	.387	.649
t_quality 3	19.2840	10.577	.363	.664
t_quality 4	18.0926	11.302	.446	.629
t_quality 6	18.1667	11.481	.502	.617
t_quality 7	18.5185	9.978	.415	.645

Table C.10 Inter-item correlations

	Mean	Min	Max	Range	Max / Min	Variance
feedback on homework (6 items)	.366	.093	.579	.486	6.246	.016
homework quality (7 items)	.241	-.101	.380	.481	-3.757	.013

C.4 Screening Data from Teacher Homework Scale in Main Study

Table C.11 Valid and missing cases

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
t_quality1	341	99.1%	3	0.9%	344	100.0%
t_quality2	341	99.1%	3	0.9%	344	100.0%
t_quality3	335	97.4%	9	2.6%	344	100.0%
t_quality4	343	99.7%	1	0.3%	344	100.0%
t_quality5	343	99.7%	1	0.3%	344	100.0%
t_quality6	342	99.4%	2	0.6%	344	100.0%
t_quality7	336	97.7%	8	2.3%	344	100.0%
t_feed1	342	99.4%	2	0.6%	344	100.0%
t_feed2	341	99.1%	3	0.9%	344	100.0%
t_feed3	342	99.4%	2	0.6%	344	100.0%
t_feed4	343	99.7%	1	0.3%	344	100.0%
t_feed5	341	99.1%	3	0.9%	344	100.0%
t_feed6	342	99.4%	2	0.6%	344	100.0%
t_man14	344	100.0%	0	0.0%	344	100.0%
t_man1	341	99.1%	3	0.9%	344	100.0%
t_man2	342	99.4%	2	0.6%	344	100.0%
t_man3	342	99.4%	2	0.6%	344	100.0%
t_man4	341	99.1%	3	0.9%	344	100.0%
t_man5	343	99.7%	1	0.3%	344	100.0%
t_man6	342	99.4%	2	0.6%	344	100.0%
t_man7	343	99.7%	1	0.3%	344	100.0%
t_man8	342	99.4%	2	0.6%	344	100.0%
t_man9	344	100.0%	0	0.0%	344	100.0%
t_man10	343	99.7%	1	0.3%	344	100.0%
t_man11	341	99.1%	3	0.9%	344	100.0%

Table C.11 (Continued)

	Valid Cases		Missing Cases		Total	
	N	Percent	N	Percent	N	Percent
t_man12	344	100.0%	0	0.0%	344	100.0%
t_man13	343	99.7%	1	0.3%	344	100.0%
t_goal1	341	99.1%	3	0.9%	344	100.0%
t_goal2	344	100.0%	0	0.0%	344	100.0%
t_goal3	342	99.4%	2	0.6%	344	100.0%
t_goal4	344	100.0%	0	0.0%	344	100.0%
t_goal5	343	99.7%	1	0.3%	344	100.0%
t_goal6	343	99.7%	1	0.3%	344	100.0%
t_goal7	340	98.8%	4	1.2%	344	100.0%
t_goal8	344	100.0%	0	0.0%	344	100.0%
t_goal9	344	100.0%	0	0.0%	344	100.0%
t_deep1	343	99.7%	1	0.3%	344	100.0%
t_deep2	344	100.0%	0	0.0%	344	100.0%
t_deep3	343	99.7%	1	0.3%	344	100.0%
t_deep4	344	100.0%	0	0.0%	344	100.0%

Table C.12 Descriptive statistics

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
t_quality1	341	4	1	5	3.90	.923	-.551	-.291
t_quality2	341	4	1	5	3.86	.815	-.385	-.124
t_quality3	335	4	1	5	3.49	1.014	-.222	-.481
t_quality4	343	4	1	5	4.10	.857	-.869	.692
t_quality5	343	3	2	5	4.52	.611	-.986	.344
t_quality6	342	4	1	5	3.83	.820	-.292	-.285
t_quality7	336	4	1	5	3.37	1.131	-.346	-.530
t_feed1	342	4	1	5	4.09	.853	-.802	.421
t_feed2	341	3	2	5	3.67	.931	-.100	-.893
t_feed3	342	3	2	5	4.24	.719	-.536	-.406
t_feed4	343	3	2	5	4.06	.813	-.496	-.389
t_feed5	341	4	1	5	3.90	.840	-.535	.271
t_feed6	342	3	2	5	4.08	.748	-.393	-.392
t_man14	344	3	2	5	4.66	.559	-1.512	1.877
t_man1	341	3	2	5	3.96	.796	-.278	-.596
t_man2	342	4	1	5	3.88	.871	-.348	-.487
t_man3	342	4	1	5	3.89	.973	-.550	-.425
t_man4	341	4	1	5	3.90	.957	-.624	-.060
t_man5	343	4	1	5	3.76	1.126	-.582	-.566
t_man6	342	4	1	5	3.98	.995	-.790	.131
t_man7	343	4	1	5	4.21	.839	-1.069	1.365

Table C.12 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
t_man8	342	4	1	5	4.00	.940	-.784	.277
t_man9	344	4	1	5	3.97	.911	-.751	.310
t_man10	343	3	2	5	4.05	.815	-.488	-.413
t_man11	341	4	1	5	4.07	.892	-.840	.310
t_man12	344	4	1	5	3.94	1.008	-.902	.411
t_man13	343	3	2	5	4.27	.800	-.894	.214
t_goal1	341	2	3	5	4.68	.509	-1.240	.476
t_goal2	344	3	2	5	4.52	.740	-1.601	2.229
t_goal3	342	3	2	5	4.38	.673	-.794	.238
t_goal4	344	2	3	5	4.78	.457	-1.868	2.666
t_goal5	343	4	1	5	2.92	1.323	.179	-1.081
t_goal6	343	4	1	5	4.22	.780	-.992	1.343
t_goal7	340	4	1	5	3.11	1.274	-.199	-1.088
t_goal8	344	3	2	5	4.72	.501	-1.644	2.697
t_goal9	344	4	1	5	4.36	.892	-1.584	2.324
t_deep1	343	3	2	5	4.55	.642	-1.393	1.899
t_deep2	344	4	1	5	3.99	.803	-.699	.666
t_deep3	343	4	1	5	4.15	.780	-1.015	1.783
t_deep4	344	3	2	5	4.22	.765	-.825	.448

Table C.13 Descriptive statistics after imputation

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
t_quality1	344	4.00	1.00	5.00	3.9012	.92368	-.539	-.314
t_quality2	344	4.00	1.00	5.00	3.8547	.81304	-.382	-.118
t_quality3	344	4.00	1.00	5.00	3.4913	1.01011	-.215	-.477
t_quality4	344	4.00	1.00	5.00	4.1017	.85619	-.870	.701
t_quality5	344	3.00	2.00	5.00	4.5233	.61044	-.979	.331
t_quality6	344	4.00	1.00	5.00	3.8314	.81927	-.287	-.286
t_quality7	344	4.00	1.00	5.00	3.3692	1.11981	-.340	-.492
t_feed1	344	4.00	1.00	5.00	4.0901	.85409	-.795	.395
t_feed2	344	3.00	2.00	5.00	3.6715	.92878	-.092	-.888
t_feed3	344	3.00	2.00	5.00	4.2384	.71725	-.531	-.398
t_feed4	344	3.00	2.00	5.00	4.0523	.81362	-.488	-.406
t_feed5	344	4.00	1.00	5.00	3.9012	.84107	-.521	.234
t_feed6	344	3.00	2.00	5.00	4.0814	.74763	-.386	-.403
t_man14	344	3.00	2.00	5.00	4.6599	.55907	-1.512	1.877
t_man1	344	3.00	2.00	5.00	3.9593	.79251	-.281	-.574
t_man2	344	4.00	1.00	5.00	3.8779	.86875	-.351	-.472
t_man3	344	4.00	1.00	5.00	3.8866	.97278	-.536	-.443
t_man4	344	4.00	1.00	5.00	3.8983	.95288	-.629	-.032

Table C.13 (Continued)

Item	N	Range	Min	Max	Mean	SD	Skewness	Kurtosis
t_man5	344	4.00	1.00	5.00	3.7529	1.12485	-.577	-.569
t_man6	344	4.00	1.00	5.00	3.9855	.99405	-.795	.143
t_man7	344	4.00	1.00	5.00	4.2093	.83811	-1.068	1.373
t_man8	344	4.00	1.00	5.00	3.9971	.93677	-.786	.296
t_man9	344	4.00	1.00	5.00	3.9680	.91098	-.751	.310
t_man10	344	3.00	2.00	5.00	4.0523	.81362	-.488	-.406
t_man11	344	4.00	1.00	5.00	4.0640	.89474	-.838	.296
t_man12	344	4.00	1.00	5.00	3.9360	1.00812	-.902	.411
t_man13	344	3.00	2.00	5.00	4.2645	.79892	-.892	.218
t_goal1	344	2.00	3.00	5.00	4.6802	.50889	-1.236	.463
t_goal2	344	3.00	2.00	5.00	4.5174	.74014	-1.601	2.229
t_goal3	344	3.00	2.00	5.00	4.3692	.68323	-.843	.418
t_goal4	344	2.00	3.00	5.00	4.7762	.45741	-1.868	2.666
t_goal5	344	4.00	1.00	5.00	2.9157	1.32101	.179	-1.075
t_goal6	344	4.00	1.00	5.00	4.2180	.77994	-.995	1.345
t_goal7	344	4.00	1.00	5.00	3.1134	1.26926	-.197	-1.078
t_goal8	344	3.00	2.00	5.00	4.7151	.50097	-1.644	2.697
t_goal9	344	4.00	1.00	5.00	4.3576	.89218	-1.584	2.324
t_deep1	344	3.00	2.00	5.00	4.5494	.64152	-1.385	1.880
t_deep2	344	4.00	1.00	5.00	3.9913	.80264	-.699	.666
t_deep3	344	4.00	1.00	5.00	4.1512	.77899	-1.015	1.793
t_deep4	344	3.00	2.00	5.00	4.2180	.76484	-.825	.448

APPENDIX D

HIERARCHICAL LINEAR MODEL ASSUMPTIONS

D.1 Assumption Tests for the Model with Mastery Goal Orientation as Outcome

Comparison of multilevel standard errors with robust standard errors gives information about tenability of hierarchical linear modeling assumptions. If these errors differ considerably from each other, this indicates that there might be violations of important assumptions (Maas & Hox, 2004). Multilevel standard errors and robust standard errors are displayed in Table D.1 and D.2, respectively. There are not large differences in these values indicating that there is not a serious problem with tenability of assumptions.

Table D.1 Final estimation of fixed effects

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean	-.093	.015	-6.161	.000
MASTERY_GOAL, γ_{00}				
QUAL_MEAN, γ_{01}	.260	.009	28.154	.000
FEMALE, γ_{10}	.191	.017	11.088	.000
PRIOR_ACH, γ_{20}	.083	.008	10.504	.000
FEEDBACK, γ_{30}	.146	.015	9.828	.000
QUALITY, γ_{40}	.552	.017	33.362	.000

Table D.2 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean	-.093	.015	-6.249	.000
MASTERY_GOAL, γ_{00}				
QUAL_MEAN, γ_{01}	.260	.011	28.584	.000
FEMALE, γ_{10}	.191	.017	11.127	.000
PRIOR_ACH, γ_{20}	.083	.009	9.758	.000
FEEDBACK, γ_{30}	.146	.015	9.845	.000
QUALITY, γ_{40}	.552	.017	33.096	.000

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.1.1 Assumption of normal distribution of level-1 errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.1. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

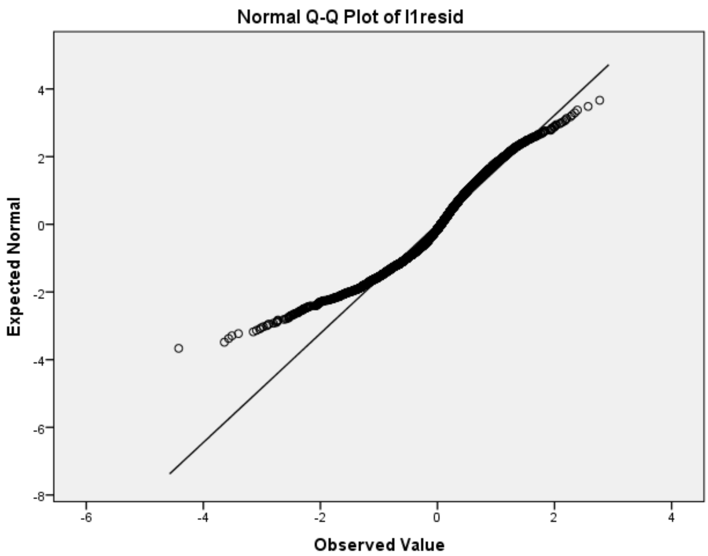


Figure D.1 Q-Q Plot of the Level-1 Residuals

D.1.2 Homogeneity of variance assumption

H statistic is used to test homogeneity of level-1 variance (Raudenbush & Bryk, 2002). *H* statistic is found to be 1077.410 with 340 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.2. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, "a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

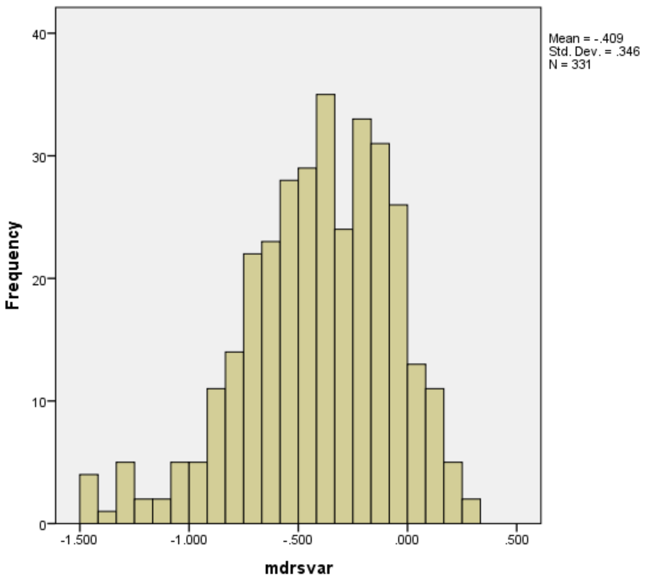


Figure D.2 Histogram of MDRSVAR

D.1.3 Normality assumption of level-2 residuals

CHIPCT and MDIST are two of the variables in level-2 residual file which are helpful in testing normal distribution of level-2 residuals. Rauenbush et al. (2004) explains that "If we model q level-1 coefficients, MDIST would be the Mahalanobis distance. Essentially, MDIST provides a single, summary measure of the distance of a unit's EB estimates, β^{*}_{qj}, from its 'fitted value', $\hat{\gamma}_{q0} + \sum \hat{\gamma}_{q0} W_{sj}$. CHIPCT are the expected values of the order statistics for a sample of size J selected from a population that is distributed $\chi^2_{(v)}$. If the Q-Q plot resembles a 45 degree line, we have evidence that the random effects are distributed v-variate normal. In addition, the plot will help us detect outlying units (i.e., units with large MDIST values well above the 45 degree line)" (pp. 41-42). Figure C.3 represent Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

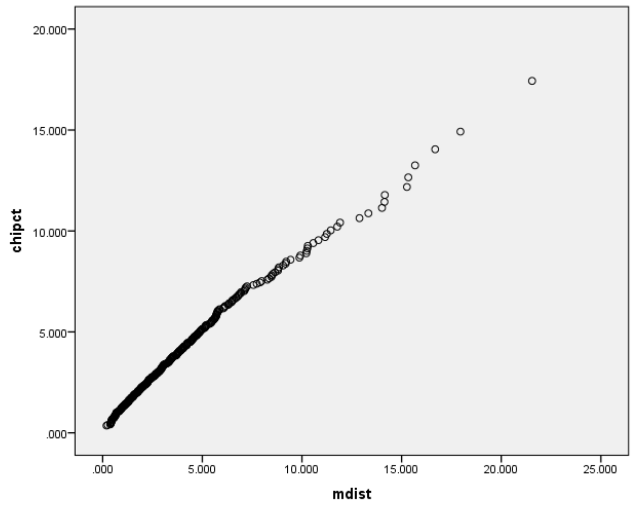


Figure D.3 Plot of CHIPCT vs MDIST

D.1.4 Assumption of linear relationship between level-2 predictors and an outcome

In order to inspect linear relationship between EB residuals and level-2 predictor, plots of EB residuals for intercept against perceptions of homework quality (level-2 predictor) is drawn (Figure D.4). Examination of the plot suggests that residuals are randomly distributed around zero line without regard to values of level-2 predictor indicating no threat for linear relationship between perceptions of homework quality and residual for the intercept.

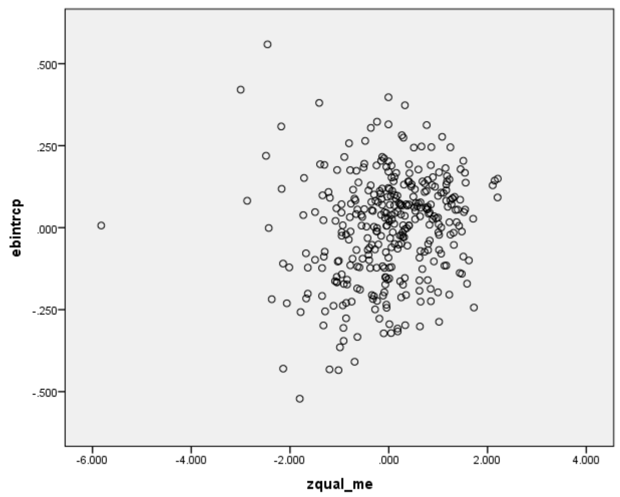


Figure D.4 EB residuals for intercept against perceived homework quality

D.2 Assumption Tests for the Model with Performance Goal Orientation as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.3 and Table D.4, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.3 Final estimation of fixed effects:

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PERFOR_GOAL, γ_{00}	-.078	.017	-4.644	.000
QUAL_MEAN, γ_{01}	.184	.011	16.610	.000
FEMALE, γ_{10}	.170	.020	8.488	.000
PRIOR_ACH, γ_{20}	.062	.011	5.750	.000
FEEDBACK, γ_{30}	.116	.017	6.803	.000
QUALITY, γ_{40}	.427	.018	23.144	.000

Table D.4 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PERFOR_GOAL, γ_{00}	-.078	.017	-4.684	.000
QUAL_MEAN, γ_{01}	.184	.014	13.595	.000
FEMALE, γ_{10}	.170	.020	8.498	.000
PRIOR_ACH, γ_{20}	.062	.011	5.804	.000
FEEDBACK, γ_{30}	.116	.017	6.804	.000
QUALITY, γ_{40}	.427	.019	22.863	.000

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.2.1 Assumption of normal distribution of level-1 errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.5. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

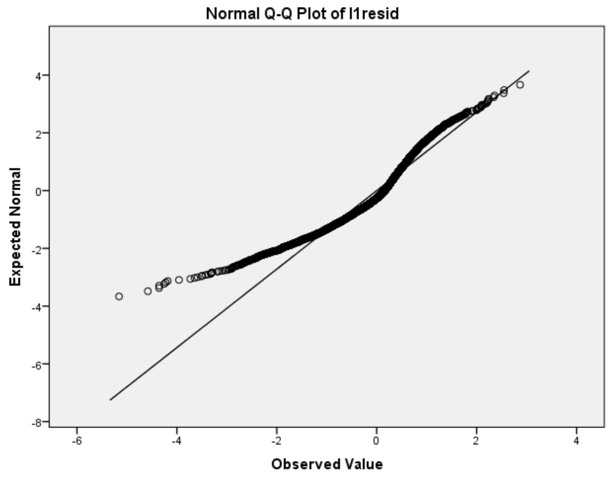


Figure D.5 Q-Q Plot of the Level-1 Residuals

D.2.2 Homogeneity of Variance Assumption

H statistic was found to be 950.782 with 339 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.6. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, "a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

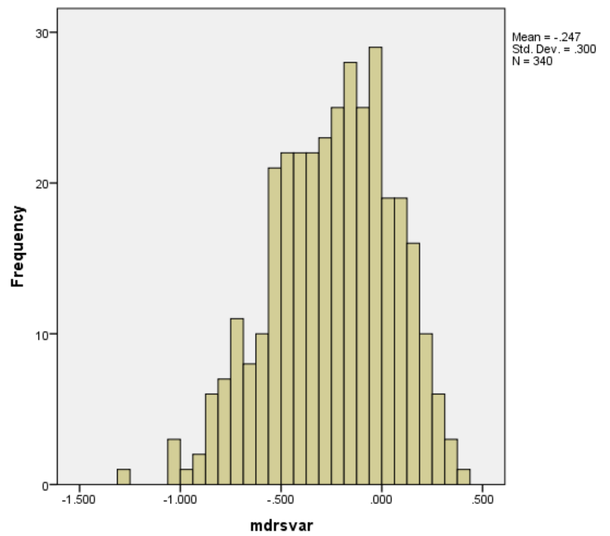


Figure D.6 Histogram of MDRSVAR

D.2.3 Normality assumption of level-2 residuals

Figure D.7 represents Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

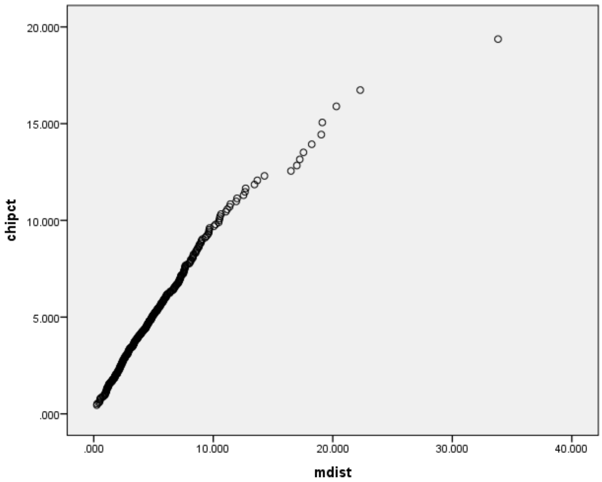


Figure D.7 Plot of CHIPCT vs MDIST

D.2.4 Assumption of linear relationship between level-2 predictors and an outcome

Scatterplot of EB residuals for intercept against perceptions of homework quality (level-2 predictor) is displayed in Figure D.8, which suggests that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between perceptions of homework quality and residual for the intercept.

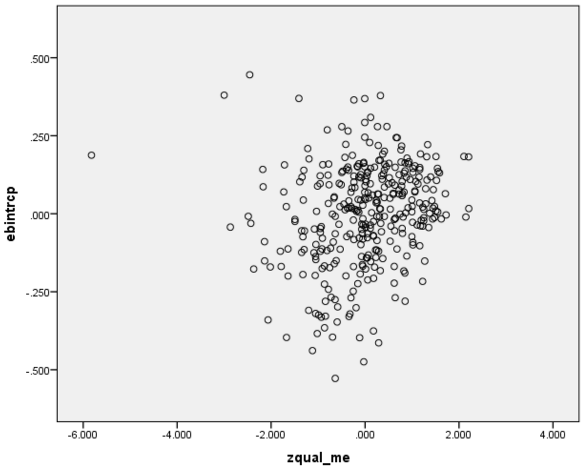


Figure D.8 EB residuals for intercept against perceived homework quality

D.3 Assumption Tests for the Model with Work-Avoidance Goal Orientation as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.5 and Table D.6, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.5 Final estimation of fixed effects:

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean AVOID_GOAL, γ_{00}	.225	.022	10.235	.000
QUAL_MEAN, γ_{01}	-.057	.017	-3.330	.001
FEMALE, γ_{10}	-.0444	.024	-18.709	.000
PRIOR_ACH, γ_{20}	-.153	.012	-12.567	.000
FEEDBACK, γ_{30}	-.041	.015	-2.787	.006
QUALITY, γ_{40}	.048	.017	2.800	.006

Table D. 6 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean AVOID_GOAL, γ_{00}	.225	.022	10.192	.000
QUAL_MEAN, γ_{01}	-.057	.019	-3.003	.003
FEMALE, γ_{10}	-.0444	.024	-18.707	.000
PRIOR_ACH, γ_{20}	-.153	.012	-12.535	.000
FEEDBACK, γ_{30}	-.041	.015	-2.734	.007
QUALITY, γ_{40}	.048	.017	2.865	.005

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.3.1 Assumption of Normal Distribution of Level-1 Errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.9. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

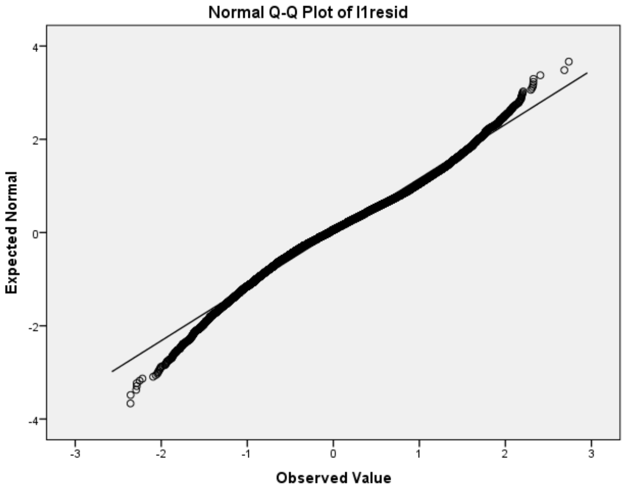


Figure D.9 Q-Q Plot of the Level-1 Residuals

D.3.2 Homogeneity of Variance Assumption

H statistic was found to be 401.680 with 339 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.10. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, "a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

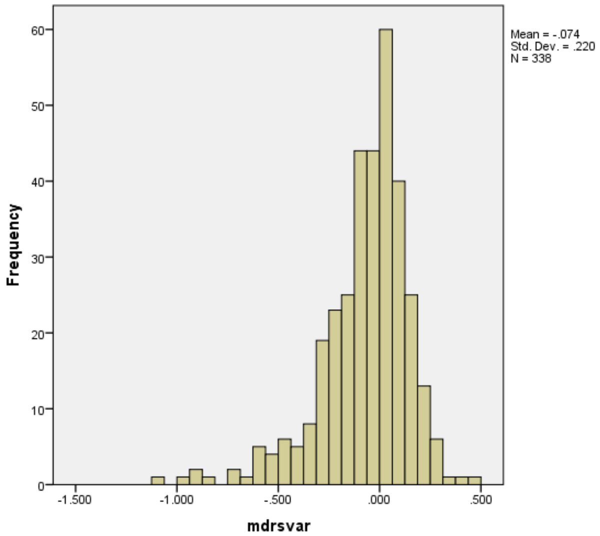


Figure D.10 Histogram of MDRSVAR

D.3.3 Normality assumption of level-2 residuals

Figure D.11 represents Q-Q plot of CHIPCT against MDIST which approximates a 45 degree line and suggests no serious departure from a normal distribution.

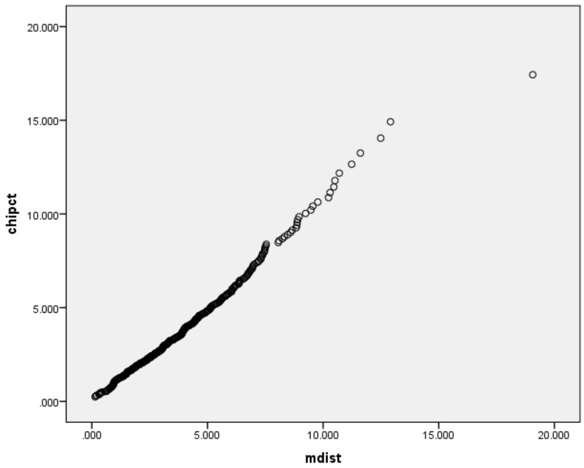


Figure D.11 Plot of CHIPCT vs MDIST

D.3.4 Assumption of linear relationship between level-2 predictors and an outcome

Scatterplot of EB residuals for intercept against perceptions of homework quality (level-2 predictor) is displayed in Figure D.12, which suggests that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between perceptions of homework quality and residual for the intercept.

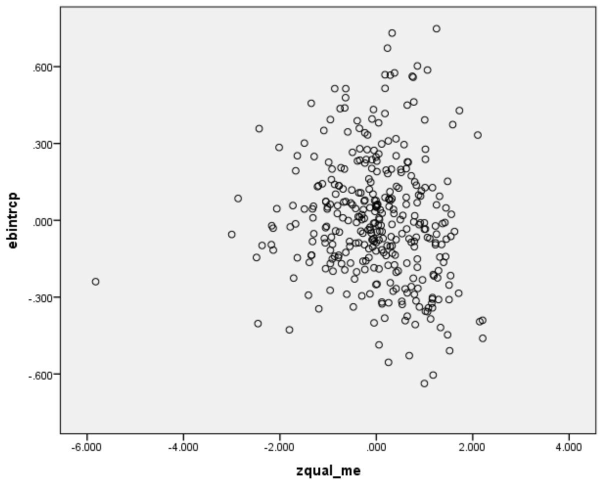


Figure D.12 EB residuals for intercept against perceived homework quality

D.4 Assumption Tests for the Model with Homework Procrastination as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.7 and Table D.8, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.7 Final estimation of fixed effects:

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PROCRAST, γ_{00}	.152	.024	6.344	.000
QUAL_MEAN, γ_{01}	-.170	.016	-10.509	.000
FEMALE, γ_{10}	-.304	.023	-13.131	.000
PRIOR_ACH, γ_{20}	-.197	.012	-15.853	.000
FEEDBACK, γ_{30}	-.086	.017	-5.169	.000
QUALITY, γ_{40}	-.144	.016	-8.913	.000

Table D.8 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean PROCRAST, γ_{00}	.153	.024	6.350	.000
QUAL_MEAN, γ_{01}	-.170	.019	-8.828	.000
FEMALE, γ_{10}	-.304	.023	-13.240	.000
PRIOR_ACH, γ_{20}	-.197	.012	-15.923	.000
FEEDBACK, γ_{30}	-.086	.017	-5.169	.000
QUALITY, γ_{40}	-.144	.016	-8.916	.000

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.4.1 Assumption of Normal Distribution of Level-1 Errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.13. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

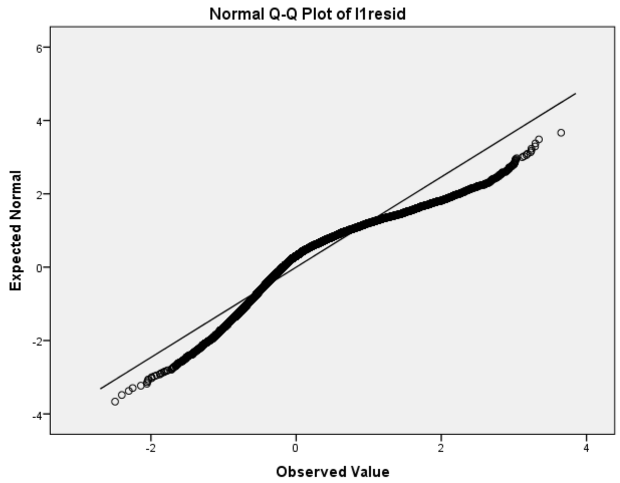


Figure D.13 Q-Q Plot of the Level-1 Residuals

D.4.2 Homogeneity of Variance Assumption

H statistic was found to be 1543.994 with 339 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.14. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, "a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

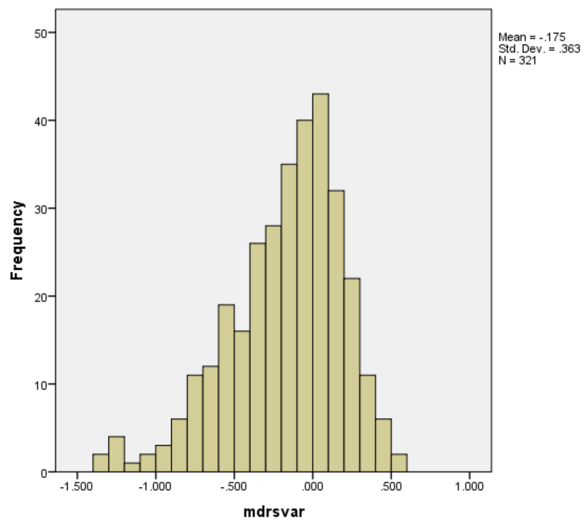


Figure D.14 Histogram of MDRSVAR

D.4.3 Normality assumption of level-2 residuals

Figure D.15 represents Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

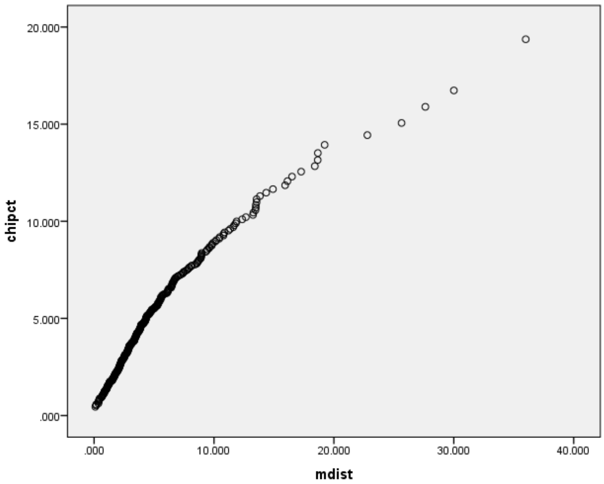


Figure D.15 Plot of CHIPCT vs MDIST

D.4.4 Assumption of Linear Relationship between Level-2 Predictors and an Outcome

Scatterplot of EB residuals for intercept against perceptions of homework quality (level-2 predictor) is displayed in Figure D.16, which suggests that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between perceptions of homework quality and residual for the intercept.

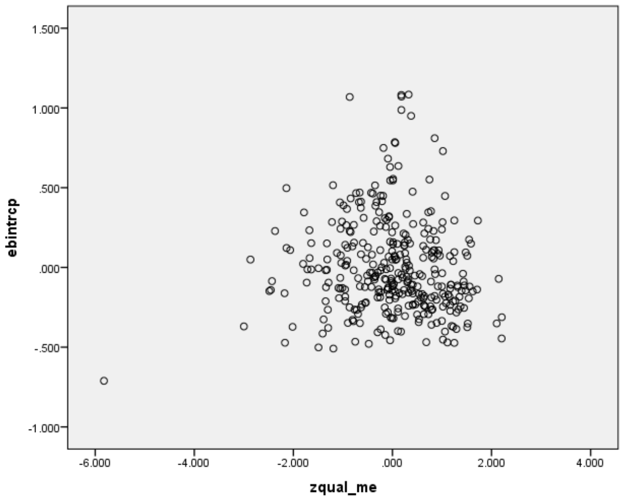


Figure D.16 EB residuals for intercept against perceived homework quality

D.5 Assumption Tests for the Model with Homework Deep Learning Strategy Use as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.9 and Table D.10, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.9 Final estimation of fixed effects:

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean DEEP, γ_{00}	-.037	.014	-2.601	.010
QUAL_MEAN, γ_{01}	.215	.021	10.332	.000
FEED_MEAN, γ_{02}	.072	.021	3.460	.001
FEMALE, γ_{10}	.085	.015	5.465	.000
PRIOR_ACH, γ_{20}	.147	.008	17.811	.000
FEEDBACK, γ_{30}	.319	.016	19.940	.000
QUALITY, γ_{40}	.425	.016	26.921	.000

Table D.10 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean DEEP, γ_{00}	-.037	.014	-2.625	.009
QUAL_MEAN, γ_{01}	.215	.022	9.932	.000
FEED_MEAN, γ_{02}	.072	.024	3.064	.003
FEMALE, γ_{10}	.085	.017	5.006	.000
PRIOR_ACH, γ_{20}	.147	.009	16.692	.000
FEEDBACK, γ_{30}	.319	.016	19.385	.000
QUALITY, γ_{40}	.425	.016	26.755	.000

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.5.1 Assumption of normal distribution of level-1 errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.17. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

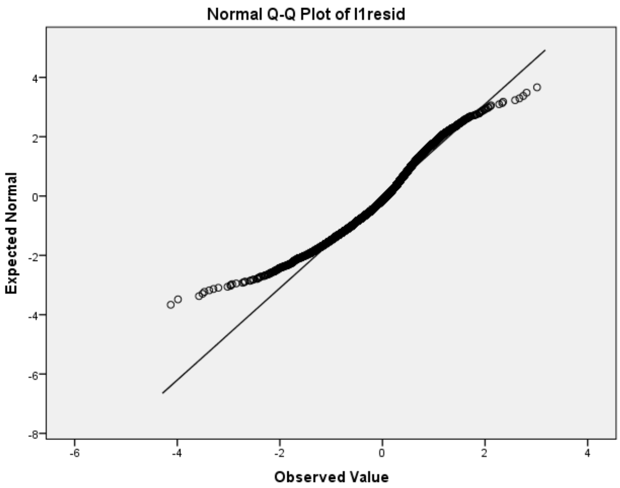


Figure D.17 Q-Q Plot of the Level-1 Residuals

D.5.2 Homogeneity of variance assumption

H statistic was found to be 734.415 with 341 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.18. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, “a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

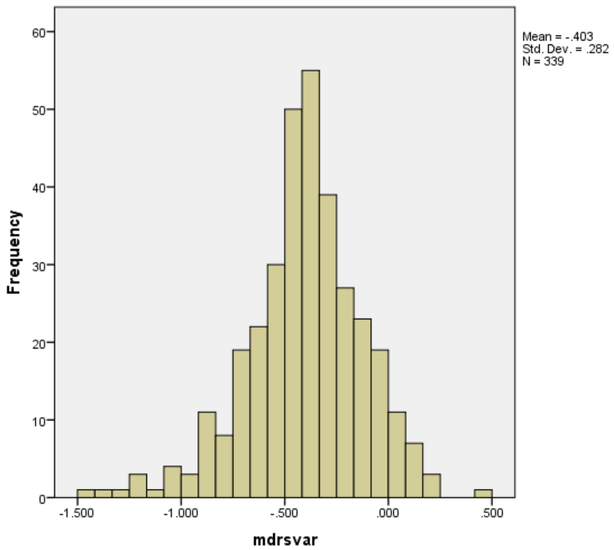


Figure D.18 Histogram of MDRSVAR

D.5.3 Normality assumption of level-2 residuals

Figure D.19 represents Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

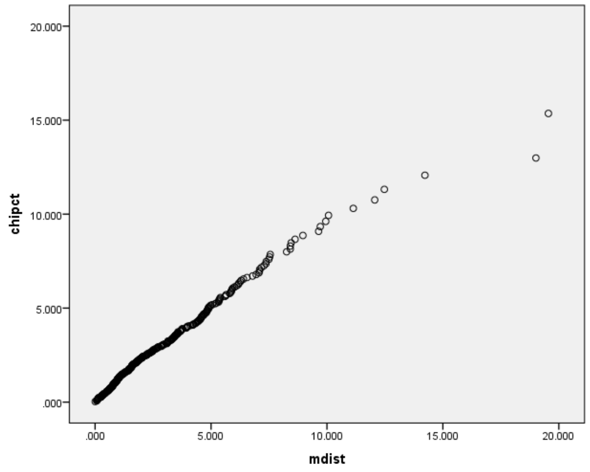


Figure D.19 Plot of CHIPCT vs MDIST

D.5.4 Assumption of Linear Relationship between Level-2 Predictors and an Outcome

Scatterplot of EB residuals for intercept against perceptions of homework quality and perceptions of homework feedback (level-2 predictors) are displayed in Figure D.20 and Figure D.21, respectively. Plots suggest that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between level-2 predictors and residual for the intercept.

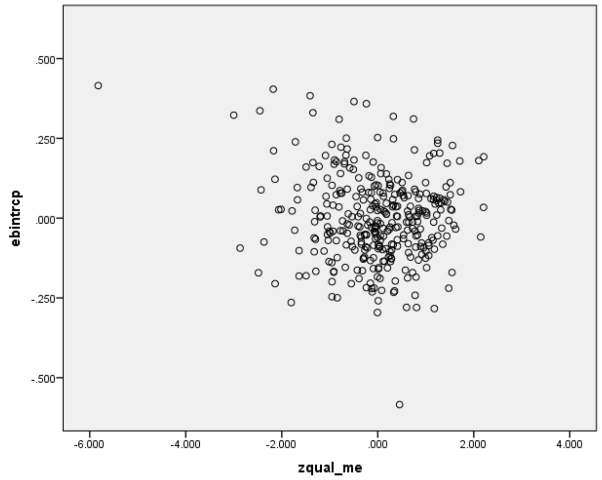


Figure D.20 EB residuals for intercept against perceived homework quality

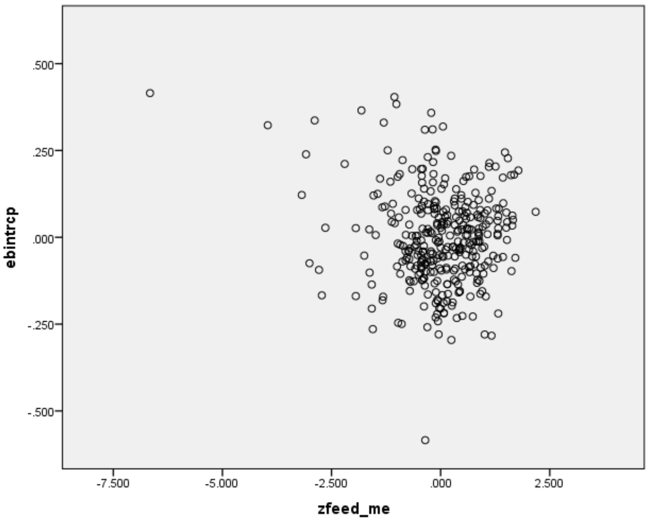


Figure D.21 EB residuals for intercept against perceived homework feedback

D.6 Assumption Tests for the Model with Homework Management Strategy Use as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.11 and Table D.12, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.11 Final estimation of fixed effects:

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MANAGE, γ_{00}	-.120	.015	-8.134	.000
QUAL_MEAN, γ_{01}	.198	.021	9.422	.000
FEED_MEAN, γ_{02}	.047	.021	2.232	.026
FEMALE, γ_{10}	.236	.016	14.743	.000
PRIOR_ACH, γ_{20}	.157	.010	16.223	.000
FEEDBACK, γ_{30}	.303	.016	19.299	.000
QUALITY, γ_{40}	.375	.016	23.413	.000

Table D.12 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean MANAGE, γ_{00}	-.120	.015	-8.160	.000
QUAL_MEAN, γ_{01}	.198	.022	9.063	.000
FEED_MEAN, γ_{02}	.047	.025	1.884	.060
FEMALE, γ_{10}	.236	.016	14.521	.000
PRIOR_ACH, γ_{20}	.157	.010	16.242	.000
FEEDBACK, γ_{30}	.303	.016	18.877	.000
QUALITY, γ_{40}	.375	.016	23.414	.000

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.6.1 Assumption of normal distribution of level-1 errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.22. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

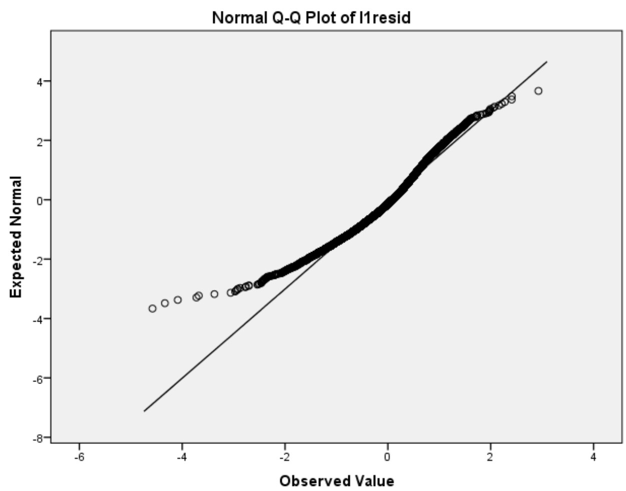


Figure C.22 Q-Q Plot of the Level-1 Residuals

D.6.2 Homogeneity of variance assumption

H statistic was found to be 606.824 with 340 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.23. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, “a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

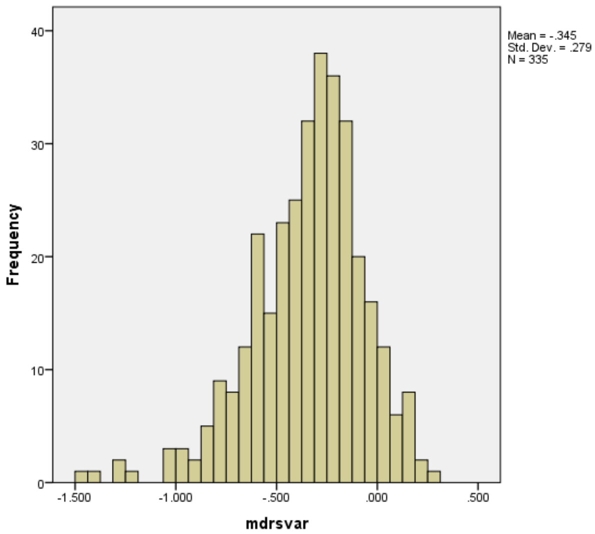


Figure D.23 Histogram of MDRSVAR

D.6.3 Normality Assumption of Level-2 Residuals

Figure D.24 represents Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

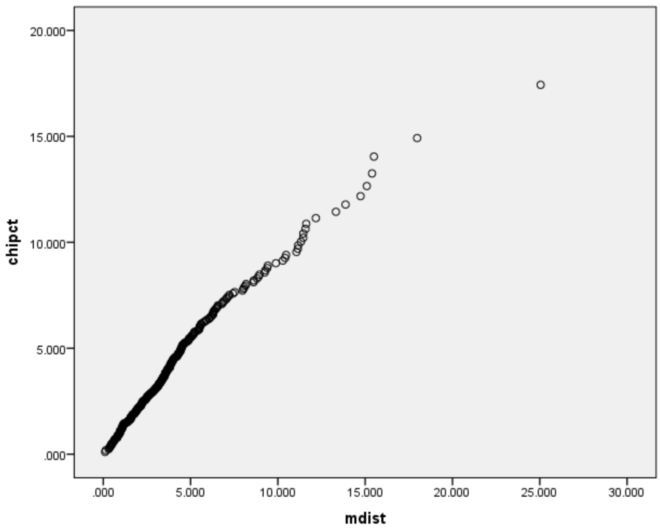


Figure D.24 Plot of CHIPCT vs MDIST

D.6.4 Assumption of Linear Relationship between Level-2 Predictors and an Outcome

Scatterplot of EB residuals for intercept against perceptions of homework quality and perceptions of homework feedback (level-2 predictors) are displayed in Figure D.25 and D.26, respectively. Plots suggest that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between level-2 predictors and residual for the intercept.

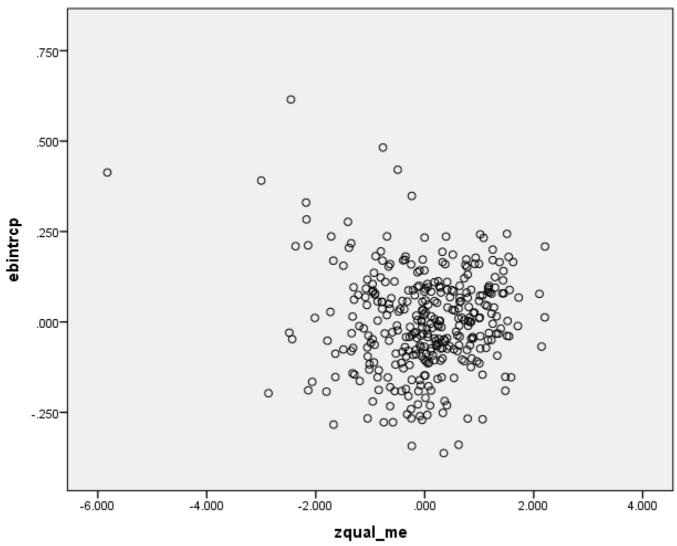


Figure D.25 EB residuals for intercept against perceived homework quality

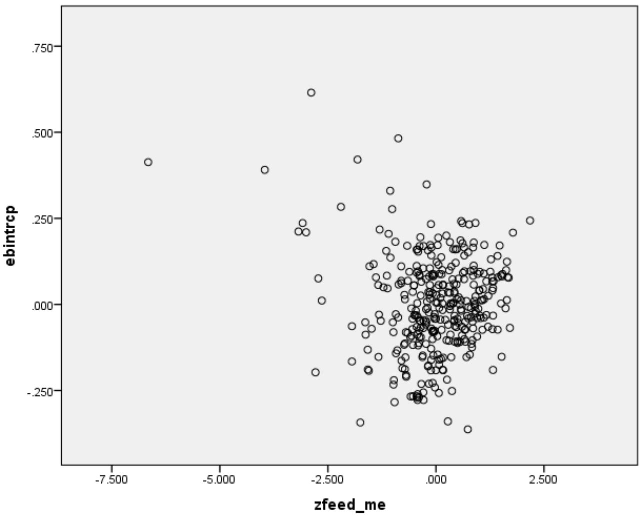


Figure D.26 EB residuals for intercept against perceived homework feedback

D.7 Assumption Tests for the Model with Science Achievement as Outcome

There are not large differences between multilevel standard errors and robust standard errors (See Table D.13 and Table D.14, respectively) which suggest that there is not a serious problem with tenability of hierarchical linear modeling assumptions (Maas & Hox, 2004).

Table D.13 Final estimation of fixed effects

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean ACH, γ_{00}	-.023	.029	-.796	.426
FEED_MEAN, γ_{01}	.158	.029	5.532	.000
T_DEEP_SUPPORT, γ_{02}	.060	.028	2.163	.031
FEMALE, γ_{10}	.018	.019	.931	.353
PRIOR_ACH, γ_{20}	.319	.012	27.595	.000
FEEDBACK, γ_{30}	.004	.012	.313	.755
QUALITY, γ_{40}	.023	.013	1.791	.073
MASTERY_GOAL, γ_{50}	.037	.014	2.561	.011
PERFOR_GOAL, γ_{60}	-.005	.013	-.374	.709
AVOID_GOAL, γ_{70}	-.052	.009	-5.732	.000
PROCRAST, γ_{80}	-.116	.011	-10.189	.000
MANAGE, γ_{90}	.002	.014	.173	.863
DEEP, γ_{100}	.030	.015	2.049	.041

Table D.14 Final estimation of fixed effects (with robust standard errors)

Fixed Effect	*Coefficient*	*SE*	*t-ratio*	*p-value*
Overall mean ACH, γ_{00}	-.023	.029	-.796	.426
FEED_MEAN, γ_{01}	.158	.029	5.528	.000
T_DEEP_SUPPORT, γ_{02}	.060	.029	2.049	.041
FEMALE, γ_{10}	.018	.019	.940	.348
PRIOR_ACH, γ_{20}	.319	.012	27.635	.000
FEEDBACK, γ_{30}	.004	.013	.308	.758
QUALITY, γ_{40}	.023	.014	1.695	.090
MASTERY, γ_{50}	.037	.015	2.375	.018
PERFOR, γ_{60}	-.005	.012	-.394	.694
AVOID, γ_{70}	-.052	.010	-5.393	.000
PROCRAST, γ_{80}	-.116	.011	-10.268	.000
MANAGE, γ_{90}	.002	.015	.171	.865
DEEP, γ_{100}	.030	.015	2.058	.040

Although there seems to be no problem with tenability of assumptions in general, each assumption is examined one by one in the following sections.

D.7.1 Assumption of normal distribution of level-1 errors

Normal Q-Q plot of the level-1 residuals based on the final fitted model is displayed in Figure D.27. The plot is approximately linear suggesting that there is not a serious threat for normal distribution of level-1 residuals.

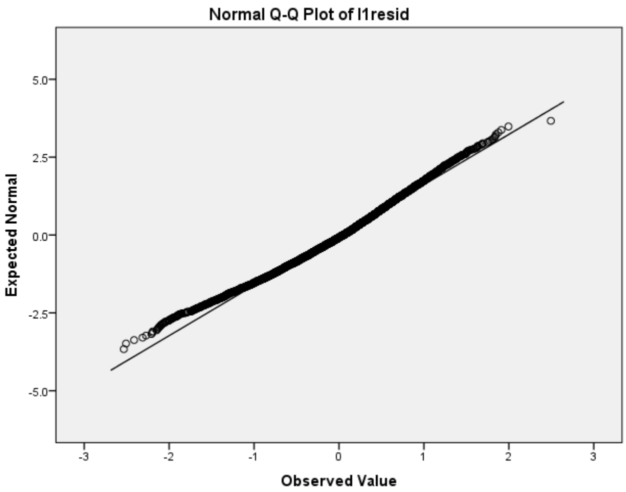


Figure D.27 Q-Q Plot of the Level-1 Residuals

D.7.2 Homogeneity of variance assumption

H statistic was found to be 544.374 with 337 df, which is significant beyond the .001 level. This result indicates that heterogeneity of level-1 variance exists among classes. For inspection of homogeneity, histogram of natural logarithm of the final model residual standard deviation each unit is drawn in Figure D.28. There appear to be some groups where dispersion is smaller than expected, if homogeneity is assumed. However, “a violation of homogeneity assumption is not per se a serious problem for estimating level-2 coefficients or their standard errors (Raudenbush & Bryk, 2002, p.264).

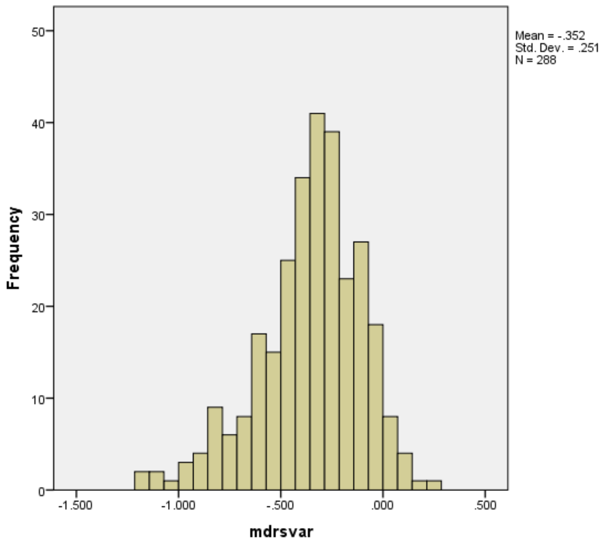


Figure D.28 Histogram of MDRSVAR

D.7.3 Normality assumption of level-2 residuals

Figure D.29 represents Q-Q plot of MDIST against CHIPCT which approximates a 45 degree line and suggests no serious departure from a normal distribution.

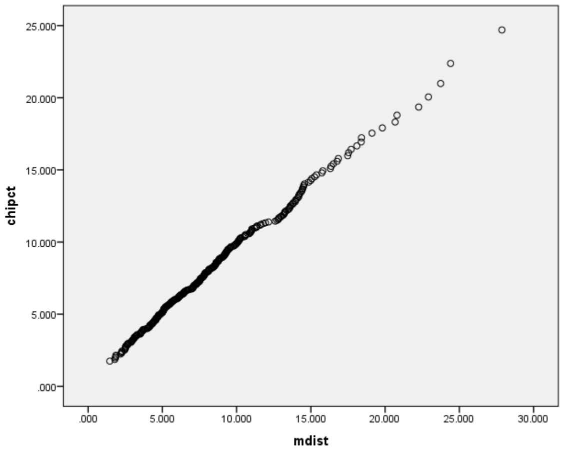


Figure D.29 Plot of CHIPCT vs MDIST

D.7.4 Assumption of linear relationship between level-2 predictors and an outcome

Scatterplot of EB residuals for intercept against perceptions of homework feedback and teacher support for deep learning strategy use during homework (level-2 predictors) are displayed in Figure D.30 and Figure D.31, respectively. Plots suggest that residuals are randomly distributed around zero line without regard to values of level-2 predictor, indicating no threat for linear relationship between level-2 predictors and residual for the intercept.

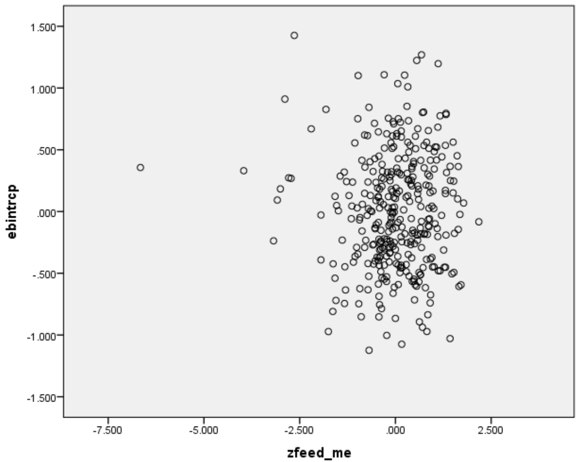


Figure D.30 EB residuals for intercept against perceptions of homework feedback

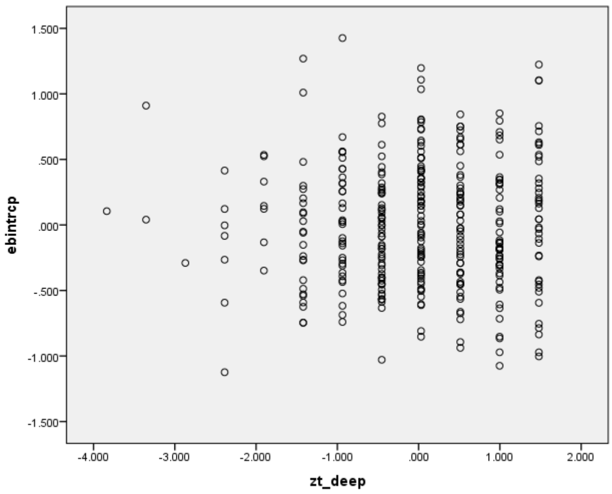


Figure D.31 EB residuals for intercept against teacher support for deep learning strategy

APPENDIX E

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Taş, Yasemin
Nationality: Turkish (TC)
Date and Place of Birth: 17 May 1982, Ankara
Marital Status: Single
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EDUCATION

Degree	**Institution**	**Year of Graduation**
MS	METU Science and Mathematics Education	2008
BS	METU Elementary Science Education	2005
High School	Kanuni Super High School, Ankara	2000

VISITING SCHOLAR

September 2011– August 2012	The Ohio State University, USA	School of Educational Policy and Leadership

WORKSHOP

June 25-29, 2007	University of Connecticut, USA	DATIC HLM Workshop

AWARD

2008	Foundation of Prof. Dr. Mustafa Parlar	Thesis of the Year

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2006- Present	METU Department of Elementary Education	Research Assistant
March-September 2006	Ministry of National Education Çalış Elementary School	Science and Technology Teacher

FOREIGN LANGUAGES

English

PUBLICATIONS

Journal Article

Tas, Y., and Tekkaya, C. "Personal and contextual factors associated with students' cheating in science", The Journal of Experimental Education, 78, 440-463 (2010)

Tas, Y., and Sungur, S. "Effect of problem-based learning on self-regulated learning: A review of literature", Croatian Journal of Education, 14, 533-560 (2012)

Journal Article Currently Under Publication

Tas, Y., Sungur, S., and Tekkaya, C. "A Study of Science Teachers' Homework Practices", Research in Education (in press)

Kingir, S., **Tas, Y.**, Gok, G., and Sungur, S. "Relationships among Constructivist Learning Environment Perceptions, Motivational Beliefs, Self-Regulation, and Science Achievement", Research in Science & Technological Education (in press)

Journal Article Currently Under Review

Gok, G., Kingir, S., **Tas, Y.**, and Tuncer Teksoz, G. "Preservice science teachers' understanding of climate change, greenhouse effect and ozone layer depletion", Croatian Journal of Education (under review)

National and International Conference Presentations

Kirkpatrick, K., Chang, Y., Lee, Y. J., **Tas, Y.**, and Anderman, E. M. "*The role of the perceived social cost of math and science learning".* Paper presented at the annual meeting of American Educational Research Association, San Francisco, USA, (2013, April-May).

Yerdelen, S., **Tas, Y**., and Sungur, S. "*Predictors of pre-service science teacher self-efficacy".* Paper presented at the annual meeting of European Conference on Educational Research, Cadiz, Spain, (2012, September).

Tas, Y., Sungur, S., and Tekkaya, C. "*Personal and contextual factors as predictors of homework management and procrastination in science courses".* Paper presented at the NARST Annual International Conference, Indianapolis, USA, (2012, March).

Tas, Y., Sungur, S., and Tekkaya, C. “*Development of students’ perceptions of homework quality and teacher feedback on homework scales*”. Paper presented at the annual meeting of the International Conference on New Trends in Education and Their Implications, Antalya, Turkey, (2011, April).

Haser, C., **Tas,** Y., and Yerdelen, S. “*Perceptions of Phd comprehensive examination by doctoral students and directors”.* Paper presented at the annual meeting of European Conference on Educational Research, Helsinki, Finland, (2010, August).

Araz Gok, G., **Tas,** Y., Kingir, S., and Tuncer Teksoz, G. “*Preservice science teachers’ understanding of greenhouse effect”.* Paper presented at the annual meeting of European Science Education Research Association, Istanbul, Turkey, (2009, August-September).

Tas, Y., and Tekkaya, C. “*Relationships among students’ cheating behavior, personal goal orientations and classroom goal structure”,* Paper presented at the annual meeting of International Organization for Science and Technology Education Symposium, Kusadasi, Turkey, (2008, September).

Tas., Y., Kingir, S., Gok, G., and Tuncer Teksoz, G. “*Fen ve Teknoloji dersi ogretmen adaylarinin iklim degisikligine iliskin gorusleri*”, Paper presented at the annual meeting of Ulusal Fen Bilimleri ve Matematik Egitimi Kongresi, Bolu, Turkey, (2008, August).

Tas, Y., and Tekkaya, C. “*Students’ adoption of personal goal orientations and their perceptions of science classroom goal structures*”, Paper presented at the annual meeting of Conference of Junior Researchers of EARLI, Leuven, Belgium, (2008, July).

HOBBIES

Volleyball, Squash

APPENDIX F

TURKISH SUMMARY

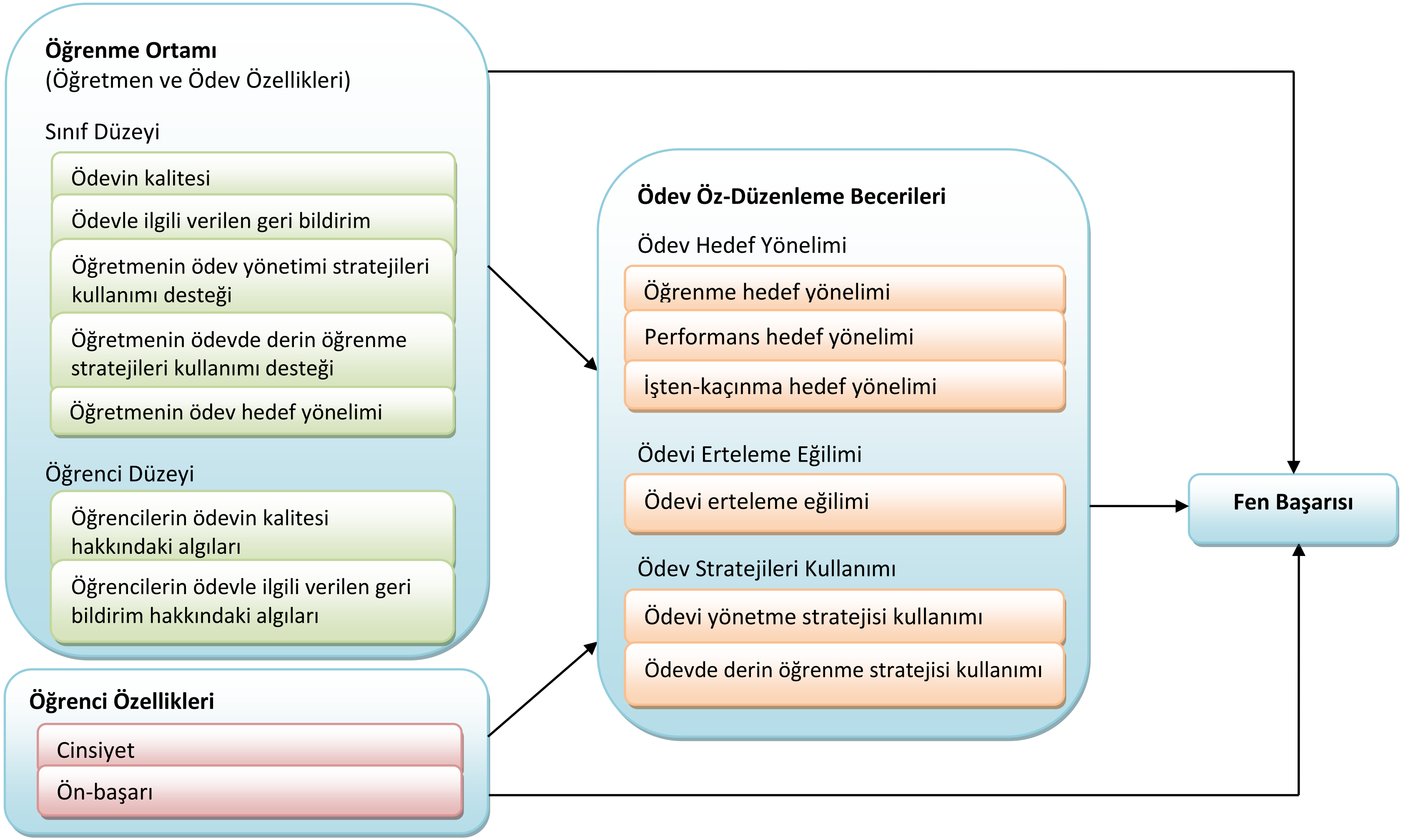
Giriş

Ödev "öğretmenler tarafından öğrencilere okul dışındaki saatlerde yapmaları için verilen görevlerdir" (Cooper, 2007, s. 4). Öğretmenler, öğrencilerin derste gördükleri konuları tekrar etmeleri, bir sonraki derse hazırlık yapmaları ve kişisel gelişimlerini desteklemek gibi çok çeşitli sebeplerle ödev vermektedirler (Epstein & Van Voorhis, 2001). Ödevin, öğrencilerin bilgiyi akılda tutmaları, derste işlenen konuyu anlamaları, çalışma disiplini geliştirmeleri gibi faydaları vardır (Cooper, 2007, Cooper & Valentine, 2001). Ödev yaparken öğrenciler, kendilerine hedef koyar ve motive eder, zamanı planlama ve dikkatini dağıtan şeyleri idare etme gibi stratejiler kullanırlar. Böylece, ödev yaparken öğrenciler öz-düzenleme becerileri başvururlar (Ramdass & Zimmerman, 2011).

Ödev, uzun zamandır çalışılan bir konu olmasına rağmen, çalışmalardaki bazı sınırlıklar sebebiyle ödev ile başarı arasındaki ilişki iyi kurulamamıştır (Trautwein & Koller, 2003). Birçok araştırmacı çalışmasında ödeve ayrılan zamana odaklanmıştır (Cooper, Robinson, & Patall, 2006). Oysaki öğrencilerin ödevdeki hedef yönelimi, zaman yönetimi ve ödev yapmak için uygun bir ortam oluşturması gibi çok çeşitli ödev değişkenlerinin çalışılmasına ihtiyaç vardır (Ramdass & Zimmerman, 2011; Trautwein, Ludtke, Schnyder, & Niggli, 2006; Trautwein, 2007). Bunun yanı sıra, çok düzeyli (multi-level) veri yapısının göz önüne alınması ve genel ölçüm araçları yerine belirli bir derse yönelik ölçümlerin yapılması önemlidir (Trautwein, 2007; Trautwein & Koller, 2003). Ödev çalışmalarındaki bir başka sınırlılık ise, ödev sürecini daha iyi anlayabilmek için çalışmaların eğitim teorileri ile daha sıkı ilişkilendirilmeye ihtiyaç duymasıdır. Öz-düzenleme teorisinin de ödev konusunda kapsamlı bir bakış açısı sağlayabileceği önerilmektedir (Trautwein & Koller, 2003). Ödevin verilme sebeplerinden biri de öğrencilerin öz-düzenleme becerilerini geliştirmek olduğu halde (Epstein & Van Voorhis, 2001; Warton, 2001), bu konuda özellikle de ilköğretim düzeyinde çok az çalışma vardır.

Öğrencilerin öğrenmesinde etkili olacak ödevin kalitesi, ödevle ilgili sağlanan geri-bildirim, öğretmenlerin ödevle ilgili hedef yönelimleri ve öğrencilerin ödev strateji kullanımlarını ne ölçüde destekledikleri ödevle ilgili üzerinde durulması gereken konulardır. Ancak, bu konularda az sayıda araştırma yapılmıştır.

Bu çalışmanın amacı, 7. sınıf öğrencilerin Fen ve Teknoloji ödevlerindeki öz-düzenleme becerilerini (ödev yönelimlerini, ödevi erteleme eğilimlerini ve ödev yaparken strateji kullanımlarını), öğretmenlerin ödevle ilgili uygulamaları ve fen başarısı ile ilişkilendirerek araştırmaktır. Öz-düzenleme teorisi (Pintrich, 2005; Zimmerman, 2005) ışığında söz konusu değişkenlerin aralarındaki ilişkiyi açıklayan bir model kurulmuştur (bkz. Şekil 1). Model, öğrenme ortamının (öğretmen ve ödev özellikleri) ve öğrenci özelliklerinin (ön-başarı ve cinsiyet), öğrencilerin ödev öz-düzenleme becerilerini ve fen başarısını tahmin ettiğini; öğrencilerin ödev öz-düzenleme becerilerinin de fen başarısı ile ilişkili olduğunu ileri sürmektedir.



Şekil 1 Önerilen ödev modeli

Çalışmada aşağıdaki araştırma sorularına cevap aranmıştır:

1. Farklı sınıflardaki öğrenciler, ödev öz-düzenleme becerileri ve fen başarısı açısından ne ölçüde değişim göstermektedir?

1.a. Farklı sınıflardaki öğrenciler, ödevlerindeki öğrenme hedef yönelimi açısından ne ölçüde değişim göstermektedir?

1.b. Farklı sınıflardaki öğrenciler, ödevlerindeki performans hedef yönelimi açısından ne ölçüde değişim göstermektedir?

1.c. Farklı sınıflardaki öğrenciler, ödevlerindeki işten-kaçınma hedef yönelimi açısından ne ölçüde değişim göstermektedir?

1.d. Farklı sınıflardaki öğrenciler, ödevi erteleme eğilimi açısından ne ölçüde değişim göstermektedir?

1.e. Farklı sınıflardaki öğrenciler, ödev yaparken kullandıkları derin öğrenme stratejileri açısından ne ölçüde değişim göstermektedir?

1.f. Farklı sınıflardaki öğrenciler, kullandıkları ödev yönetimi stratejileri açısından ne ölçüde değişim göstermektedir?

1.g. Farklı sınıflardaki öğrenciler, fen başarısı açısından ne ölçüde değişim göstermektedir?

2. Öğrenci özellikleri ve öğrenme ortamı özellikleri, ödev öz-düzenleme becerilerini ne ölçüde tahmin etmektedir?

2.a.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödevlerindeki öğrenme hedef yönelimini ne ölçüde tahmin etmektedir?

2.a.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi) öğrencilerin ödev yapmaktaki öğrenme hedef yönelimini ne ölçüde tahmin etmektedir?

2.b.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödevlerindeki performans hedef yönelimini ne ölçüde tahmin etmektedir?

2.b.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi) öğrencilerin ödev yapmaktaki performans hedef yönelimini ne ölçüde tahmin etmektedir?

2.c.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödevlerindeki işten-kaçınma hedef yönelimini ne ölçüde tahmin etmektedir?

2.c.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi) öğrencilerin ödevden kaçınma hedef yönelimini ne ölçüde tahmin etmektedir?

2.d.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödevlerini erteleme eğilimini ne ölçüde tahmin etmektedir?

2.d.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi) öğrencilerin ödevlerini erteleme eğilimini ne ölçüde tahmin etmektedir?

2.e.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödev yaparken kullandıkları derin öğrenme stratejilerini ne ölçüde tahmin etmektedir?

2.e.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi) öğrencilerin ödev yaparken kullandıkları derin öğrenme stratejilerini ne ölçüde tahmin etmektedir?

2.f.1. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin ödev yönetimi strateji kullanımını ne ölçüde tahmin etmektedir?

2.f.2. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi), öğrencilerin ödev yönetimi strateji kullanımını ne ölçüde tahmin etmektedir?

3. Öğrenci özellikleri, öğrenme ortamı özellikleri ve ödev öz-düzenleme becerileri, fen başarısını ne ölçüde tahmin etmektedir?

3.a. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları), öğrencilerin fen başarısını ne ölçüde tahmin etmektedir?

3.b. Öğrenci özellikleri (ön-bilgi ve cinsiyet) ve öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları) ve ödev öz-düzenleme becerileri (ödevdeki hedef yönelimi, ödev, erteleme eğilimi ve ödev stratejilerini kullanma), öğrencilerin fen başarısını ne ölçüde tahmin etmektedir?

3.c. Ödev öz-düzenleme becerileri (ödevdeki hedef yönelimi, ödev, erteleme eğilimi ve ödev stratejilerini kullanma), öğrenci düzeyindeki öğrenme ortamı değişkenleri (öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları) ve fen başarısı arasındaki ilişkiye aracılık etmekte midir?

3.d. Sınıf düzeyindeki değişkenler (ödevin kalitesi, ödev üzerine verilen geri-bildirim, öğretmenin öğrencilerin strateji kullanmaları için sağladıkları destek ve öğretmenlerin ödev hedef yönelimi), öğrencilerin fen başarısını ne ölçüde tahmin etmektedir?

Literatür Taraması

Öz-düzenleme becerileri, “kişinin kendisi için koyduğu hedeflere ulaşmak için planladığı ve adapte ettiği düşünceler, duygular ve davranışlardır” (Zimmerman, 2005, s. 14). Öz-düzenleme becerileri gelişmiş olan öğrenciler, çok çeşitli bilişsel, bilişüstü ve kaynak yönetimi stratejileri kullanırlar (Pintrich, 1999). Aynı zamanda bu stratejileri kullanmak için gerekli motivasyonları da vardır (Zimmerman, 2002). Bu kişiler, işlerini de erteleme eğilimi içerisine girmezler (Wolters, 2003).

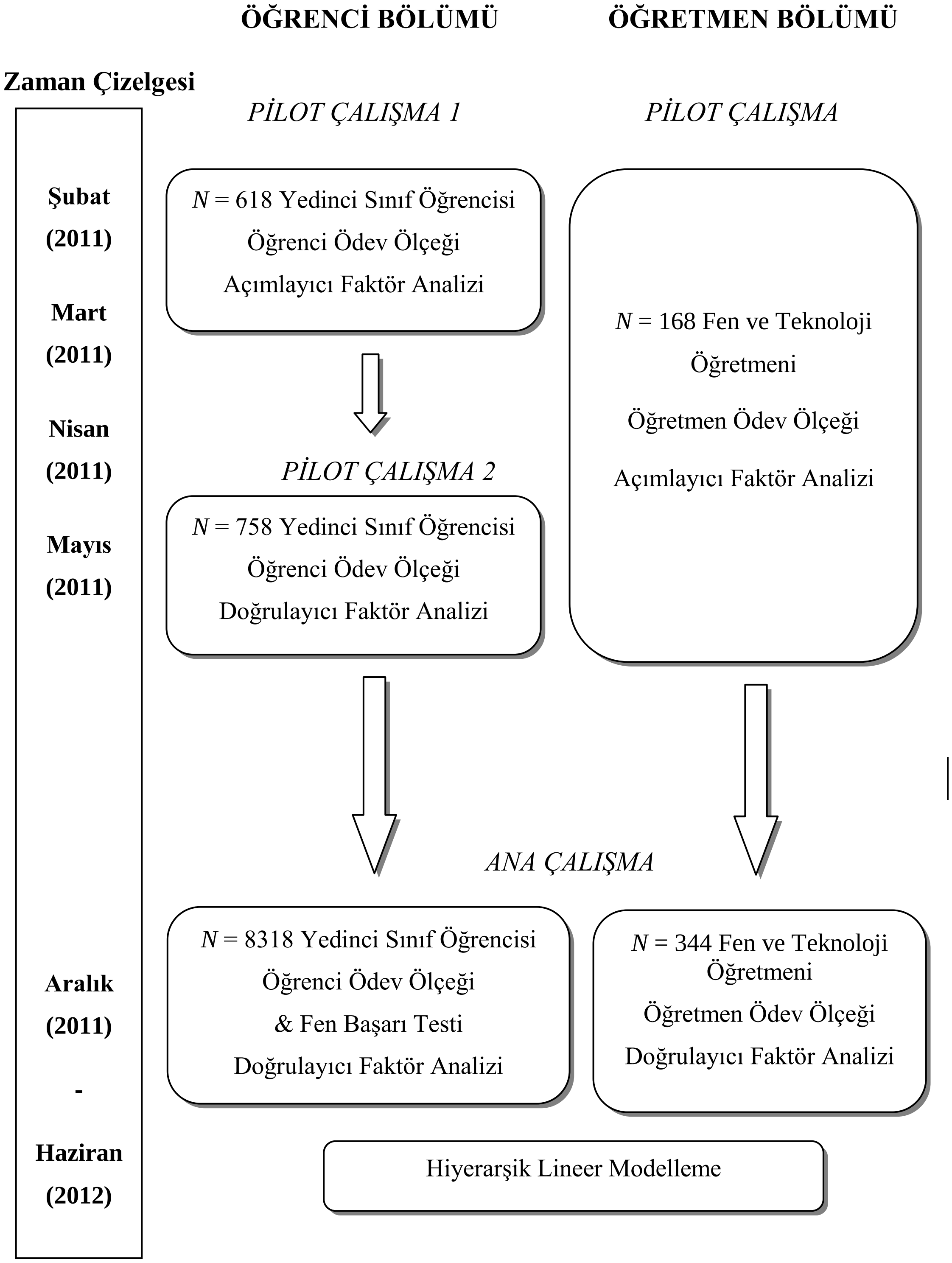
Öğrencilerin öz-düzenleme becerilerinin akademik başarı ile ilişkili olduğunu gösteren çalışmalar vardır. Örneğin, becerilerini geliştirmek ve dersteki konuları daha iyi anlamak isteyen (öğrenme hedef yönelimine sahip) öğrencilerin akademik başarısı daha yüksektir (Ör. Hsieh, Sullivan, & Guerra, 2007; Kaplan & Maehr, 1999). Öte yandan, verilen işte daha az emek harcamayı isteyen ve işten bir an önce kurtulma eğiliminde olan öğrenciler ise (işten-kaçınma hedef yönelimine sahip) daha düşük başarı göstermiştir (Ör. Ainley, 1993; Meece, Blumenfeld, & Hoyle, 1988). Öğrencilerin işlerini erteleme eğiliminin de yine düşük başarı ile pozitif ilişkili olduğu görülmüştür (Ör. Akkaya, 2007; Moore, 2008). Diğer taraftan, daha çok öğrenme stratejileri kullanan öğrenciler daha yüksek başarı sergilemiştir (Ör. Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1986, 1990).

Öğrenme ortamının, öğrencilerin öz-düzenleme becerilerini ve akademik başarısını etkilediğini ortaya koyan çalışmalar vardır. Örneğin, verilen işin öğrenciler için anlamlı olması ve işin zorluk düzeyi, öğrencilerin hedef yönelimini (Kumar & Jagacinski, 2011; Seifert & O'Keefe, 2001) ve işi erteleme eğilimini etkilemektedir (Ferrari, Mason, & Hammer, 2006; Ferrari & Scher, 2000). Öğretmenin öğrencilerinin strateji kullanımını desteklemesi, öğrencilerin strateji kullanımını ve başarısını arttırmaktadır (Hamman, Berthelot, Saia, & Crowley, 2000; Kistner ve diğerleri, 2010). Öğretmenlerin, öğrenmeyi ve yeterlilikleri geliştirmeyi vurgulaması (öğretmen öğrenme hedef yönelimi), öğretmenlerin performansı ön plana çıkarmasından (öğretmen performans hedef yönelimi) daha çok olumlu öğrenci değişkenleri ile ilişkili çıkmıştır (Ör. Kaplan & Maehr, 1999; Rolland, 2012). Sözü geçen çalışmalar ödeve özel olmasa bile, bu çalışmaların ödev sürecini anlamaya yardımcı olabileceği düşünülmektedir. Öz-düzenleme becerileri oldukça çalışılmış bir konu olmasına rağmen, öğrencilerin ödevdeki öz-düzenleme becerileri konusunda sınırlı çalışma vardır (Bembenutty, 2005; Hong, Peng, & Rowell, 2009). Ödev konusuna özel yapılan çalışma sonuçlarına göre, öğrencilerin ödevin kalitesi ile ilgi algıları (ödevleri ne kadar iyi hazırlanmış ve ilginç buldukları), öğrencilerin ödevdeki motivasyonlarını ve ödev davranışlarını pozitif olarak tahmin etmektedir (Trautwein & Ludtke, 2009). Öğretmenin ödevle ilgili sağladığı geri-bildirimin öğrencilerin ödev yapmadaki sebepleri (Ör. Xu & Wu, 2013) ve ödev yönetimi stratejileri (Ör. Xu, 2009) ile ilişkili olduğu bulunmuştur. Bunun yani sıra birçok çalışma, öğrenci cinsiyetinin ve ön-başarının, öz-düzenleme becerileri ve akademik başarı ile ilişkili olduğunu bulmuştur (Ör. Reynolds & Walberg, 1992; Roeser, Midgley, & Urdan, 1996; Trautwein, Koller, Schmitz, & Baumert, 2002).

Bu çalışmada, öğrenme ortamı, öğrenci özellikleri, ödev öz-düzenleme becerileri ve fen başarısı arasındaki ilişkiler, öz-düzenleme becerilerine sosyo-bilişsel perspektif ile yaklaşan teoriler (Pintrich, 2005; Zimmerman, 2005) ışığında ve hiyerarşik veri yapısı göz önüne alınarak incelenecektir.

Yöntem

Çalışmanın örneklemi, kullanılan veri toplama araçları ve veri analizleri Şekil 2'de verilmiştir.



Şekil 2 Çalışmanın örneklemi, kullanılan veri toplama araçları ve veri analizlerine genel bakış

Evren ve Örneklem

Çalışmanın evrenini, Türkiye'deki il ve ilçe merkezlerindeki devlet okullarına giden bütün 7. sınıf öğrencileri ve onların Fen ve Teknoloji öğretmenleri oluşturmaktadır. Milli Eğitim Bakanlığının 2009-2010 resmi eğitim istatistiklerine göre il ve ilçe merkezlerinde toplam 10137 devlet okulu vardır. Evreni temsil edecek örneklem büyüklüğünü belirlenirken, $n= [n_0/(1+(n_0/N))]$ formülünü kullanılmıştır. Buradaki n_0 ise $n_0= [(t \text{ x } S)/d]^2$ denklemi ile bulunur. Denklemdeki d doğruluk derecesini, N evren büyüklüğünü, S tahmin edilen standart sapmayı ve t güven düzeyine karşılık gelen tablo değerini temsil etmektedir (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz ve Demirel, 2010). Bu çalışmada d=0.05, S=0.5, t=1.96 (0.95 güven düzeyi için) olarak ele alındığında, N=10137 okul için uygun örneklem büyüklüğü 370 olarak hesaplanmıştır. Böylece 370 ilköğretim okulunun seçilmesine karar verilmiştir. Türkiye İstatistik Kurumu'nun (TÜİK) 2005 yılına ait İstatistikî Bölge Birimleri Sınıflandırmasına göre Türkiye, sosyoekonomik, kültürel ve coğrafik durumlara göre 12 bölgeden oluşmaktadır. Örneklem seçimi yapılırken bu bölgeler göz önüne alınmıştır. Örneklem büyüklüğünün (370) evren büyüklüğüne (10137) oranı hesaplanmış ve her bölgedeki okulların yaklaşık olarak %3.7'si örnekleme dahil edilmiştir. Okul listeleri SPSS programına girilmiş ve her bölgeden belirlenen kadar okul seçkisiz yöntemle seçilmiştir. Veri toplama araçları Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı (EARGED) tarafından okullara postalanmıştır. Okullara bir de uygulama yönergesi gönderilmiştir. Buna göre, her okuldan bir 7. sınıf şubesi çalışmaya katılmış, birden fazla 7. sınıfın bulunduğu okullarda ise çalışmaya katılacak şube idare tarafından rastgele seçilmiştir. Seçilen sınıftaki bütün öğrenciler ve seçilen sınıfın Fen ve Teknoloji öğretmeni anketleri doldurmuştur. Seçilen okullardan 348 okul çalışmaya katılmayı kabul etmiştir.

Toplam 8318 yedinci sınıf öğrencisi ve 344 Fen ve Teknoloji öğretmeni çalışmaya katılmıştır. Çalışmaya katılan öğrencilerin ve öğretmenlerin özellikleri Tablo 1 ve Tablo 2'de sunulmuştur.

Tablo 1 Çalışmaya katılan öğrencilerin demografik özellikleri

Değişken	*Frekans*	*Yüzde (%)*
Cinsiyet		
Erkek	4026	48.4%
Kız	4258	51.2%
Cevapsız	34	0.4%
Anne Eğitim Düzeyi		
Hiç okula gitmemiş	893	10.7%
İlköğretim	5217	62.7%
Lise	1494	18.0%
Üniversite	598	7.2%
Cevapsız	116	1.4%
Baba Eğitim Düzeyi		
Hiç okula gitmemiş	217	2.6%
İlköğretim	4440	53.4%
Lise	2197	26.4%
Üniversite	1162	14.0%
Cevapsız	302	3.6%
Anne Çalışma Durumu		
Çalışıyor	1555	18.7%
İşsiz	6571	79.0%
Emekli	124	1.5%
Cevapsız	68	0.8%
Baba Çalışma Durumu		
Çalışıyor	6844	82.3%
İşsiz	782	9.4%
Emekli	539	6.5%
Cevapsız	153	1.8%

Tablo 1 (Devamı)

Değişken	*Frekans*	*Yüzde (%)*
Evde Çalışma Odası Olma		
Evet	5715	68.1%
Hayır	2507	30.1%
Cevapsız	96	1.2%
Evinde internet bağlantılı bilgisayara sahip olma		
Evet	4230	50.9%
Hayır	4000	48.1%
Cevapsız	88	1.1%

Tablo 2 Çalışmaya katılan öğretmenlerin demografik özellikleri

Değişken	*Frekans*	*Yüzde (%)*
Cinsiyet		
Erkek	159	46.2%
Bayan	184	53.5%
Cevapsız	1	0.3%
Mezun olunan bölüm		
Fen ve Teknoloji Öğretmenliği	206	59.88%
Fen ve Teknoloji Öğretmenliği dışında başka bir öğretmenlik bölümü	77	22.38%
Öğretmenlik bölümü dışında bir bölüm	61	17.73%

Veri Toplama Araçları

Veriler, Öğrenci Demografik Bilgi Ölçeği, Fen Başarı Testi, Öğrenci Ödev Ölçeği, Öğretmen Demografik Bilgi Ölçeği ve Öğretmen Ödev Ölçeği kullanılarak toplanmıştır. Veri toplama araçları oluşturulurken bazı ölçekler İngilizce'den Türkçe'ye çevrilmiştir. Türkçe'ye adapte etme sürecinde Hambleton ve arkadaşlarının (Hambleton, Merenda, & Spielberger, 2005; Hambleton & Patsula, 1999) tavsiyeleri göz önüne alınarak kültürümüze uygun ifadelere yer verilmiş, ileri yönde çeviri yapılmış, 3 kişi çeviri işlemine katılmış ve hedef grubun (ilköğretim öğrencilerinin) dil seviyesi göz önüne alınmıştır. Kullanılması planlanan bazı ölçekler ise daha önceden Türkçeye çevrilmiş olup, bu çalışma kapsamında maddelerde ödev durumuna yönelik olarak uyarlamalar yapılmıştır. Kullanılması planlanan diğer ölçekler ise ilgili literatür ışığında araştırmacılar tarafından geliştirilmiştir. Kapsam geçerliği ve görünüş geçerliği ile ilgili uzman görüşüne başvurulmuş ve öneriler ölçeklere yansıtılmıştır. Daha sonra, bir ilköğretim öğrencisinden öğrenci ölçeklerine ait maddeleri okuması istenmiş ve anlaşılmayan maddeler tespit edilerek gerekli düzenlemeler yapılmıştır. Benzer şekilde, bir Fen ve Teknoloji öğretmeni, öğretmen ölçeklerine ait maddeleri değerlendirmiş ve önerileri doğrultusunda bazı değişiklikler yapılmıştır. Tekrar uzman görüşüne başvurulmuş ve ölçekler pilot çalışma içi uygun hale getirilmiştir.

Öğrenci demografik bilgi ölçeği

Öğrenci Demografik Bilgi Ölçeği, öğrencilerin cinsiyeti, yaşı, 6. sınıf Fen ve Teknoloji dersi karne notu, anne ve babanın eğitim düzeyi ve çalışma durumu, evde çalışma odasına ve internet bağlantılı bilgisayara sahip olma durumu ve bir haftada Fen ve Teknoloji ödevine ayrılan zamanı sormaktadır.

Öğrenci ödev ölçeği

Öğrenci Ödev Ölçeği, ödev hedef yönelimi, ödevi erteleme eğilimi, ödevde kullanılan stratejiler ve öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algıları bölümlerinden oluşmaktadır. Ödev hedef yönelimi ile ilgili maddeler, Meece ve Miller (2001) ve Xu (2009) tarafından geliştirilen maddeler adapte edilerek oluşturulmuştur. Ödevi erteleme eğilimine ait maddeler Uzun Ozer, Sackes ve Tuckman (2009) tarafından kullanılan maddelerden adapte edilmiştir. Ödevde kıllanılan stratejiler ile ilgili maddeler, Öğrenmede Güdüsel Stratejiler Anketi'nin (Motivated Strategies for Learning Questionnaire; MSLQ; Pintrich, Smith, Garcia, & Mckeachie, 1991) bilişsel ve bilişüstü strateji kullanımı alt boyutları ile Ödev Yönetimi Ölçeği'nden (Homework Management Scale; Xu, 2008) adapte edilmiştir. Ödevin kalitesi ile ilgili öğrencilerin algılarını ölçen maddelerden dördü Trautwein et al. (2006) tarafından geliştirilen maddelerden adapte edilip kalan dördü ise bu çalışma için yazılmıştır. Öğrencilerin ödevleri ile ilgili aldıkları geri bildirim hakkındaki algılarını ölçen maddeler ise bu çalışma için geliştirilmiştir.

Öğrenci Ödev Ölçeğinin geçerlilik ve güvenirlik çalışması kapsamında, 2 pilot çalışma yapılmıştır. Birinci pilot çalışmaya, Ankara'nın Keçiören ve Yenimahalle ilçelerindeki 18 ilköğretim okulunun 25 sınıfında okuyan toplam 618 yedinci sınıf öğrencisi katılmıştır. Öğrencilerin 315'i kız, 302'si erkek olup bir öğrenci ise cinsiyetini bildirmemiştir. Grubun yaş ortalaması 13.15'tir. Ölçeğin faktör yapısını ortaya çıkarmak için toplanan veriler açımlayıcı faktör analizi ile incelenmiştir. Çoğu ölçek beklendiği şekilde faktör yapısı sergilerken bazı maddelerin faktör yüklerinde sorun olduğu görülmüş ve ölçekten çıkarılmıştır. Analiz sonuçlarına göre ödev hedef yönelimi 3 alt faktörden oluşmuştur; öğrenme, performans ve işten-kaçınma hedef yönelimi. Ödev yaparken kullanılan stratejiler ise derin öğrenme stratejileri ve ödev yönetimi stratejileri olarak iki faktörlü yapıya sahiptir. Ödevi erteleme ölçeği tek boyutlu olup ödevin niteliği ve ödevle ilgili geri bildirim ölçeği ise öğrencilerin ödevin niteliği ve ödevle ilgili sağlanan geri bildirim hakkındaki algıları olarak iki faktörlü yapı sergilemiştir. Faktörlerin Cronbach alpha güvenirlik katsayısı .74 ile .96 arasında değişmiştir.

İkinci pilot çalışmaya Ankara'nın Keçiören ve Yenimahalle ilçelerindeki 23 ilköğretim okulunun 26 sınıfında okuyan toplam 758 yedinci sınıf öğrencisi katılmıştır. Öğrencilerin 404'ü kız, 353'ü erkek olup bir öğrenci ise cinsiyetini bildirmemiştir. Grubun yaş ortalaması 13.14'tür. Veriler doğrulayıcı faktör analizi ile incelenmiştir. Analiz sonuçları, birinci pilot çalışma sonucuna göre tahmin edilen faktör yapısını desteklemiş ve model veriye iyi uyum sağlamıştır. Faktörlerin Cronbach alpha güvenirlik katsayısı .77 ile .96 arasında değişmiştir.

Öğrenci Ödev Ölçeğinin faktör yapısı, ana çalışma verilerinde de doğrulayıcı faktör analizi yapılarak test edilmiştir. Analizler sonucunda elde edilen uyum iyiliği istatistiklerine göre veriler, beklenen yapıya iyi uyum sağlamıştır. Ana çalışmadan elde edilen faktörlerin Cronbach alpha güvenirlik katsayıları ve faktörlerdeki madde sayıları Tablo 3'de verilmiştir.

Tablo 3 Faktörlerdeki madde sayısı ve faktörlerin Cronbach alpha güvenirlik katsayı

	Madde sayısı	Cronbach alpha
Öğrenme hedef yönelimi	6	.86
Performans hedef yönelimi	4	.74
İşten-kaçınma hedef yönelimi	4	.81
Derin öğrenme stratejisi kullanımı	7	.87
Ödev yönetimi stratejisi kullanımı	9	.82
Ödevi erteleme eğilimi	12	.97
Ödevin kalitesi	7	.84
Ödevle ilgili sağlanan geri bildirim	7	.86

Fen başarı testi

Fen Başarı Testi, geçmiş yıllara ait orta öğretime geçiş sınavlarında (Seviye Belirleme Sınavı ve Devlet Parasız Yatılı ve Bursluluk Sınavı) çıkan 14 çoktan seçmeli sorudan oluşmaktadır. Test, 7. sınıf birinci dönemin sonunda uygulanacağı için, Fen ve Teknoloji dersi ilk iki ünitesi olan Vücudumuzda Sistemler ve Kuvvet ve Hareket konularını içermektedir. Programda yer alan kazanımlar incelenmiş ve testteki her soru içerik geçerliliği ve format açısından değerlendirilmiştir. Teste ait belirtke tablosu Tablo 4'te sunulmuştur. Testin Kuder Richardson-20 güvenirlik katsayısı 0.77 olarak hesaplanmıştır.

Tablo 4 Belirtke tablosu

		Bloom Taksonomi		
Konular	Kazanımlar	Bilgi	Kavrama	Uygulama
Vücudumuzda Sistemler	Duyu organlarının görevlerini belirler.	1*, 2		
	Duyu organlarındaki yapıları isimlendirir.	3		
	İç salgı bezlerinin görevlerini belirler.	4, 5		
	Verilen şekil üzerinde, sindirim sistemi organlarını, organların görevleri ile eşleştirir.		6	
	Vücudumuzdaki hormonların salgılanmasına örnek verir.		7	
	Besinlerin sindirilmesinde meydana gelen kimyasal olayları yorumlar.		8	
	Verilen şekil üzerinde, boşaltım sistemi organlarını, organların görevleri ile eşleştirir.		9	
Kuvvet ve Hareket	Potansiyel ve kinetik enerjilerin dönüştüğünü şekil üzerinde gösterir.		10	
	Bir yayın, onu sıkıştıran veya geren cisme uyguladığı kuvvetin yönünü tahmin eder.		11	
	Farklı eğik düzlemlerde cisme uygulana kuvveti karşılaştırır.			12
	Kaldıraçlarda uygulanan kuvvetin büyüklüğü ile kuvvet kolu uzunluğu arasında ilişki kurar.			13
	Bir cisme etki eden kuvvetin yönü ile iş arasında ilişki kurar.			14
	Toplam madde sayısı	5	6	3

Öğretmen demografik bilgi ölçeği

Öğretmen Demografik Bilgi Ölçeği, öğretmenlerin cinsiyeti, yaşı, mezun olduğu bölümü, öğretmenlikteki deneyimi, sınıflarındaki öğrenci sayısı (sınıf mevcudu) ve haftalık ortalama girdiği ders saatini sormaktadır.

Öğretmen ödev ölçeği

Öğretmen Ödev Ölçeği iki bölümden oluşmaktadır. İlk bölüm, öğretmenlere, öğretmenlik eğitimleri sürecinde nasıl ödev verilmesi gerektiği konusunda yeterli eğitim alıp almadıkları hakkındaki düşünceleri; ödev konusunda hizmet-içi eğitime katılma durumları; Fen ve Teknoloji programının, programa uygun ödev hazırlama konusunda bilgi verici olup olmadığı; programa uygun ödev hazırlamanın ne kadar zamanlarını aldığı; ödev verme sıklığı; sınıflarındaki öğrencilerin yüzde kaçının ödevlerini düzenli olarak yaptığı; verdikleri ödev çeşitleri (10 madde); bireysel ve grup ödevi verme sıklıkları ve ödev verme sebeplerini (13 madde) sormaktadır. Ödev çeşitleri ile ilgi maddelerden 4'ü ve ödev verme sebeplerindeki maddelerden 8'i Sidhu ve Fook (2010) tarafından geliştirilmiştir. Bu maddeler Türkçe'ye çevrilip adapte edilirken kalan diğer maddeler ise bu çalışma için geliştirilmiştir.

İkinci bölüm ise öğretmenlerin ödev vermedeki hedef yönelimleri, öğrencilerin ödev yaparken strateji kullanımlarını desteklemeleri ve ödevin kalitesi ve ödevle ilgili verdikleri geri bildirim hakkındaki algılarını sormaktadır. Öğretmenlerin ödev vermedeki hedef yönelimlerine ait maddeler, Friedel, Cortina, Turner, ve Midgley (2007) tarafından geliştirilen maddelerden adapte edilmiştir. Öğretmenlerin, öğrencilerin ödev stratejilerini desteklemeleri ile ilgili maddeler Öğrenmede Güdüsel Stratejiler Anketi'nin (Motivated Strategies for Learning Questionnaire; MSLQ; Pintrich ve diğerleri, 1991) ve Ödev Yönetimi Ölçeği'nden (Homework Management Scale; Xu, 2008) adapte edilmiştir. Öğretmenlerin ödevin kalitesi ile ilgili algılarını soran maddelerin üçü Trautwein ve diğerleri (2006) tarafından geliştirilmiş olup bu çalışmada Türkçe'ye adapte edilmiş, kalan dört madde ise bu çalışma için geliştirilmiştir. Öğretmenlerin ödev üzerine verdikleri geri bildirim ile ilgili maddeler ise bu çalışma için yazılmış olup öğrenci ödev ölçeğindeki, öğrencilerin ödevle ilgili aldıkları geri bildirim hakkındaki algılarını ölçen maddelerle paraleldir.

İlk olarak pilot çalışma yapılmıştır. Ölçek 168 Fen ve Teknoloji öğretmenine uygulanmıştır. Katılımcıların 128'i bayan, 40'ı erkek olup grubun yaş ortalaması 33.08'dir. Veriler, açımlayıcı faktör analizi ile incelenerek ölçeğin faktör yapısı araştırılmış ve hangi maddelerin ölçekte tutulacağına karar verilmiştir. Analiz sonuçlarına göre öğretmenlerin ödev vermedeki hedef yönelimi 2 alt faktörden oluşmuştur; öğrenme ve performans hedef yönelimi. Öğretmenlerin, öğrencilerini ödev stratejileri kullanımı konusunda desteklemeleri ise ödev yönetimi stratejileri ve derin öğrenme stratejilerini destekleme olarak iki faktörlü yapıya sahiptir. Ödevin niteliği ve ödevle ilgili öğrencilere verdikleri geri bildirim ile ilgili algıları ise, öğretmenlerin ödevin niteliği ve ödevle ilgili sağladığı geri bildirim hakkındaki algıları olarak iki faktörlü yapı sergilemiştir. Faktörlerin Cronbach alpha güvenirlik katsayısı .68 ile .92 arasında değişmiştir.

Ana çalışmada ise ölçek 344 Fen ve Teknoloji öğretmenine uygulanmış ve veriler doğrulayıcı faktör analizi ile incelenmiştir. Analiz sonuçları pilot çalışmadaki faktör yapısını desteklemiş, önerilen model verilere iyi uyum sağlamıştır. Ana çalışmadan elde edilen faktörlerin Cronbach alpha güvenirlik katsayıları ve faktörlerdeki madde sayıları Tablo 5'de verilmiştir.

Tablo 5 Faktörlerdeki madde sayısı ve faktörlerin Cronbach alpha güvenirlik katsayı

	Madde sayısı	Cronbach alpha
Öğrenme hedef yönelimi	5	.64
Performans hedef yönelimi	4	.60
Derin öğrenme stratejisi kullanımını destekleme	4	.70
Ödev yönetimi stratejisi kullanımını destekleme	14	.93
Ödevin kalitesi	6	.69
Ödevle ilgili sağladığı geri bildirim	6	.79

Çalışmanın Sayıltıları

Veri toplama araçlarının standart koşullarda uygulandığı, uygulama sırasında öğrencilerin birbiriyle etkileşime geçmediği, katılımcıların veri toplama araçlarına doğru ve samimi yanıtlar verdiği ve örneklemin evreni temsil ettiği kabul edilmiştir.

Sonuçlar ve Tartışma

Öğrencilerin sınıflarda gruplanması, hiyerarşik veri yapısının oluşmasına sebep olmaktadır. Hiyerarşik veri yapısını analiz ederken çok düzeyli (multi-level) tekniklere başvurmak gerekmektedir (Raudenbush & Bryk, 2002). Hiyerarşik Lineer Modelleme (HLM) çok düzeyli analiz tekniklerinden biri olup, aynı anda birden fazla düzeyde çalışmaya olanak tanımaktadır (Lee, 2000). Bu çalışmada, öğrenciler birinci düzeyi oluştururken sınıflar ikinci düzeyde yer almaktadır.

İlk olarak, sınıflar arasında ödev öz-düzenleme becerileri ve fen başarısı açısından bir fark olup olmadığı incelenmiştir. Daha sonra, öğrenme ortamı ve öğrenci özelliklerinin öz-düzenleme becerilerini tahmin etme gücü incelenmiştir. Bunu takiben, fen başarısı bağımlı değişken olarak atanıp öğrenci düzeyinde iki model kurulmuştur. Birinci modelde başarı, öğrenci düzeyindeki öğrenme ortamı değişkenleri ve öğrenci özellikleri tarafından tahmin edilmiştir. İkinci modelde ise bu bağımsız değişkenlere ek olarak öz-düzenleme becerileri de modele dahil edilmiştir. En son kurulan final modelinde ise sınıf düzeyindeki değişkenler modele eklenmiştir.

HLM analizinden önce, regresyon baş katsayılarını daha kolay yorumlayabilmek için bütün nicel değişkenler, ortalaması 0 ve standart sapması 1 olacak şekilde standartlaştırılmıştır. Öğrencilerin, ödevin niteliği ve ödev hakkında aldıkları geri bildirim ile ilgi algılarının sınıf düzeyinde ortalamaları alınarak, öğretmenlerin ödev uygulamalarını değerlendiren sınıfın ortak algıları hesaplanmıştır. Bu değişkenler sınıf düzeyinde bağımsız değişken olarak kullanılmıştır. HLM'in varsayımları test edilmiş ve savunulabilir olduğu görülmüştür. HLM analizi sonuçları Tablo 5 ve 6'da özetlenmiş ve Şekil 3 – 9'da ayrıntılı olarak gösterilmiştir.

Tablo 5 Ödev öz-düzenleme becerileri için kurulan modeller

	Öğrenme Hedef Yönelimi		Performans Hedef Yönelimi		İşten-Kaçınma Hedef Yönelimi		Ödevi Erteleme Eğilimi	
	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata
Sınıf Düzeyi								
ORT_KALİTE	.260***	.009	.184***	.011	-.057***	.017	-.170***	.016
Öğrenci Düzeyi								
KIZ	.191***	.017	.170***	.020	-.444***	.024	-.304***	.023
ÖN-BAŞARI	.083***	.008	.062***	.011	-.153***	.012	-.197***	.012
GERİ-BİLDİRİM	.146***	.015	.116***	.017	-.041**	.015	-.086***	.017
KALİTE	.552***	.016	.427***	.018	.048**	.017	-.144***	.016
Açıklanan varyans								
Sınıf Düzeyi	.696		.574		.061		.203	
Öğrenci Düzeyi	.542		.377		.131		.186	

Not: *p< .05, **p<.01, ***p< .001

Tablo 5 (Devamı)

	Derin Öğrenme Stratejisi Kullanımı		Ödev Yönetimi Stratejisi Kullanımı	
	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata
Sınıf Düzeyi				
ORT_KALİTE	.215***	.021	.198***	.015
ORT_GERİ-BİLDİRİM	.072***	.021	.047*	.021
Öğrenci Düzeyi				
KIZ	.085***	.015	.236***	.016
ÖN-BAŞARI	.147***	.008	.157***	.010
GERİ-BİLDİRİM	.319***	.016	.303***	.016
KALİTE	.425***	.016	.375***	.016
Açıklanan varyans				
Sınıf Düzeyi	.700		.628	
Öğrenci Düzeyi	.509		.481	

Not: **p*< .05, ***p*<.01, ****p*< .001

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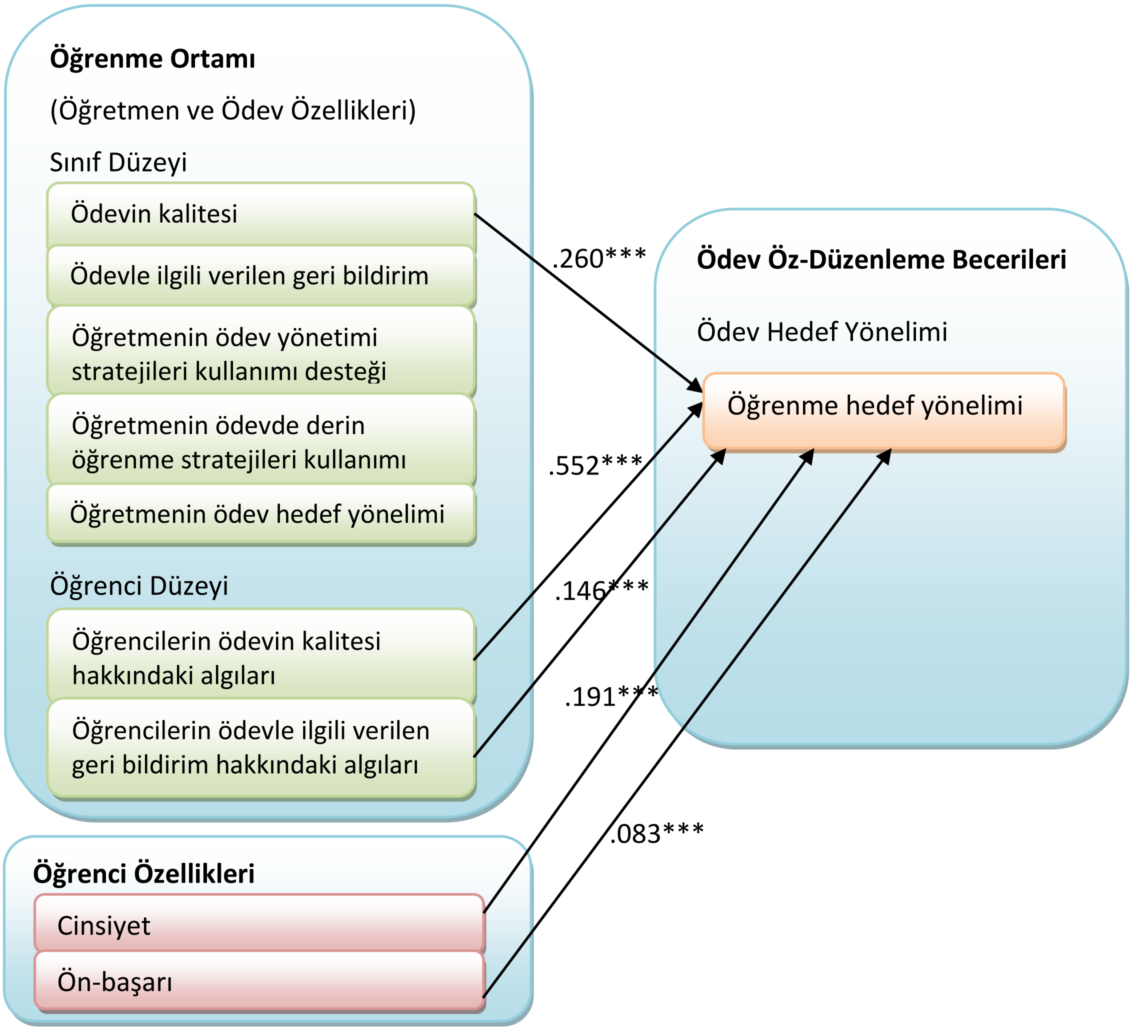
Tablo 6 Fen başarısı için kurulan modeller

	Model 1		Model 2		Son Model	
	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata	Baş katsayısı	Standart Hata
Sınıf Düzeyi						
ORT_GERİ-BİLDİRİM					.158***	.029
ÖĞETMEN_DERİN					.060*	.029
Öğrenci Düzeyi						
KIZ	.085***	.019	.017	.019	.018	.019
ÖN-BAŞARI	.359***	.011	.318***	.012	.319***	.011
GERİ-BİLDİRİM	.035**	.013	.005	.013	.004	.013
KALİTE	.067***	.013	.019	.013	.023	.013
ÖĞRENME –HED_YÖN			.039**	.014	.037*	.015
PERFOR –HED_YÖN			-.004	.013	-.005	.012
İŞTEN-KAÇ_HED_YÖN			-.053***	.009	-.052***	.010
ERTELEME_EĞİLİMİ			-.116***	.011	-.116***	.011
YÖNETİM_STR			.003	.014	.002	.014
DERİN_ÖĞRENME_STR			.033*	.015	.030*	.015
Açıklanan varyans						
Sınıf Düzeyi					.118	
Öğrenci Düzeyi					.318	

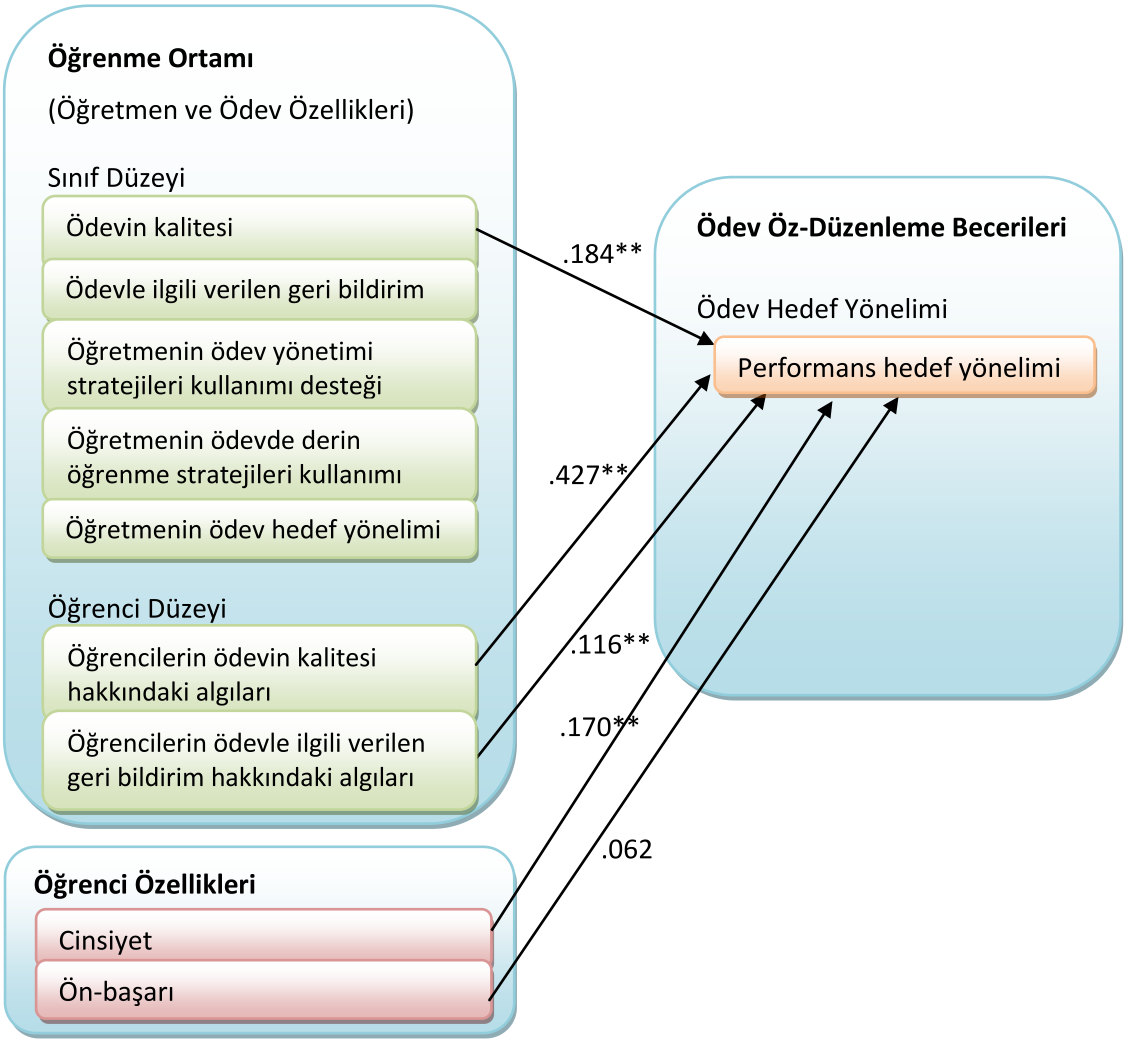
Not: **p*< .05, ***p*<.01, ****p*< .001



Şekil 3 Öğrenme hedef yönelimini tahmin eden model

Not: **p*< .05, ***p*<.01, ****p*< .001

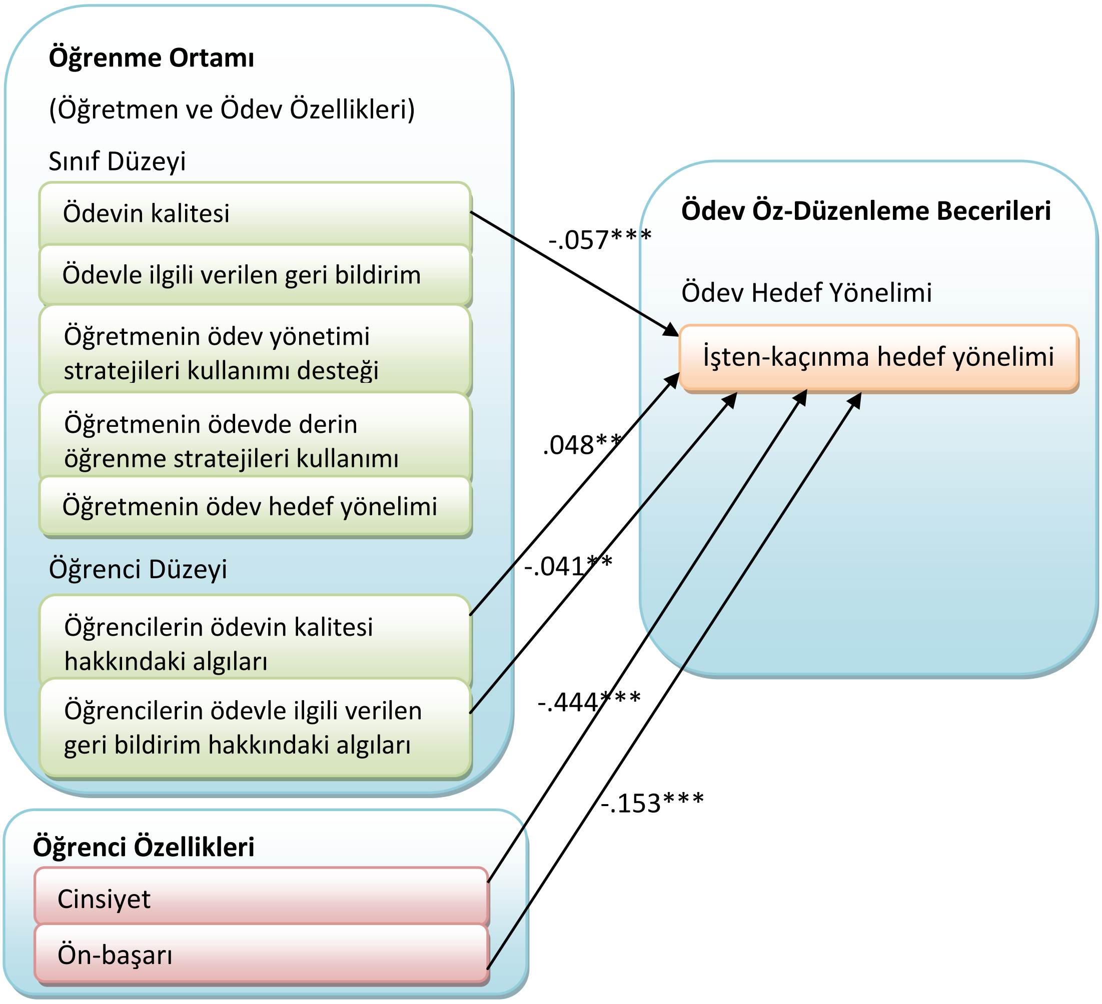
Öğrenme hedef yönelimini tahmin eden modele göre (bkz. Şekil 3 ve Tablo 5), kız öğrenciler (γ_{10}= .191, *se*= .017), yüksek ön-başarıya sahip olan öğrenciler (γ_{20}= .083, *se*= .008), ödev hakkında aldığı geri bildirim (γ_{30}= .146, *se*= .015) ve ödevin kalitesi (γ_{40}= .552, *se*= .016) ile ilgili algılarının yüksek olduğu öğrenciler, sınıftaki diğer öğrencilere göre ödevlerini daha fazla öğrenme ve becerilerini geliştirmek amacıyla yapmaktadır (öğrenme hedef yönelimi). Bunun yani sıra, ödevin kalitesi hakkındaki öğrencilerin ortak algılarının daha yüksek olduğu sınıflarda okuyan öğrenciler (γ_{01}= .260, *se*= .009), diğer sınıflardaki öğrencilere göre ödevlerinde daha fazla öğrenme hedef yönelimi benimsemektedir.



Şekil 4 Performans hedef yönelimini tahmin eden model

Not: **p*< .05, ***p*<.01, ****p*< .001

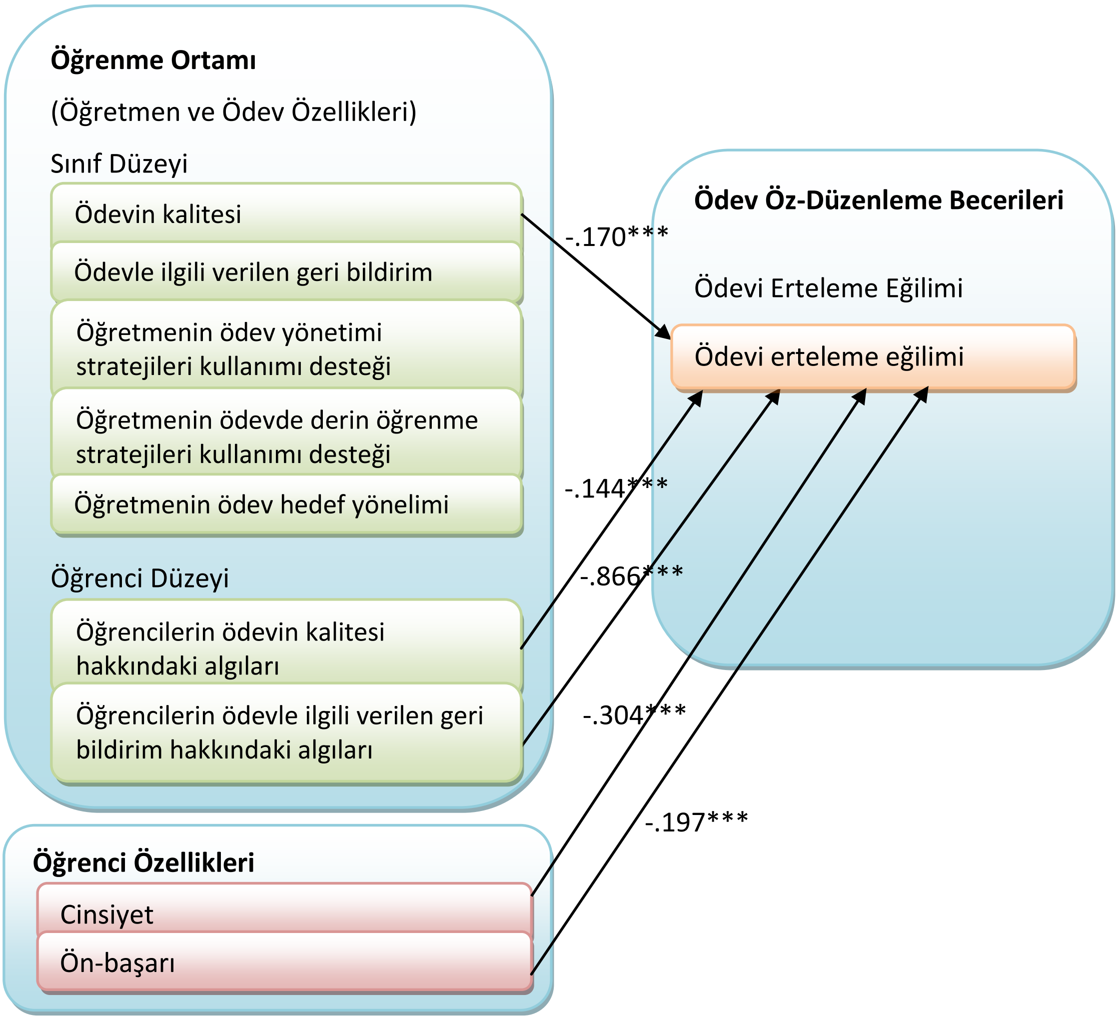
Performans hedef yönelimini tahmin eden modele göre (bkz. Şekil 4 ve Tablo 5), kız öğrenciler (γ_{10}= .170, *se*= .020), yüksek ön-başarıya sahip olan öğrenciler (γ_{20}= .062, *se*= .011), ödev hakkında aldığı geri bildirim (γ_{30}= .116, *se*= .017) ve ödevin kalitesi (γ_{40}= .427, *se*= .018) ile ilgili algılarının yüksek olduğu öğrenciler, sınıf arkadaşlarına göre ödevlerini daha fazla becerilerini başkalarına göstermek ve başkalarının takdirini kazanmak için yapmaktadır (performans hedef yönelimi). Bunun yanı sıra, ödevin kalitesi hakkındaki öğrencilerin ortak algılarının daha yüksek olduğu sınıflarda okuyan öğrenciler (γ_{01}= .184, *se*= .011), diğer sınıflardaki öğrencilere göre ödevlerinde daha fazla performans hedef yönelimi benimsemektedir.



Şekil 5 İşten-kaçınma hedef yönelimini tahmin eden model

Not: **p*< .05, ***p*<.01, ****p*< .001

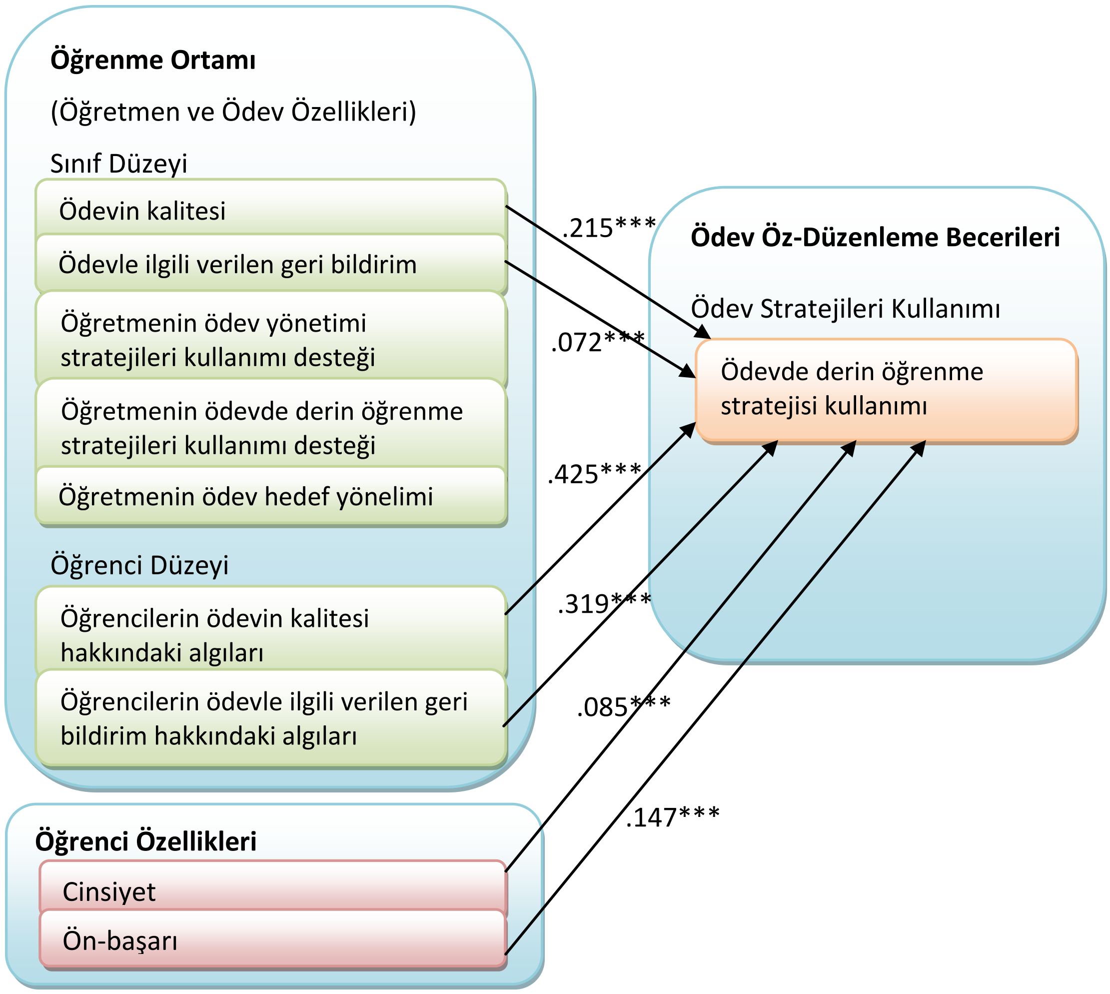
İşten-kaçınma hedef yönelimini tahmin eden modele göre (bkz. Şekil 5 ve Tablo 5), erkek öğrenciler (γ_{10}= -.444, *se*= .024), düşük ön-başarıya sahip olan öğrenciler (γ_{20}= -.153, *se*= .012), ödev hakkında aldığı geri bildirim (γ_{30}= -.041, *se*= .015) ile ilgili algısının düşük olduğu öğrenciler ve ödevin kalitesi (γ_{40}= .048, *se*= .017) ile ilgili algılarının yüksek olduğu öğrenciler, diğer öğrencilere göre ödevlerini yapmak için sarf etmeleri gereken emek hakkında daha çok endişelenmektedir (işten-kaçınma hedef yönelimi). Bunun yanı sıra, ödevin kalitesi hakkındaki öğrencilerin ortak algılarının daha düşük olduğu sınıflarda okuyan öğrenciler (γ_{01}= -.057, *se*= .017), diğer sınıflardaki öğrencilere göre ödevlerinde daha fazla işten-kaçınma hedef yönelimi benimsemektedir.



Şekil 6 Ödevi erteleme eğilimini tahmin eden model

Not: *p< .05, **p<.01, ***p< .001

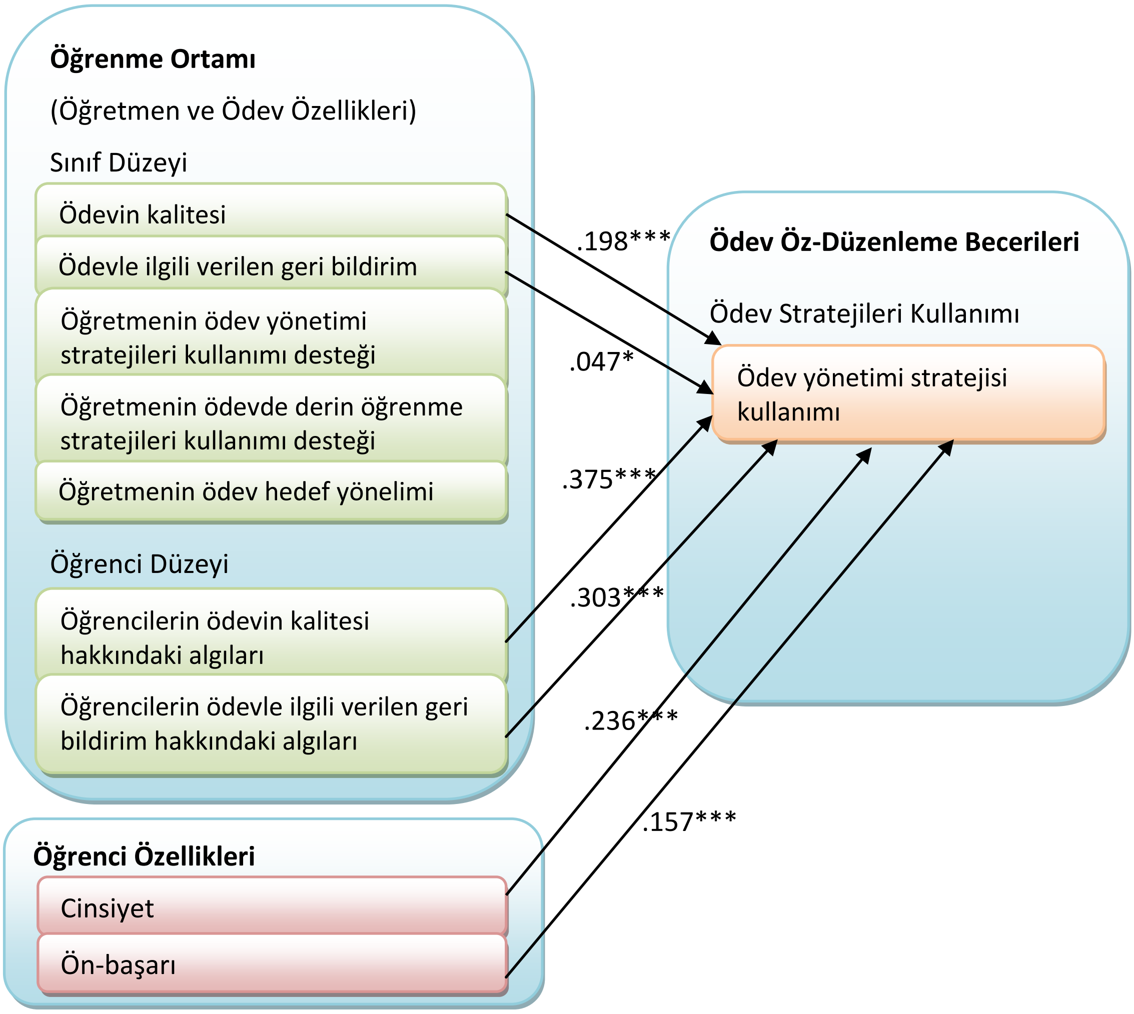
Ödevi erteleme eğilimini tahmin eden modele göre (bkz. Şekil 6 ve Tablo 5), erkek öğrenciler (γ_{10}= -.304, *se*= .023), düşük ön-başarıya sahip olan öğrenciler (γ_{20}= -.197, *se*= .012), ödev hakkında aldığı geri bildirim (γ_{30}= -.086, *se*= .017) ve ödevin kalitesi (γ_{40}= -.144, *se*= .016) ile ilgili algılarının düşük olduğu öğrenciler, sınıftaki diğer öğrencilere göre ödevlerini yapmayı daha fazla ertelemektedir. Bunun yanı sıra, ödevin kalitesi hakkındaki öğrencilerin ortak algılarının daha düşük olduğu sınıflarda okuyan öğrenciler (γ_{01}= -.170, *se*= .016), diğer sınıflardaki öğrencilere göre ödevlerini daha fazla erteleme eğilimindedir.



Şekil 7 Ödevde derin öğrenme stratejisi kullanımını tahmin eden model

Not: $*p< .05$, $**p<.01$, $***p< .001$

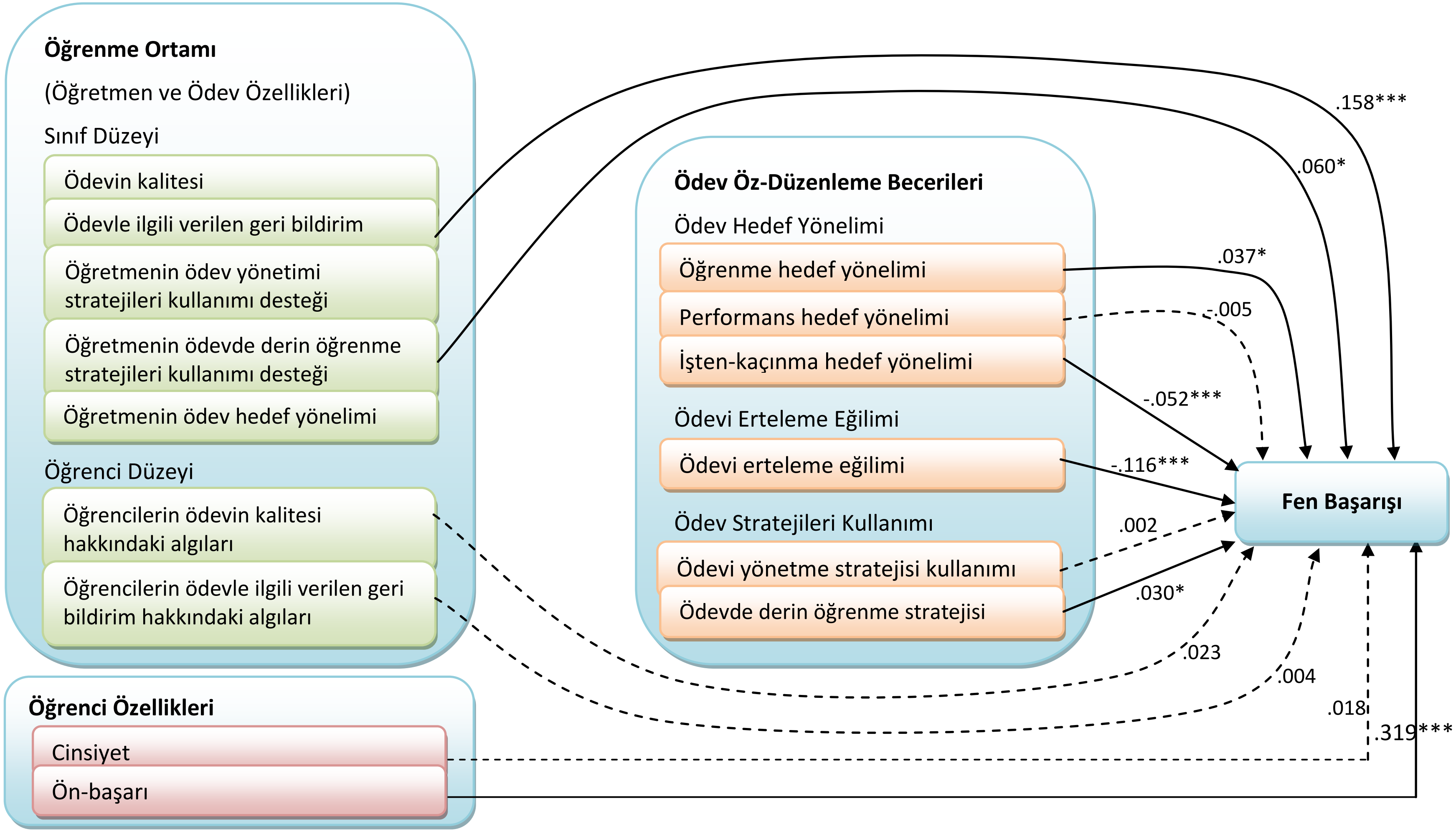
Ödevde derin öğrenme stratejisi kullanımını tahmin eden modele göre (bkz. Şekil 7 ve Tablo 5), kız öğrenciler (γ_{10}= .085, *se*= .015), yüksek ön-başarıya sahip olan öğrenciler (γ_{20}= .147, *se*= .008), ödev hakkında aldığı geri bildirim (γ_{30}= .319, *se*= .016) ve ödevin kalitesi (γ_{40}= .425, *se*= .016) ile ilgili algılarının yüksek olduğu öğrenciler, diğer öğrencilere göre ödevlerini yaparken daha çok bilişsel ve bilişüstü stratejiler (derin öğrenme stratejileri) kullanmaktadır. Bunun yanı sıra, ödevin kalitesi (γ_{01}= .215, *se*= .021) ve ödev hakkında sağlanan geri bildirim (γ_{02}= .072, *se*= .021) ile ilgili öğrencilerin ortak algılarının daha yüksek olduğu sınıflarda okuyan öğrenciler, diğer sınıflardaki öğrencilere göre ödevlerinde daha fazla derin öğrenme stratejisi kullanmaktadır.



Şekil 8 Ödev yönetimi stratejisini tahmin eden model

Not: **p*< .05, ***p*<.01, ****p*< .001

Ödev yönetimi stratejisi kullanımını açıklayan modele göre (bkz. Şekil 8 ve Tablo 5), kız öğrenciler (γ_{10}= .236, *se*= .016), yüksek ön-başarıya sahip olan öğrenciler (γ_{20}= .157, *se*= .010), ödev hakkında aldığı geri bildirim (γ_{30}= .303, *se*= .016) ve ödevin kalitesi (γ_{40}= .375, *se*= .016) ile ilgili algılarının daha yüksek olduğu öğrenciler, diğer öğrencilere göre daha çok ödev ortamını düzenlemekte, zamanını yönetmekte, dikkatini dağıtan şeyleri elimine etmekte, duygu ve motivasyonunu düzenlemektedir (ödev yönetimi stratejileri kullanımı). Bunun yanı sıra, ödevin kalitesi (γ_{01}= .198, *se*= .015) ve ödev hakkında sağlanan geri bildirim (γ_{02}= .047, *se*= .021) ile ilgili öğrencilerin ortak algılarının yüksek olduğu sınıflarda okuyan öğrenciler, diğer sınıflardaki öğrencilere göre daha fazla ödev yönetimi stratejisi kullanmaktadır.



Şekil 9 Fen başarısını tahmin eden model (son model)

Not: **p*< .05, ***p*<.01, ****p*< .001

Fen başarısını tahmin eden ilk modele göre (bkz. Tablo 6), kız öğrenciler (γ_{10}= .085, *se*= .019), yüksek ön-başarıya sahip olan öğrenciler (γ_{20}= .359, *se*= .011), ödev hakkında aldığı geri bildirim (γ_{30}= .035, *se*= .013) ve ödevin kalitesi (γ_{40}= .067, *se*= .013) ile ilgili algılarının yüksek olduğu öğrenciler, diğer öğrencilere göre fen testinde daha başarılı olmuştur. Fen başarısını tahmin eden ikinci modelde (bkz. Tablo 6), ödev-öz düzenleme becerileri de bağımsız değişkenler olarak modele eklenmiştir. Buna göre, öğrenme hedef yönelimi yüksek (γ_{50}= .039, *se*= .014), işten-kaçınma hedef yönelimi düşük (γ_{70}= -.052, *se*= .009), ödevi erteleme eğilimi düşük (γ_{80}= -.116, *se*= .011) ve ödev yaparken daha çok derin öğrenme stratejisi kullanan (γ_{100}= .033, *se*= .015) öğrenciler, diğer öğrencilerden daha başarılıdır. Diğer yandan, ödev yapmaktaki performans hedef yönelimi (γ_{60}= -.004, *se*= .013) ve ödev yönetimi stratejisi kullanımı (γ_{90}= .003, *se*= .014), fen başarısı ile ilişkili değildir. Ödev öz-düzenleme becerileri modele dahil edildikten sonra, öğrencilerin ödev hakkında aldıkları geri bildirim (γ_{30}= .005, *se*= .013) ve ödevin kalitesi (γ_{40}= .019, *se*= .013) ile ilgili algıları artik fen başarısını tahmin etmemektedir. Bu durum, ödev öz-düzenleme becerilerinin, öğrencilerin ödevin kalitesi ve ödevle ilgili aldıkları geri bildirim hakkındaki algılarının, öğrencinin başarısı ile olan ilişkisine aracılık ettiğini göstermektedir. Fen başarısını tahmin eden son modelde ise (bkz. Şekil 9 ve Tablo 6), sınıf düzeyindeki değişkenler de modele eklenmiştir. Buna göre, ödev hakkında sağlanan geri bildirim ile ilgili öğrencilerin ortak algılarının daha yüksek olduğu sınıflarda (γ_{01}= .158, *se*= .029) ve öğretmenlerin öğrencileri daha fazla derin öğrenme stratejisi kullanımı konusunda desteklediği sınıflardaki (γ_{02}= .060, *se*= .029) öğrenciler, diğer sınıflardaki öğrencilerden daha başarılıdır.

Özet olarak sonuçlar, önerilen ödev modelini (Şekil 1) desteklemektedir. Sınıflar arasında öğrencilerin öz-düzenleme becerileri ve fen başarısı açısından farklılıklar tespit edilmiştir. Öğrencilerin cinsiyeti ve ön-bilgisi kontrol edilirken, öğrencilerin ödevin kalitesi ile ilgili algıları, onların ödevdeki hedef yönelimlerini (öğrenme, performans ve işten-kaçınma) ve ödevlerindeki strateji kullanımını (ödev yönetimi ve derin strateji kullanımı) pozitif olarak tahmin ederken, ödevi erteleme eğilimini ise negatif olarak tahmin etmiştir. Ödevleri ile ilgili geri bildirim alan öğrenciler, yüksek seviyede öğrenme ve performans hedef yönelimi ile düşük seviyede işten-kaçınma hedef yönelimi benimsemiştir. Yine ödevleri ile ilgili geri bildirim alan öğrenciler, ödev yaparken daha çok ödev yönetimi ve derin öğrenme stratejisi kullanmış ve ödevlerini erteleme eğilimi içinde olmamıştır.

Ödevin kalitesi ile ilgili sınıfın ortak algısının daha yüksek olduğu sınıflardaki öğrenciler, diğer sınıflardaki öğrencilere göre ödevlerinde daha çok öğrenme ve performans hedef yönelimi ve daha az işten-kaçınma hedef yönelimi benimsemiş; ödevlerini erteleme eğilimi içinde olmamış ve ödev yaparken daha çok ödev yönetimi ve derin öğrenme stratejileri kullanmıştır. Ödevle hakkında sağlanan geri bildirim ile ilgili sınıfın ortak algısının daha yüksek olduğu sınıflardaki öğrenciler, diğer sınıflardaki öğrencilere göre daha çok ödev yönetimi ve derin öğrenme stratejileri kullanmıştır. Öte yandan, öğretmenin hedef yönelimi ve öğrencilerini strateji kullanımı için sağladığı destek, öğrencilerin ödev öz-düzenleme becerileri ile ilişkili çıkmamıştır.

Fen başarısı ile ilgili kurulan modeller göstermiştir ki; ödevin kalitesi ve ödev hakkında sağlanan geri bildirim ile ilgili algılarının daha yüksek olduğu öğrenciler, fen testinde sınıf arkadaşlarından daha başarılı olmuştur. Ödevlerinde daha çok öğrenme ve daha az işten-kaçınma hedef yönelimi benimseyen, ödevlerini erteleme eğilimi içinde olmayan ve ödev yaparken daha çok derin örenme stratejisi kullanan öğrenciler, fen testinde gösterdikleri performans ile sınıf arkadaşlarını geride bırakmışlardır. Öte yandan, performans hedef yönelimi benimseme ve ödev yönetimi stratejileri kullanma, fen başarısı ile ilişkili çıkmamıştır. Ödev öz-düzenleme becerilerine ait değişkenler modele dahil ettikten sonra, ödevin kalitesi ve ödevle ilgili sağlanan geri bildirim, fen başarısı ile artık istatistiksel olarak ilişkili çıkmamıştır. Ödev üzerine verilen geri bildirim ile ilgili ortalama sınıf algısının daha yüksek olduğu sınıflarda ve öğretmenin öğrencilerin derin öğrenme stratejisi kullanımını daha çok desteklediği sınıflarda okuyan öğrenciler, diğer sınıflardaki öğrencilerden daha yüksek fen başarısı sergilemişlerdir.

Doğurgalar

Bu çalışmada, 7. sınıf öğrencilerinin ödev öz-düzenleme becerileri (ödev yapmaktaki hedef yönelimleri, ödevlerini erteleme eğilimi ve ödev stratejileri kullanımı), öğretmenlerin ödevle ilgi uygulamaları ve fen başarısı ile ilişkilendirerek incelenmiştir. Öğretmenlerin ödev uygulamalarının, öğrencilerin ödev öz-düzenleme becerilerini ve fen başarısını etkilemekte potansiyeli olduğu bulunmuştur. Öğrencilerin ödevin kalitesi ve ödev üzerine aldıkları geri bildirim ile ilgili algıları, öğrencilerin ödevdeki hedef yönelimini, ödevi erteleme eğilimini, ödev stratejileri kullanımını ve fen başarısını tahmin etmiştir. Bu sebepten dolayı çalışma sonuçları öğretmenleri şu konuların farkında olmaya dikkatlerini çekmektedir: Öğrencilerine daha kaliteli ödevler vermeleri ve ödevleri üzerine daha etkili geri bildirim sağlamaları durumunda öğrenciler

- ödevlerini öğrenme ve becerilerini geliştirmek için yapmakta,
- ödevlerini başkalarına becerilerini göstermek ve başkalarının beğenisini kazanmak amacıyla yapmakta,
- ödev yaparken, derin öğrenmeye sevk eden bilişsel ve bilişüstü stratejileri kullanmakta,
- ödev yaptıkları ortamı düzenlemekte, zamanını yönetmekte, etrafındaki dikkatini dağıtan şeyleri azaltmakta, duygularını ve motivasyonunu düzenlemekte,
- ödevi için harcayacağı emeği azaltma ve olabildiğince kolay yoldan ödevi yapma eğilimi içinde olmamakta, ve
- ödevini yapmayı geciktirmemektedirler.

Böylece, öğretmenlerin kaliteli ödev hazırlaması, bir başka değişle zorluk düzeyi değişen, öğrencileri fen konuları üzerinde düşünmeye sevk eden, fen konularını anlamalarına ve becerilerini geliştirmeye yardım eden ödevler vermesi önemlidir. Bunun yanı sıra, öğretmenin ödevle ilgili geri bildirim vermesi, yani ödevleri düzenli olarak kontrol etmesi, ödevleri kısa sürede değerlendirmesi, ödevle ilgili sınıfta tartışma yapması ve öğrencileri ödevde gösterdikleri performans hakkında bilgilendirmesi (doğru ve yanlış yaptıkları kısımlar hakkında haberdar etmek gibi) önem arz etmektedir.

Ödev öz-düzenleme becerilerinin, fen başarısı ile bulunan ilişkisi göstermiştir ki, ödevlerini yaparken fen konularını daha iyi öğrenmek ve becerilerini geliştirmek isteyen (öğrenme hedef yönelimi yüksek), ödevlerini yapmak için ortaya koyacakları emek hakkında endişelenmeyen (işten-kaçınma hedef yönelimi düşük), ödevlerini yapmayı geciktirmeyen (ödevi erteleme eğilimi düşük) ve ödev yaparken daha çok bilişsel ve bilişüstü stratejileri (derin öğrenme stratejileri) kullanan öğrenciler, fen testinde daha başarılı olmuştur. Bu nedenle, Fen ve Teknoloji öğretmenleri öğrencilerinin daha fazla öğrenme ve daha az işten-kaçınma hedef yönelimini benimsemeleri, ödevlerini ertelememeleri ve daha çok derin öğrenme stratejileri kullanmaları için desteklemelidir. Bunu yapabilmek için öğretmenler, belirli bir ödevi verme sebebini öğrencilerle paylaşabilir, öğrencilerin eksik oldukları ve geliştirmeleri gereken konulara ödevde yer verebilir ve öğrenciler için ilgi çekici ve hayatlarıyla ilişkili ödevler hazırlayabilir. Öğrencilerin daha fazla bilişsel ve bilişüstü strateji kullanımına olanak tanıyan ödevler vermeleri de faydalı olabilir. Öğretmenler, konuları anlamanın, emek sarf etmenin ve kişisel gelişimin önemli olduğunu vurgulayabilirler.

Ek olarak, öğretmenin, öğrencilerinin ödevde derin öğrenme stratejilerini kullanımını destelediği sınıflardaki öğrenciler, diğer sınıflardaki öğrencilere göre fen testinde daha başarılı olmuşlardır. Bu sonuç gösteriyor ki, öğrencinin yeni öğrendikleri ile önceki öğrendikleri arasında bağlantı kurmasını, diğer derslerde öğrendikleri ile Fen ve Teknoloji dersinde öğrendikleri arasında bağlantı kurmasını, sınıftaki tartışmalar ve okumaları gibi farklı kaynaklardan edindiği bilgileri bir araya getirmesini ve edindiği bilgilerin güvenilirliğini sorgulamasını gerektiren ödevler, öğrencilerin öğrenmesine katkı sağlayabilir.

Çalışma sonuçlarına göre öğretmen yetiştirme programları için de bazı öneriler yapılabilir: Öğretmen yetiştirme programları, öğretmen adaylarına kaliteli ödev hazırlama, ödev üzerine etkili geri bildirimde bulunma ve öğrencilerin ödev stratejisi kullanımını destekleme konularında eğitim verebilir. Bu eğitim, öğretmen yetiştirme programlarındaki öğretim yöntem ve teknikleri dersine entegre edilebilir. Örneğin, öğretmen adaylarına, zamanında ve bilgi verici geri bildirimde bulunmak; değişen zorlukta, öğrencilerin fen konularını öğrenmeye sevk eden, öğrencilerin konuları anlamasına ve becerilerini geliştirmesine yardımcı olan ödev hazırlamak ve öğrencilerin bilişsel ve bilişüstü strateji kullanımını desteklemeleri konularında eğitim verilebilir. Çalışan öğretmenlere ise ödevin kalitesini, ödevle ilgili geri bildirimin etkisini ve öğrencilerinin ödev stratejisi kullanımını desteklenmesini arttırmak için hizmet-içi eğitim verilebilir. Öğretmenlerin kendi ödev uygulamalarının, öğrencilerinin ödev öz-düzenleme becerileri ve başarıları üzerindeki etkisinin farkında olmaları, öğrencilerin ödev öz-düzenleme becerilerindeki yetersizlikleri tespit etmeleri ve bu becerileri geliştirmeleri için öğrencileri desteklemeleri önemlidir.

Özetle bu çalışma, öğrencilerin ödev-öz düzenleme becerilerini geliştirebilmelerine olanak tanımak için kaliteli ödev hazırlamak ve ödev üzerinde etkili geri bildirimde bulunmak gibi öğretmenlerin ödev uygulamalarında düzenlemeler önermektedir. Ödev öz-düzenleme becerileri, öğrencilerin başarısı ile ilişkili olduğu için bu becerileri geliştirmek önem arz etmektedir.

Sınırlılıklar ve İleriki Çalışmalar için Öneriler

Bu çalışmanın değinilmesi gereken bazı sınırlılıkları vardır. Araştırmanın veri toplama araçlarına yönelik sınırlılığı; veriler, öğrenci ve öğretmenlerin kendi raporlarına dayanmaktadır. Öğrencilerin ödev öz-düzenleme becerilerini derinlemesine anlamaya yardımcı olabilecek günlük yazma ve sesli-düşünme protokolleri gibi farklı veri toplama araçları kullanılabilir. Ek olarak, sınıf gözlemleri öğretmenlerin ödev uygulamalarını anlama konusunda faydalı olabilir. Bu çalışmada veriler tek zaman diliminde toplanmıştır (cross-sectional); öğrencilerin ödev öz-düzenleme becerilerinin zamanla değişimini araştırabilmek için uzun süreli (longitudinal) çalışmalar yapılabilir. Uzun süreli çalışmalar, öğretmenlerin ödev uygulamalarının, öğrencilerin ödev-öz düzenleme becerileri ve başarıları üzerindeki etkisini incelemek için bilgi verici olabilir. Bu çalışmadaki bir başka sınırlılık ise neden sonuç ilişkisi kurulmasındaki zorluktur. Korelasyonel bir araştırma olduğu için, elde edilen sonuçlar değişkenler arasındaki ilişkileri anlamaya yardımcı olmakta; ancak sebep-sonuç ilişkisi kurmaya olanak tanımamaktadır. İlgili literatüre göre, anne-babanın ödev konusundaki yardımları (Ör. Cooper, Lindsay, & Nye, 2000; Xu & Corno, 2003) gibi bazı değişkenler öğrencilerin ödev uygulamaları ile ilgili olabilir. Velilerin ödeve dahil olması ile ilgili değişkenler bu çalışmanın kapsamında yer almadığı için çalışmaya dahil edilmemiştir ancak; ileriki çalışmalarda velilerin ödeve katılımı ile ilgili değişkenlerin öğrencilerin ödev öz-düzenleme becerilerine olan etkisi incelenebilir. Çalışma ile ilgili değinilmesi gereken bir diğer sınırlılık ise kullanılan Fen Başarı Testinin ünite bazlı oluşudur. Başarı testi, Vücudumuzda Sistemler ve Kuvvete ve Hareket ünitelerine ait sorulardan oluşmuştur. Sonuçlar yorumlanırken bu durumun göz önüne alınması gereklidir.

Bir başka öneri ise öğrencilere, öğretmenlerinin / sınıflarındaki vurgulanan hedef yönelimini ve öğretmenlerin, ödev stratejisi kullanmaları için yaptıkları desteğin öğrencilere sorulmasıdır. Bu çalışmada, ilgili konularda sadece öğretmenlerin kendi sınıflarındaki hedef yönelimlerini ve öğrencilerin strateji kullanımını desteklemeleri sorulmuştur. İleriki çalışmalarda öğrencilerin bu konulardaki algılarının incelenmesi faydalı olabilir. Çünkü öğrencilerin sınıf ortamında vurgulanan hedef yönelimini ve öğretmenlerinin sağladığı desteği nasıl algıladıkları, onların deneyimleri ile ilgili daha zengin bilgi verebilir (Ames, 1992; Rolland, 2012). Son olarak Öğrenci Ödev Ölçeğinin farklı sınıflarda (4. sınıftan 8. sınıfa kadar), özel okullarda ve farklı kültürlerde uygulanması önerilmektedir.

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APPENDIX G

TEZ FOTOKOPİSİ İZİN FORMU

<u>ENSTİTÜ</u>

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ■

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

<u>YAZARIN</u>

Soyadı : Taş
Adı : Yasemin
Bölümü : İlköğretim

<u>TEZİN ADI</u> (İngilizce) : An Investigation of Students’ Homework Self-Regulation and Teachers’ Homework Practices

<u>TEZİN TÜRÜ</u> : 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. ■

<u>TEZİN KÜTÜPHANEYE TESLİM TARİHİ</u>: