THE CONTRIBUTION OF CHEMISTRY SELF-EFFICACY AND GOAL ORIENTATIONS TO ELEVENTH GRADE STUDENTS' CHEMISTRY ACHIEVEMENT

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AYŞE ŞENAY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
SECONDARY SCIENCE AND MATHEMATICS EDUCATION

SEPTEMBER 2010

Approval of the thesis:

THE CONTRIBUTION OF CHEMISTRY SELF-EFFICACY AND GOAL ORIENTATIONS TO ELEVENTH GRADE STUDENTS' CHEMISTRY ACHIEVEMENT

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

Prof. Dr. Canan ÖZGEN ________________________
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Ömer GEBAN ________________________
Head of Department, **Secondary Science and Mathematics Education**

Assoc. Prof. Dr. Esen UZUNTİRYAKİ ________________________
Supervisor, **Secondary Science and Mathematics Education Dept., METU**

Examining Committee Members:

Assoc. Prof. Dr. Jale ÇAKIROĞLU ________________________
Elementary Education Dept., METU

Assoc. Prof. Dr. Esen UZUNTİRYAKİ ________________________
Secondary Science and Mathematics Education Dept., METU

Assoc. Prof. Dr. Safure BULUT ________________________
Secondary Science and Mathematics Education Dept., METU

Assoc. Prof. Dr. Yezdan BOZ ________________________
Secondary Science and Mathematics Education Dept., METU

Assist. Prof. Dr. Ömer Faruk ÖZDEMİR ________________________
Secondary Science and Mathematics Education Dept., METU

Date: 15.09.2010

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

Name, Last name : AYŞE ŞENAY

Signature :

ABSTRACT

THE CONTRIBUTION OF CHEMISTRY SELF-EFFICACY AND GOAL ORIENTATIONS TO ELEVENTH GRADE STUDENTS' CHEMISTRY ACHIEVEMENT

Şenay, Ayşe

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

Supervisor: Assoc. Prof. Dr. Esen Uzuntiryaki

September 2010, 132 pages

The purpose of this study was to investigate the contribution of 11th grade Turkish students' chemistry self-efficacy for cognitive skills (CSCS), and self-efficacy for chemistry laboratory (SCL), mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals to their chemistry achievement.

The sample of the study included 604 students (343 females and 261 males) from seven different general public high schools in Çankaya, a district of Ankara. High School Chemistry Self-efficacy Scale which was developed by Çapa Aydın and Uzuntiryaki (2009), Achievement Goal Questionnaire which was developed by

Elliot and McGregor (2001), and Chemistry Achievement Test (CAT) which was developed by the researcher were used to collect the data in the study.

The simultaneous multiple regression analysis was used to analyze the data of the study. Results revealed that the students' CSCS, mastery-approach goal, performance-approach goal were a positive significant predictors and performance-avoidance goal was a negative significant predictor of their scores on the CAT. Students' CSCS had the largest unique contribution to explaining the students' chemistry achievement. These four independent variables explained a significant 9.1 % of variance in the students' chemistry achievement.

Keywords: chemistry self-efficacy, goal orientation, achievement goals, chemistry achievement

ÖZ

KİMYA ÖZYETERLİĞİ VE HEDEF YÖNELİMİNİN 11. SINIF ÖĞRENCİLERİNİN KİMYA BAŞARISINA KATKISI

Şenay, Ayşe

Yüksek Lisans, Ortaöğretim Fen ve Matematik Alanları Eğitimi

Tez Yöneticisi: Doç. Dr. Esen Uzuntiryaki

Eylül 2010, 132 sayfa

Bu çalışmanın amacı, 11. sınıf öğrencilerinin bilişsel beceriler için kimya özyeterliliklerinin, laboratuvar çalışmaları için kimya özyeterliliklerinin, öğrenme-yaklaşım hedef yönelimlerinin, öğrenme-kaçınma hedef yönelimlerinin, performans-yaklaşım hedef yönelimlerinin ve performans-kaçınma hedef yönelimlerinin kimya başarılarına olan katkılarını araştırmaktır.

Çalışma, Ankara'nın bir ilçesi olan Çankaya'daki yedi farklı devlet lisesinden 604 öğrenciyi (343 kız, 261 erkek) içermiştir. Bu çalışmanın verileri, Çapa Aydın ve Uzuntiryaki (2009) tarafından geliştirilmiş olan Lise Kimya Özyeterlilik Ölçeği, Elliot ve McGregor (2001) tarafından geliştirilmiş olan Hedef Yönelimleri Ölçeği, ve araştırmacı tarafından geliştirilmiş olan 11. sınıf Kimya Başarı Testi kullanılarak toplanmıştır.

Çalışmanın verileri, simultane çoklu regresyon analizi kullanılarak analiz edilmiştir. Sonuçlar, öğrencilerin bilişsel beceriler için kimya özyeterlilikleri, öğrenme-yaklaşım hedef yönelimlerinin, ve performans-yaklaşım hedef yönelimlerinin kimya başarısınıanlamlı olarak pozitif yönde yordadığını ve performans-kaçınma hedef yönelimlerinin kimya başarısını anlamlı olarak negatif yönde yordadığını göstermiştir. . Öğrencilerin bilişsel beceriler için kimya özyeterlilikleri, kimya başarısına en büyük katkıyı sağlamıştır. Bu dört bağımsız değişken, öğrencilerin kimya başarısı varyansının % 9,1 ini açıklamıştır.

Anahtar sözcükler: Kimya öz-yeterliliği, hedef yönelimleri, başarı hedefleri, kimya başarısı.

To my Mother, Altınter Şensöz

and

To my Uncle, Sümer Taşkıran

ACKNOWLEDGMENTS

I would like to express my deep appreciation and sincere gratitude to Assoc. Prof. Dr. Esen Uzuntiryaki, my advisor, for her wisdom, invaluable guidance, continuous support and patience with answering my endless questions. I would also like to thank her for editing my countless drafts, giving me warm encouragement and for her professionalism from the beginning to the end of this challenging process of my research.

A special thank you goes to the Research Assist. Cansel Kadıoğlu, in the Department of Secondary Science and Mathematics Education, METU, for her support in analyzing the data and interpreting the results of the analysis of my study.

I really want to thank my mother, Altınter Şensöz, for her unconditional love, support, believing in me and for encouragement to pursue special interests in my life. I would also like to thank my uncle, Sümer Taşkıran, for teaching me the value of education, guidance and offering all kinds of support and lovingly encouragement throughout my life and education. Words are not enough to express my love for and gratitude to my mother and uncle. Without their love and support, I am sure that I would not have been able to achieve so much.

My heartiest thanks to my uncles, Kemal Talaş, İsmail Taşkıran, and Adnan Talaş and my aunts, Gülsüm Taşkıran, Zeliha Talaş, Seçil Taşkıran, and Ayşe Talaş, for all kinds of support throughout my life and education. Many thanks also to my cousins Serdar Talaş and Cansu Talaş, for their support in this study.

My heartiest thanks also go to my best friends, Gülay Akpınar and Dawn Hanson and for their emotional support and believing in me throughout this study. I would like to extend my heartiest thanks to my love, Robert Olesrud, for his love and affection, emotional support, understanding, faithfulness, and encouragement throughout this challenging study.

My gratitude also goes to the principals and teachers who co-operated with me and supported this study in the process of collecting the data, and to the students who participated in this study. I would also like to extend my gratitude to the principal, Aydın Ünal and the chemistry teachers of TED Ankara College Foundation Private High School, for their support to make this study possible.

I also want to acknowledge the Controversial Support for Modern Life Association (ÇYDD), for their scholarship in providing me the invaluable support during my undergraduate education.

Lastly, I would like to thank the members of my thesis jury, for their willingness to be in the jury and their invaluable feedback on my thesis.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

AGQ	: Achievement Goal Questionnaire
AMOS	: Analysis of Moment Structures
CFA	: Confirmatory Factor Analysis
CFI	: Comparative Fit Index
CSCS	: Chemistry self-efficacy for cognitive skills
GPA	: Grade Point Average
HCSS	: High School Chemistry Self-Efficacy Scale
ID	: Identification
M	: Mean
MNE	: Ministry of National Education
MSLQ	: Motivated Strategies for Learning Questionnaire
NNFI	: Non-Normed Fit Index
P-P	: Probability plot
PALS	: Patterns of Adaptive Learning Survey
PISA	: Program for International Student Assessment

RMSEA : Root Mean Square Error of Approximation

SAT : Scholastic Aptitude Test

SCL : Self-efficacy for chemistry laboratory

SD : Standard deviation

USA : United States of America

VIF : Variance inflation factor

CHAPTER 1

INTRODUCTION

Teachers may often comment on the students who perform poorly at school related tasks as ‘not motivated to learn’ or ‘if they tried harder, they would do better. Many seminars are carried out about motivating students each year because teachers often find motivating their students as their number one priority in their classes (Pintrich & Schunk, 2002). According to the reports in many professional journals, adolescents’ outstanding issue is the motivation. Adolescents either do not have the motivation, or have too much motivation, or use their motivation incorrectly (Anderman & Maehr, 1994).

Motivation can influence future learning and what degree the past learning performs itself. Students who are motivated to learn show interest in the task, put the necessary effort into the task, stick with the task, have positive beliefs about their capabilities, and experience the success in the task (Pintrich & Schunk, 2002). Many studies agree that motivation is the central construct for explaining the achievement behaviors (Schunk, 1990). According to the social cognitive theory, learning and achievement are affected by the processes of motivation (Schunk, 1989).

Motivation is considered as the causes which make individuals rise to action by psychologists (Covington, 2000). Although the exact nature of motivation has still got some disagreements, the definition of motivation which is cognitive and possesses the most of the points of the researchers is that “motivation is the process whereby goal-directed activity is instigated and sustained” (Pintrich & Schunk, 2002, p. 5; Schunk, 1990). It is not directly observable and is conceptualized as some internal characteristics like motives, instincts, etc. by early theories (Weiner, 1990). Social-cognitive processes are seen as the originator of motivation by contemporary motivation theorists (Meece, Anderman, & Anderman, 2006). According to social-cognitive theory, learning and outcome are affected by motivational processes like self-efficacy, control beliefs, goal orientations, anxiety, and task value (Schunk, 1989). The present study focused on the contributions of 11^{th} grade Turkish state high school students’ chemistry self-efficacy beliefs and goal orientations to their chemistry achievement.

Self-efficacy is described as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated type of performances” (Bandura, 1986, p.391). Bandura (1982) characterized self-efficacy as being task and domain specific. Students might have different self-efficacy judgments in different types of tasks or domains. For instance, a student who feels efficacious in biology might not feel that efficacious in mathematics. Thus, students’ self-efficacy judgments across areas are very little (Smith & Fouad, 1999) and should be investigated specifically for each domain. Self-efficacy beliefs develop as a result of information from four types of resources: mastery (enactive) experiences, vicarious experiences, verbal persuasion, and physiological states. Enactive experiences are derived from what one has experienced are to be the most forceful reference of self-efficacy beliefs. Vicarious experience is gained by observing a model's performance and comparing it with the observer. A comparatively weak source of self-efficacy is the persuasions like "I have faith in you" given by others. The last source of students' self-efficacy is physiological reactions which are stress, anxiety, and other feelings seen as signs of physical incompetency (Bandura, 1997).

Self-efficacy influences people's choice of tasks, showing effort and persistence at the task, and thus, is a better predictor of performance and motivation compared to other variables (Bandura, 1997). Efficacious students look for new challenges, show persistence at tasks, and have the ultimate success (Britner, 2008; Zeldin & Pajares, 2000). Even though such students have prior difficulties, the belief in their capabilities to overcome these difficulties results in the motivated performance (Bandura, 1986; Schunk, 1989). Many research studies showed that self-efficacy was the most reliable predictor of students' achievement (Britner; Britner & Pajares, 2001, 2006; Cavallo, Potter, & Rozman, 2004; Lau & Roeser, 2002; Pintrich & De Groot, 1990).

Achievement goals form another important aspect of motivation. Achievement goal theory is also based on the social-cognitive theory (Meece, Anderman, & Andeman, 2006). Achievement goals are conceptualized as the purpose (Maehr, 1989) or cognitive-dynamic focus of competence related act (Elliot, 1997). In early studies, the goal aspect of motivation was classified as mastery (intrinsic/learning/task-involvement) and performance (ego-involvement) goal orientations (Ames, 1992; Ames & Archer, 1988). Mastery goal orientations are centered on growth of competence through task attainment but performance goal orientations are centered on showing off competence to other students by getting the best grades or besting others in the class (Ames, 1992; Elliot, 1999). In studies, mastery goals were consistently found to be linked to positive actions and results (Dweck & Leggett, 1988; Harackiewicz, Barron & Elliot, 1998; Kadıoğlu & Uzuntiryaki, 2008; Nicholls, 1989; Pintrich & De Groot, 1990). Studies with performance goals revealed contradicting results. Some studies showed that performance goals had negative results when combined with low perceived competence (Elliot & Church, 1997; Smiley & Dweck, 1994) whereas some showed that performance goal orientations were associated with higher achievement (Elliot & Harackiewicz, 1996; Kaplan & Midgley, 1997; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996). Elliot and his co-workers proposed a trichotomous model to resolve this conflict using the empirical data for the performance goals. The model consisted of mastery goals, performance-approach goals, and performance-avoidance goals (Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Elliot & Church's study (1997) showed that these three dimensions of the framework were distinct. Mastery goals remained the same in this framework. Performance approach goals focus on accomplishing high competence relative to others while performance-avoidance goals focus on avoiding low competence relative to others (Elliot, 1999).

Elliot and McGregor (2001) proposed 2x2 framework of achievement goals to include each of combinations of standard and valence dimensions of competence. This framework included four distinct types of achievement goals: mastery-approach, mastery- avoidance, performance-approach, and performance-avoidance goals. Performance-approach and avoidance goals remained the same in this model but mastery goals were divided into two parts. Mastery-approach goals focus on learning and accomplishing the task. Mastery-avoidance goals focus on not failing or misunderstanding the task. Students having mastery approach goals try to attain the task through learning and understanding the task thoroughly. Students with mastery avoidance goals try to avoid not mastering or misunderstanding the task. Students with performance approach goals try to be the best at the task compared to others and surpass the others in the class. Students with performance avoidance goals try to avoid inferiority and looking stupid compared to others (Elliot, 1999; Elliot & McGregor, 2001; Pintrich & Schunk, 2002). Because all the positive motivational outcomes are related to mastery (approach) goals, mastery (approach) goals would be expected to give higher achievement levels (Dweck & Leggett, 1988; Pintrich & Schunk, 2002). However, some correlational classroom studies showed that mastery (approach) goals are not associated with the performance or achievement which is usually indexed by grades or Grade Point Averages (GPA). On the contrary, performance approach goals are found to be related with higher grades in some studies (Elliot, McGregor, & Gable, 1999). Mastery (approach) goals result with more interest in the subject matter but performance goals end up with better achievement (Harackiewicz, Barron, & Elliot, 1998). All of these four achievement goals are important constructs for motivation and thus, 2x2 achievement goal framework was included in this study.

In summary, two of the most important motivational constructs are students' self-efficacy and achievement goals. In this study, the contributions of motivational variables, which are chemistry self-efficacy for cognitive skills and laboratory skills, mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals were investigated.

1.1 Significance of the Study

In the present study, the contribution of high school students' chemistry self-efficacy beliefs and goal orientations to their chemistry achievement was examined. Since students' self-efficacy judgments are task and domain specific, students' self-efficacy beliefs should be studied separately in different domain such as chemistry, physics, biology etc. A student might have a high self-efficacy in one domain but the same student might not have a high self-efficacy in another domain (Bandura, 1997). There are many studies in literature which found that students' science self-efficacy is significantly correlated to their achievement (Andrew, 1998; Britner & Pajares, 2001, 2006; Kupermintz, 2002; Lau & Roeser, 2002; Pajares, Britner, & Valiante, 2000). However, these findings about science self-efficacy cannot be transferrable into the domain of chemistry. Therefore, the present study is important in studying self-efficacy in the domain of chemistry.

Besides, some of the subjects of chemistry are difficult for students to understand because of having an abstract structure (Barker & Millar, 1999). Thus, chemistry is an intimidating subject for most of the students. In Turkey, 11^{th} grade chemistry curriculum includes advanced subjects like acids and bases, electrolysis, chemical equilibrium, solubility equilibria, and rates of chemical reactions.

Additionally, the curriculum is dominated by solving problems requiring higher levels of thinking about these subjects. Considering the role of self-efficacy beliefs and goal orientations on achievement, it is worthwhile to study such factors contributing to students' chemistry achievement. The findings of this study may be useful for further studies on enhancing student achievement as well as understanding students' self-efficacy beliefs and goal orientations.

Moreover, students' self-efficacy beliefs are dynamic (Bandura, 1988). That means, students' self-efficacy beliefs alter over time due to having different experiences and new knowledge. Therefore, the results of the studies about students' chemistry self-efficacy conducted with middle school students (e.g., Bong, 2009; Özkan, 2003; Pajares, Britner, & Valiante, 2000), 9^{th} or 10^{th} grade students (e.g., Kan & Akbaş, 2006; Lavonen & Laaksonen, 2009; Lau & Roeser, 2002; Uzuntiryaki & Kadıoğlu, 2008; Yumuşak, 2006; Yumuşak, Sungur, and Çakıroğlu, 2007), and college students (e.g., Dalgety & Coll, 2006; Demirdöğen, Uzuntiryaki, & Çapa Aydın, 2009; Taasoobshirazi & Glynn, 2009; Zusho, Pintrich, & Coppola, 2003) may not be applicable to 11^{th} grade students' self-efficacy. Thus, the results of this study add knowledge to the literature on high school students' chemistry self-efficacy beliefs.

Most of the studies conducted about the achievement goals, on the other hand, are based on either dichotomous or trichotomous model. Since mastery-avoidance goal orientations are new for the achievement goal literature (Elliot & McGregor, 2001), there has not been many studies investigated about its contribution to achievement outcome in Turkey. Harackiewicz, Barron, Pintrich, Elliot, and Thrash (2002) and Sungur and Şenler (2009) also emphasized the need for studies of performance-approach and avoidance goals. Thereby, this study is important since it has the capacity to help the clarification of the contribution of mastery-avoidance goals to Turkish high school students' chemistry achievement.

In line with the aforementioned points, results of this study may help high school teachers improve their ideas about the contributions of chemistry self-efficacy and achievement goal orientations to 11th grade students' chemistry achievement. Teachers may develop instructional methods and design their classes by taking the results of this study into consideration. Additionally, providing a new data on the 2x2 achievement goal framework and chemistry self-efficacy beliefs, results of this study may be useful for researchers.

CHAPTER 2

LITERATURE REVIEW

In this chapter of the study, information about the components of motivational beliefs (self-efficacy for learning and performance, and goal orientations) and the studies conducted regarding these components will be introduced.

2.1 Self-efficacy for learning and performance

Social cognitive theory is based on human agency view in which people are actively involved in their actions and able to accomplish tasks by their actions. In this human agency view, people hold self-beliefs which make them have control over their thoughts, feelings, and actions. In other words, "what people think, believe, and feel affects how they behave" (Bandura, 1986, p.25). How the results of actions are interpreted by individuals inform and change their environment and personal factors. Personal factors, in return, inform and change subsequent actions. This is the basis of Bandura's view of reciprocal determinism. In reciprocal determinism, behavior, environmental and social influences, and personal factors in the form of affect, cognition, and biological actions interact with each other ending in a triadic reciprocality. Environmental and social factors influence the behavior to the degree which they affect self-efficacy beliefs, emotional states, and some other personal factors. In social cognitive theory, self-efficacy beliefs stand at the very core of the theory among all the other factors influencing human behavior (Bandura, 1997). Self efficacy is defined as, "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Bandura (1997) suggested that self-efficacy plays an important role in motivation across various domains as social relations, academics, sports, and health. Self-efficacy constructs the basis for individuals' motivation, accomplishment, and personal well-being because when people believe in their ability to perform tasks successfully, they will persist in the task in the face of difficulties. Individuals' level of motivation, emotional states, and behaviors are based on rather what they believe than what is really true. Therefore, whether individuals will be successful in a task can be better predicted by their self-efficacy beliefs than their actual level of capabilities for accomplishing tasks. Indeed, self-efficacy affects students' behaviors like choice of task, persistence, effort, and achievement. People with strong self-efficacy beliefs think of the difficult activities as the challenges to be mastered rather than to be avoided. Such self-efficacious individuals grow intrinsic interest in, set challenging goals in, and maintain deep commitment to activities. The recovery of these individuals' sense of self-efficacy from failures or setbacks becomes very quick because they think that the reasons of failures are insufficient effort, deficient knowledge, or skills which can be controlled over. Such self-efficacious students achieve tasks and have reduced stress. On the other hand, students who have low self-efficacy beliefs view difficult tasks as personal threats and try to avoid them. They have weak commitment to the goals set by them and low desire to achieve the tasks. They keep their attention directed to personal deficiencies or the problems interfering with their progress rather than concentrating on how to accomplish the task. Because these students think that they experience the failure due to deficient aptitude, they slow up their efforts or give up easily when they face difficulties. The recovery of these individuals' sense of self-efficacy from failures becomes very slow and these individuals feel easily the stress and depression (Bandura, 1994).

Self efficacy beliefs are usually confused with three terms: self-concept, self-esteem, and outcome expectancy. Self-efficacy beliefs are different from self-concept. Self-concept is formed of more general beliefs about competence. Self-efficacy beliefs, on the other hand, are task specific. For example, a student can feel good about mathematics and this forms her self-concept beliefs. However, the same student might give a different judgment about solving integral problems and this forms her self-efficacy beliefs. Self-efficacy beliefs involve judgments of confidence whereas self-concept beliefs involve judgments of self-worth. Self-efficacy beliefs answer the question of "can I do this task?" whereas self-concept answer the question of "who am I/ how do I feel?" Moreover, self-efficacy beliefs are used in reference to a goal which is set by the individual, environment, or their interactions. On the other hand, self-concept is cognitive self-appraisal and independent of the goal (Bandura, 1997). Self-efficacy beliefs are also different from self-esteem. Self-esteem includes individuals' feeling about whether they can accomplish a task or not (Linnenbrink & Pintrich, 2003). Lastly, outcome expectation can be described as the beliefs about contingency between the behavior and expected outcomes. Self-efficacy beliefs are usually positively correlated with outcome expectations but it is probable that a student has high self-efficacy beliefs but low expectations about the grades earned from the exams (Pintrich & Schunk, 1996). Bandura (1982) suggested a model of high/low self-efficacy by high/low outcome expectations. In this model, the outcome expectations are strongly dependent on self-efficacy beliefs. Students holding high efficacy beliefs and outcome expectations would persist long, put significant effort, be confident, and possibly have high levels of commitment to the task. Students with high self-efficacy but low expectations about the outcomes would probably study hard, be committed to the task but they may object to the grading policies, drop out the program because they do not see any adjunction between their learning and the results. Students with low self-efficacy and outcome expectations would display resignation, lack of interest, and be unwilling to put effort in the task. These students would have given up on learning. Final type of students in this model is the ones with low self-efficacy but high outcome expectations. These students would believe that they cannot do the task but would be appropriately awarded if they could. These students hold very negative beliefs about themselves.

Self-efficacy is not a self-recognition of performing well at school. It is specific and situational. It involves fully developed judgments of having specific skills to be successful at a certain task and is used in reference to the goals attained at the task (Schunk & Miller, 2002). Smith and Fouad (1999) found in their study that self-efficacy, goals, and outcome expectancies are specific to the subject matter and the generalizability of these across different subject areas is very low. Indeed, Bandura (1997) claims that self-efficacy is a domain specific construct. Therefore, it is meaningful if we spoke of self-efficacy for reading a text, playing the saxophone, learning to speak English, solving chemistry problems, and so forth (Schunk & Miller, 2002). In addition, self-efficacy is future oriented and does not show actual level but perceptions of students. The accuracy of self-beliefs is also important in terms of efficacy judgments. Bandura (1986) noted that people tend to avoid tasks which they believe exceed their abilities and try to handle the tasks which they believe they can perform. This type of behavior will have an important affect on individuals' personal development because when people have high self-efficacy beliefs, they will choose tasks which will develop their abilities, but when they have low self-efficacy beliefs, they will avoid the tasks that will develop their capabilities. Moreover, when the avoidance happens, these individuals will not get any corrective feedback on their efficacy beliefs. Therefore, when self-efficacy perceptions exceed one's actual skill level slightly, it creates no problem and is adaptive. However, when people had unrealistic self-efficacy perceptions about a task that is far beyond their actual skill level, they would suffer from needless failure and their self-efficacy beliefs would also be weakened. On the other hand, when individuals had self-efficacy beliefs which are underestimated grossly, the results would not cause as much avoidance as in overestimation but people will limit their personal development (Bandura 1986). Therefore, self-efficacy beliefs should be in realistic limits. If the required amount of knowledge or skill is absent, self-efficacy beliefs cannot bring the success.

Students' self-efficacy beliefs become more specific and accurate with development. Young students do not differentiate what they can do and cannot do in different domains. They have the general idea of their capabilities of accomplishing tasks (Bandura, 1997). There are several reasons for why the specificity and accuracy of self-efficacy beliefs are developmental. Young students have difficulty in attending different features of a task for a long period of time. Students become able to attend to different features of a task at the same time with development. With development, students also become better with being able to derive evaluations about the difficulty of the task as they have more extensive knowledge base which will help them to understand new information. Moreover, self-evaluation becomes more accurate, students can incorporate their skills at multiple tasks, and skills affecting task performance in comparisons become more important (Schunk & Miller, 2002).

Some research, on the other hand, found that students' self-efficacy beliefs decline with development (Pajares & Valiante, 2002). One of the reasons for this decline is the periods of transition in schooling (Schunk & Pajares, 2002). Elementary school students have the same teacher nearly all day, are grouped with the same peers all day, get a lot of individual attention and feedback, and are graded with criterion-reference grading system. When students start high school, they have many different peers whom they meet in different classes all day and might not get to know. The grading becomes normative, students cannot get much individual attention from the teachers, and high school classes are harder. As a result, students have tooften reassess their self-efficacy beliefs in various domains with this normative grading system in an unfamiliar expanded pool of peers (Schunk & Miller, 2002).

Self-efficacy evaluations might vary as a function of personal and environmental factors although the task is similar. This shows that a student's self-efficacy for a certain task on a given day is changeable due to the student's physical condition such as being sick, affective mood, and external conditions such as the difficulty and length of the task and the general classroom conditions. At the beginning of an activity, individuals have different degrees of self- efficacy because of different personal qualities like abilities, attitudes, past experiences about the same or similar experiences, and social support from people in their environments (Pintrich & Schunk, 2002). As students become involved in the task, they are influenced by personal (e.g., information processing, goal setting) and situational (e.g., rewards, feedbacks of teachers) factors. These factors construct feedback for the progress of the students. If students are experiencing failure or slow progress, that does not necessarily lower the self-efficacy as long as self-efficacy beliefs are resilient (Schunk & Miller, 2002). Individuals may continue to feel efficacious even if they experience difficulties and failures (Bandura, 1997). Students' self-efficacy beliefs are the most resilient when they are gained through personal mastery experiences and these students' failure in a task will be mild to them or infrequent. Students with resilient self-efficacy will evaluate the failure, determine what they did wrong, consider what they should do next time to do better, quickly recover from the effects of the failures, and move on (Bandura, 1994). This is called as bounce-back phenomenon. Bounce-back phenomenon is clearly seen in self-efficacious and highly achieving students (Schunk & Miller, 2002).

Self-efficacy beliefs include some judgments about whether students can or cannot do the task and these beliefs of students are formed by interpreting the information from four sources: mastery experience, vicarious experience, social persuasion, and physiological states (Bandura, 1997). Students participate in tasks, interpret the outcomes of these participations, use these judgments to develop beliefs about their self-capabilities to participate in future tasks, and decide by considering their beliefs. The interpretation of previous experiences is known as mastery experience. Students' own experiences provide the most influential and reliable guides for appraising their self-efficacy compared to the effects of other sources. Successful experiences generally increase self-efficacy and unsuccessful ones generally lower it. The vicarious experience is gained through observing others do task and social comparisons. A student might say to herself, "If she can do it, I should be able to the same." Student who sees similar peers do a task are apt to evaluate that they can do it too. Therefore, similar peers provide the best basis for comparison (Bandura, 1994). Peer influence on self-efficacy becomes increasingly important with development (Steinberg, Brown, & Dornbusch, 1996). However, vicariously provided information is weaker to gauge self-efficacy compared to the mastery experiences. On the other hand, if the prior mastery experiences are limited, student might be very sensitive to vicarious experiences about creating self efficacy. Social persuasion involves verbal or nonverbal evaluations and encouragements provided by others. This rather operates with the other sources of self-efficacy to create students' self-efficacy. Finally, physiological reactions such as feelings of anxiety, stress, and mood states also form information for students' self-efficacy beliefs. The information gathered from these four sources is not directly translated into self-efficacy beliefs. The results of the activities or events are interpreted by individuals and these interpretations construct the information which supports self-efficacy beliefs of individuals. The type of information that individuals select to use in the making of self-efficacy beliefs and the rules applied for weighting and integrating the information, construct the basis of the interpretations. Students appraise their self-efficacy beliefs through the selection, interpretation, integration, and recollection of information from these four resources (Bandura, 1997; Pajares, 2002).

Researchers found a significant correlation among these sources. However, mastery experiences proved to be the strongest and the most consistent determiner of self-efficacy beliefs (Bandura, 1997; Britner, 2008; Britner & Pajares, 2006; Hampton, 1998; Klassen, 2004; Usher & Pajares, 2006). The other sources of self-efficacy information have proved to be less consistent as determiners of self-efficacy beliefs. In a study conducted with 319 middle school science students, Britner & Pajares (2006) searched the correlations among these four sources and self-efficacy for science. The correlation was significant and mastery experiences significantly predicted science (earth, life, environmental, and physical science classes) self-efficacy. The same results were supported by a study conducted with 502 science high school students by Britner (2008). In the same study, in earth and environmental science classes, girls reported stronger self-efficacy and earned higher grades than did boys. Mastery experiences were the only significant determiner of self-efficacy and self-efficacy was the only significant determiner of course grades for both boys and girls in earth and environmental science classes. In life science and physical science classes, the gender differences were more significant. In life science, girls earned higher course grades than did boys. However, girls did not report higher levels of self-efficacy and mastery experiences than did boys. Mastery experiences were not a significant predictor of self-efficacy for girls, as they were for the boys in life science classes. Persuasion was the most significant predictor of self-efficacy here. In physical science classes, girls and boys reported equal self-efficacy and earned equal grades. However, physiological and affective states were the most significant determiner of self-efficacy for the girls.

2.1.1. The Relationship between Self-Efficacy and Science and Chemistry Achievement

In most of the studies, significant positive correlation was found between self-efficacy and academic achievement across different domains such as mathematics, biology, English, reading, writing, educational psychology, accounting, and grade levels (e.g., Bong, 2009; Carroll, Houghton, Wood, Unsworth, Hattie, Gordon, & Bower, 2009; Cheng & Chiou , 2010; Multon, Brown, & Lent, 1991; Pajares, 1996; Pajares, Britner, & Valiante, 2000; Pajares & Miller, 1994; Schunk, 1995; Shell & Husman, 2001). For instance, Bong (2009) found that Korean middle school students' mathematics self-efficacy was positively correlated to their mathematics achievement. In Özkan's (2003) study with 980 10^{th} grade Turkish students, it was found that the students' self-efficacy gave the highest correlation to their biology achievement. In another study, Pajares et al. (2000) found that 497 public middle school students' writing self-efficacy was significantly correlated to their grade point average (GPA) in language arts class. Carroll et al. (2009) also showed in their study with 935 students aged between 11 and 18 years from high schools in Australia, that students' academic self-efficacy had a strong positive direct effect on their English achievement.

Yumuşak, Sungur, and Çakıroğlu (2007), however, failed to find a significant association between biology achievement and self-efficacy for 10^{th} grade Turkish students (n= 519). Güngör, Eryılmaz, and Fakıoğlu (2007) also found in their study with 890 Turkish freshmen taking physics course at the state universities in Turkey that student' self-efficacy beliefs toward physics had nonsignificant relationship with their physics achievement. In addition, Phan (2009) found a nonsignificant relationship between third year Australian educational psychology students' self-efficacy and their academic achievement.

As far as science is concerned, in a series of experimental studies, it was found that science self-efficacy was strongly related to science achievement (Andrew, 1998; Britner & Pajares, 2001, 2006; Kupermintz, 2002; Lau & Roeser, 2002; Pajares, Britner, & Valiante, 2000). Science self-efficacy can be defined as "the perception of ability to undertake science tasks" (Dalgety & Coll, 2006). Lau and Roeser (2002) studied with 491 10^{th} (53 %) and 11^{th} (47 %) grade students who were recruited in chemistry, earth science, biology, or physics classes in a high school in California participated to determine the predictive nature of science competence beliefs and science efficacy on science test scores and science grades.

Science competence beliefs of the students accommodated students' perceived science efficacy for learning the science subjects, test relevant efficacy, and science confidence beliefs. Students' science grades were formed by obtaining their science grades from the science teachers at the end of the school year and standardizing them within classes to adjust for differences in grading between classes. Science test scores were formed by making the students take a science achievement test including multiple choice questions obtained from the National Assessment of Educational Progress and the Third International Mathematics and Science Study. The results of the regression analyses displayed that science competence beliefs and science efficacy were significant positive predictors of the students' science grades and test scores. Pajares, Britner, and Valiante (2000) worked with 281 7^{th} grade students and tried to determine the relationship between the students' science self-efficacy and their GPA as one of the purposes of the study. The students' GPA was determined by using their actual grades in science class. The results of the study revealed that the students' science self-efficacy was significantly correlated to their GPA.

In a recent study, Britner and Pajares (2006) carried out a study in which 319 middle school students from grades 5 to 8 participated. One of the aims of the study was to find out whether or not students' science related efficacy predicted science achievement when other variables that were found to predict the achievement were controlled. Students' self efficacy beliefs were assessed by using a scale adapted from Bandura's Children's Multidimensional Self-efficacy Scales (Zimmerman & Bandura, 1994). Students' science grade self-efficacy was measured with a five-item scale in which students rated their grade (A, B, C, or D) that they are confident to earn in their science class (Bandura, 1997). Students' science GPAs were provided by their teachers at the end of the grading period in which the study was carried out. Regression analyses showed that science self-efficacy was the most consistent predictor of their science grade and achievement. Commonality analysis also showed that self-efficacy could explain the largest share of the unique variance. In a more recent study, Lavonen and Laaksonen (2009) worked with 4,514 Finnish students who were aged between 15 and 16 years. They used students' success on the Program for International Student Assessment (PISA) 2006 as an indicator of the students' achievement. The results of regression analysis revealed that students' science related efficacy was one of the strongest predictors for their performance on PISA.

These aforementioned research shows that the relationship between students' science self-efficacy and their science achievement is usually significant. However, since self-efficacy is task and domain specific, these findings cannot be transferrable into the domain of chemistry. Chemistry self-efficacy can be defined as, parallel to the social cognitive theory, students' perceptions of their "ability to use intellectual skills in chemistry and accomplish laboratory tasks including skills in both cognitive and psychomotor domain" (Çapa Aydın &Uzuntiryaki, 2009). Dalgety and Coll (2006) found in their study with first year New Zealand university chemistry students that self-efficacious students did not feel confident about all aspects of chemistry. In fact, the students felt less confident in high level of skills like tutoring other students or having experimental designs in chemistry. Students' confidence level, on the other hand, was high in summarizing a work from a written chemistry material.

Zusho, Pintrich, and Coppola (2003) conducted a study with 458 college students, mostly freshmen or sophomores recruited in introductory chemistry course in the USA. One of the purposes of the study was to investigate the predictive utility of motivational variables (self-efficacy, mastery and performance goal orientation, and task value) on the semester chemistry course grades with controlling for prior achievements which were Scholastic Aptitude Test (SAT) mathematics scores. The motivational measures were adapted from the Patterns of Adaptive Learning Survey (PALS, Midgley, Maehr, Hruda, Anderman, Anderman, Freeman, Gheen, Kaplan, Kumar, Middleton, Nelson, Roeser, & Urdan, 2000) and the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). Students' semester course achievement was formed by summing the grades obtained from their one quiz and three exams taken in the semester. Results of this study revealed that students' self-efficacy was the best predictor of their chemistry course achievement even after the SAT mathematics scores for prior achievement were controlled.

Taasoobshirazi and Glynn (2009) also found in their studies conducted with 101 undergraduate students whose age was 19.09 in average and who were enrolled in an introductory- level general chemistry course for science majors that self-efficacy was strongly correlated with successful solution of quantitative chemistry problems. On the other hand, Demirdöğen, Uzuntiryaki, and Çapa Aydın, (2009) investigated the predictive utility of students' overall GPA on their chemistry self-efficacy scores in a study with 410 Turkish freshmen from three public universities. Students' chemistry self-efficacy was assessed with the College Chemistry Self-efficacy Scale (CCSS) developed by Çapa Aydın and Uzuntiryaki (2009). The analyses of multiple regression indicated that the students' GPA was not a significant predictor of their chemistry self-efficacy.

Moreover, Uzuntiryaki and Kadıoğlu (2008) conducted a study in which the MSLQ (Pintrich et al., 1991) and achievement test including 25 multiple choice questions about gases and chemical reactions concepts were administered to 359 10th grade Turkish students from three public schools in Turkey. Total number of correct answers obtained from the test for each student formed the achievement score for that student. The results of multiple regression analysis indicated that 10th grade students' self-efficacy beliefs made a positive contribution to and were a significant predictor of their chemistry achievement on the subject of gases and chemical reactions. In another study, Kan and Akbaş (2006) investigated the relationship of students' attitude and self-efficacy to their chemistry achievement. They studied with 819 9th, 10th, and 11th grade students in Turkey. The students' self-efficacy beliefs toward chemistry were assessed with a scale developed by the researchers. The result of regression analysis revealed that students' self-efficacy beliefs toward chemistry, on their own, were a significant predictor of their chemistry achievement. In addition, Uzuntiryaki and Çapa Aydın (2007) conducted a study with 150 10th grade students from public high schools in northern Turkey to search the relationship between students' chemistry self-efficacy for two dimensions, self-efficacy for cognitive skills, and self-efficacy for for laboratory skills, and chemistry achievement which was measured with a chemistry test. The researchers administered Chemistry Self-efficacy Scale (CSES) which was developed by the researchers to assess the students' chemistry self-efficacy for cognitive skills and laboratory skills. The correlational analysis revealed that the relationship between chemistry self-efficacy for cognitive skills and chemistry achievement was significantly positive whereas the relationship between chemistry self-efficacy for laboratory skills and chemistry achievement was not significant.

Based on the research reviewed in this section, it looks clear that self-efficacy has a very important role in student achievement in schools. However, these results may not be applicable in all contexts and situations as educational psychology is not deterministic (Linnenbrink & Pintrich, 2003). Goal orientation is another construct which has been deemed essential for achievement by researchers (e.g. Ames, 1992; Anderman, Austin, & Johnson, 2001; Elliot, 1999; Demirdöğen, et al., 2009; Elliot & Church, 1997; Elliot & McGregor, 2001; Pintrich, 2000a; Pintrich & Schunk, 2002). The next section of the literature review chapter provides information about achievement goal orientations.

2. 2 Achievement Goals

This part of the literature review is divided into two parts: Theoretical background about the achievement goal theory and empirical studies carried out about the predictive utility of achievement goals.

2.2.1 Achievement Goal Theory

Achievement goal theory is located in social-cognitive representation of motivation and has been the focus of many educational researchers for over the past two decades (Anderman & Wolters, 2006; Elliot & McGregor, 2001; Elliot & Murayama, 2008; Pintrich, 2000c). Achievement goals or goal orientations are concerned with the purposes of the achievement behavior (Ames, 1992; Maehr, 1989). Achievement goal defines a combined design of beliefs, attributions, and affect yielding intentions for acts (Weiner, 1986) and is displayed by "different ways of approaching, engaging in, and responding to achievement type activities" (Ames, 1992, p. 261). A certain type of goal adopted was suggested to form a foundation for how individuals portray events and behave in their own achievement interest (Dweck, 1986; Nicholls, 1989). Elliot and Dweck (1988) defined the achievement goal as a cognitive program having behavioral, cognitive, and affective results. According to the goal theorists, behavior is purposeful, intentional, and directed toward accomplishment of specific goals (Pintrich & Schunk, 2002). The important characteristic of an achievement behavior is its perception of competence (Nicholls, 1984). Therefore, the classes of standards that people use to evaluate their competence and the goals adopted in achievement contexts to improve or display competence are the main focus of the achievement goal theory (Ames, 1992; Eccles & Midgley, 1989; Nicholls, 1984).

In achievement goal theory, competence is defined with reference to three standards: absolute, intrapersonal, and normative. The referent absolute refers to that which is necessary for the task itself. Individual's past accomplishment forms the standard intrapersonal, and the performance of others forms the standard normative. Thus, competence might be defined in accord with whether a student adopted becoming an adept in a task (the absolute referent), developing her performance or knowledge entirely (the intrapersonal referent), or accomplishing better than the other students (the normative standard). Since learning something new shows both mastering the task and expanding one's knowledge, the absolute and intrapersonal standards participate jointly and mostly are not distinguishable. Therefore, these standards are treated as jointly in conceptualizing the achievement goals (Elliot & McGregor, 2001, Elliot & Thrash, 2001). Achievement goals are characterized into two distinct types of goals as a function of these standards which are used in definition of competence. These two goals had alternatively been named as: Learning and performance goals (Dweck, 1986; Elliot & Dweck, 1988), task-involvement and ego involvement (Nicholls, 1984), and mastery and performance goals (Ames, 1992; Ames & Archer, 1988). There are some other types of goals which took a great deal of attention of the goal theorists in literature as well. These are work avoidance (Meece, Blumenfeld, & Hoyle, 1988; Nicholls, 1989; Nolen, 1988), extrinsic goals (Midgley, Maehr, Hicks, Roeser, Urdan, Anderman, & Kaplan, 1996; Pintrich & Garcia, 1991), and social goals (Urdan & Maehr, 1995; Wentzel, 1989). In work avoidance goals, individuals try to get away with things by placing as little effort as possible into the task. Individuals with extrinsic goals strive to get a reward or avoid a penalty. In social goals, individuals try to establish or maintain relationships with other people. There are various types of social goals including social approval goals, social status goals, and affiliation goals. Since the focus of the aforementioned goals is not on competence, these goals do not demonstrate the achievement goals. Thus, none of these goals should be taken into consideration as probable contributions to the achievement goal approach (Elliot & Thrash, 2001).

Intrapersonal and absolute competence is the core of mastery goals, whereas normative competence is the center of performance goals. Thus, the center of attraction for the individuals with the mastery goals is task mastery, development of new skills or improvement of competence, on the other hand with performance goals is the display of competence to others or doing better than others (Ames, 1992; Elliot, 1999; Elliot & McGregor, 2001; Elliot & Thrash, 2001). The public recognition that one has outperformed others is important for the individuals with performance goals (Ames, 1992; Meece, Blumenfeld, & Hoyle, 1988). The mastery goals were hypothesized to lead to "mastery" patterns (e.g. persistence at the task when failure is experienced, deep processing of the material, increased amount of enjoyment of the task) whereas the performance goals were hypothesized to lead to "helpless" patterns (e.g. giving up when failure is experienced, surface processing of the material, less amount of enjoyment of the task) in achievement contexts when accompanied by low confidence in ability (Ames, 1992; Elliot & Church, 1997). The empirical data about performance goals gave mixed results. There are some studies supporting this hypothesis for the performance goals that performance goals have only detrimental results when combined with low perceived competence (Butler, 1992; Elliot & Church, 1997; Smiley & Dweck, 1994). However, some studies had results failed to reject this hypothesis for the performance goals (Elliot & Harackiewicz, 1996; Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; Kaplan & Midgley, 1997; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996). On the other hand, the empirical data clearly supports that mastery goals are to be related to positive processes and outcomes (Ames, 1992; Dweck & Leggett, 1988; Harackiewicz, Barron & Elliot, 1999; Nicholls, 1989; Urdan, 1997).

The conflict in the empirical results for the performance goals showed that the performance goals were in need of change (Elliot, 1999). Thereby, a trichotomous framework integrating the contradicting results of the empirical data for the performance goals was proposed by Elliot (1994), Elliot & Church (1997), and Elliot and Harackiewicz (1996). In this framework, the performance goals were divided into two distinct parts as performance-approach and performance-avoidance goals but the mastery goal remained intact (Elliot, 1999). Individuals with mastery goals focus on "the development of competence through task mastery" (Elliot & McGregor, 2001). Individuals with performance-approach goals are oriented toward the accomplishment of competence relative to others whereas individuals with performance-avoidance goals are oriented toward the avoidance of incompetence relative to others (Elliot, 1999).

In achievement goal theory, valence is seen as the other important dimension of competence (Elliot & McGregor, 2001). Competence is valenced in terms of either a positive possibility for a favorable result (i.e. successful achievement) or a negative possibility for an unfavorable result (i.e. unsuccessfulness) (Elliot & McGregor, 2001; Elliot & Thrash, 2001). This difference in how competence is valenced can automatically produce approach and avoidance behavioral preferences (Forster, Higgins, & Idson, 1998). Individuals having high perceptions of competence direct themselves toward accomplishments and acquire approach goals. On the other hand, those with low perceptions of competence bring into due relation to failures and accept avoidance goals (Elliot, 1999; Elliot & McGregor, 2001; Elliot & Thrash, 2001). Mastery goals and performance approach goals were illustrated as “approach” orientations because of trying to accomplish positive possibilities. However, performance-avoidance goals were illustrated as “avoidance” orientations because of trying to avoid negative possibilities. In the trichotomous framework, mastery goals and performance-approach goals differed in how competence is defined. Performance-avoidance and performance-approach goals differed in how competence is valenced and performance-avoidance and mastery goals differed in both how competence is defined and valenced (Elliot, 1999). The research on this trichotomous framework provided a strong support for the distinct nature of each of these three goals (Elliot, 1999; Elliot & Church, 1997; Middleton & Midgley, 1997; Skaalvik, 1997; Vandewalle, 1997).

Elliot (1999) defined an achievement goal as a cognitive demonstration of a competence based probability that a person tries to accomplish. Therefore, conceptual center of achievement goals is the competence, and how competence is defined and valenced form two important dimensions of achievement goals. Thereby, a new 2x2 achievement goal framework was proposed by Elliot and McGregor (2001) to involve each combination of definition and valence dimensions of competence. These combinations of valence and definition of competence leads to four achievement goals: mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals (Elliot, 1999; Elliot & McGregor, 2001). In this new framework, performance-approach and performance-avoidance goals remained unchanged but mastery goals were bifurcated into mastery-approach and mastery-avoidance goals. In this study, the contributions of mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals to 11th graders' chemistry achievement will be investigated.

In 2x2 achievement goal framework, achievement goals include each association of the dimensions; valence, and definition of competence. In the construct of mastery-approach goals, the competence is defined in terms of absolute / intrapersonal standards and valenced positively. Thus, people with mastery-approach goals try to learn, understand, and achieve task mastery or improvement. Mastery-approach goals have positively been connected to success but in a classroom setting in which normative evaluation is used, mastery-approach goals cannot be expected to predict students' achievement in a positive way (Elliot, 1999). The competence is defined in terms of absolute / intrapersonal standards and valenced negatively in mastery-avoidance goals. Individuals who adopted mastery-avoidance goals try not to fail to reach a particular standard of task accomplishment, not to misunderstand the task, not to do it incorrectly, not to forget one has learned or lose their proficiency at a certain task. Typical examples of these students with mastery-avoidance goals would be the perfectionists since they try to avoid making any mistakes or doing anything wrong (Pintrich, 2000b). It was suggested that students having non-optimal motivational tendencies (e.g. fear of failure, low self-determination) might adopt mastery-avoidance goals when they enter into class settings having challenge and intrinsic interest promoted (Elliot & McGregor, 2001). The definition of competence made in terms of normative standards and negative valence is adopted in performance-avoidance goals. Individuals try not to do worse than others, not to look like dumb compared to others, and not to have the lowest grades in class if they adopted performance-avoidance goals. Thereby, performance-avoidance goals have negatively been linked to the exam performance since individuals are trying to avoid a negative possible outcome. Performance-approach goals are positively valenced and defined in accord with normative standards. People with performance-approach goals try to do better than others, be the smartest, beat the others, have the best or highest grades, and be the top student in class (Elliot & McGregor, 2001; Elliot & Thrash, 2001; Pintrich, 2000a). The achievement outcomes of performance-approach goals are variable (Elliot, McGregor, & Gable, 1999; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). In the pursuit of performance-approach goals, individuals might put too much effort to earn their parents' approval or to avoid a punishing situation and end up with a successful accomplishment. Some empirical data supports this probability in which performance-approach goals are linked to positive outcomes (Elliot et al. 1999; Harackiewicz et al. 2002). However, these goals may also produce negative outcomes especially when the student has no intrinsic desire and is trying to avoid a pervasive situation (Elliot, 1999). Although these goals are distinct orientations, research suggested that students might adopt multiple goals in the achievement settings (Harackiewicz, Barron, and Elliot, 1998; Meece & Holt, 1993; Pintrich, 2000b).

What are the factors affecting the adoption of a certain type of achievement goal by an individual? Achievement goal theory suggests that achievement goals are cognitive demonstrations, accessible, and conscious. Thus, they are not personal traits. Goals are assumed to be dynamic states because they are sensitive to contextual and intrapersonal elements (Ames, 1992; Pintrich, 2000b). Within this assumption, competence perceptions and achievement motives are two of the different constructs explaining an important part of the variance of the adoption of achievement goals (Elliot, 1999). In addition, goal structures, entity and incremental beliefs, self-based variables are also presumed to affect the type of achievement goal adopted by an individual.

Competence perceptions are the antecedents for only approach and avoidance goal adoption. In general students with high perceptions of competence tend to adopt approach goals and those with low perceptions of competence tend to adopt avoidance goals. Since high and low perceptions of competence are mutually exclusive, their corresponding approach and avoidance inclinations should also be mutually exclusive. Therefore, it is possible that individuals can be motivated by approach and avoidance dispositions at the same time (Elliot, 1999). When this is the case, a conflict is produced in the process of self-regulation because the attention is drawn by the possibilities which are not compatible. The conflict of goals is another avenue for future researchers (Elliot & Thrash, 2001).

Achievement motives are also viewed to be another antecedent of the achievement goals (Elliot, 1999). Achievement motives (reasons) are stated to be more general and affective, energize the achievement behavior, and direct people toward success or failure. Achievement motives deliver the adoption of achievement goals in an automatic manner and the goals respond to their prime motives as the regulator of achievement outcome. They also stay in touch with the goals throughout the pursuit of the achievement goals (Elliot, 1999; Elliot & Thrash, 2001). The motive of ‘need for achievement’ is an approach motive and directs individuals toward positive outcomes. Thus, it is suggested that this motive causes the possession of mastery approach and performance approach goals since they focus on probabilities of positive outcomes. On the other hand, the motive, fear of failure is an avoidance motive and it directs people toward negative results. It is hypothesized that this motive ends up with the adoption of mastery-avoidance and performance-avoidance goals because of the focus on the possibilities of negative outcomes (Elliot & Church, 1997). However, this last motive can also yield the adoption of performance approach goals because of the wish to avoid failure or rejection can end up with trials to accomplish the task. Thus, the performance approach goals are viewed as more complicated since the outcome of the goal might not always match with its undergirded motive or motives (Elliot, 1999; Elliot & McGregor, 2001).

Goal structure defines the achievement goal which is specifically dominated in a classroom, school, or learning environment because of teachers’ usage of certain type of instructions, evaluation strategies, and grouping practices (Ames, 1992; Kaplan, Middleton, Urdan, & Midgley, 2002). Achievement goal theory suggests that goal structure of an achievement setting may influence an individual’s motivation, cognitive engagement, and success in that environment (Ames & Archer, 1988). A setting can alone create situation-specific worries which in turn cause a selection of certain goals if the setting is strong enough. Individuals can activate the goals before they enter into a certain situation and can have different goals in different situations depending on the characteristics of the situation. Environmental factors can also indirectly affect the adoption of achievement goals by determining the degree to which motivationally related variables are made active or by changing the students' perceptions of competence (Elliot, 1999). For instance, a student who wants to study medicine can adopt performance goals in an organic chemistry class which is used as a filter class for submissions to the medicine school and therefore, a highly competitive course. On the other hand, the same student can have mastery goals in a regular chemistry class since it is not that competitive. However, the variability in the access of achievement goals does not mean that there can be no stability in goal adoption for individuals over time. Some students can generally be in want of learning and thus, these students will be more likely to be mastery oriented across contexts and domains. Some students might be competitive and grade-conscious, and these students are highly possible to adopt performance goals across contexts and domains (Pintrich, 2000a). Goals that are adopted as a product of environmental factors alone are weaker over the course of achievement process compared to the goals having dispositional support (Elliot, 1999).

Elliot and McGregor (2001) found in their study that entity beliefs about the ability (i.e. that ability is unchangeable) were a positive predictor for both mastery-avoidance and performance-avoidance goals but were not a significant predictor for mastery- and performance-approach goals. On the other hand, incremental beliefs about the ability (i.e. that ability is changeable) predicted mastery-avoidance goal orientations negatively but yielded null results for performance approach, mastery-approach, and performance-avoidance goals in the same study.

Self-based variables and relationally-based variables, one example of which could be people's self-efficacy, are also assumed to be antecedents of the achievement goals (Elliot, 1999). The relationship between achievement and interest is mediated by self-efficacy and the achievement ends with higher self-efficacy which consequently leads to stronger academic goals (Lapan, Shaughnessy & Boggs, 1996). Students with intrinsic goal orientations are likely to interpret the feedback in favor of their progress, hence grow their self-efficacy (Pintrich & Schunk, 2008). Mastery goals were found to be positively correlated to self-efficacy in many studies (Demirdöğen, Uzuntiryaki, & Çapa Aydın, 2009; Meece, Blumenfeld, & Hoyle, 1988; Midgley, Kaplan, Middleton, Maehr, Urdan, Anderman, Anderman, & Roeser, 1998; Roeser, Midgley, & Urdan,1996; Taş, 2008; Wolters 2004; Wolters & Rosenthal, 2000). In one study, Bong (2009) searched the correlation between 512 Korean middle school students' self-efficacy toward mathematics and the achievement goals in 2x2 framework. The MSLQ (Pintrich et al. 1991) was administered to assess the students' self-efficacy beliefs and the PALS (Midgley, Maehr, Hicks, Roeser, Urdan, Anderman, and Kaplan, 1996) were used to assess the student's achievement goal orientations. The correlations showed that mastery-approach and performance-approach goals were significantly correlated to students' mathematics self-efficacy whereas performance-avoidance and mastery-avoidance goals were not. If academic task specific goals are adopted by individuals, then the individuals' self-efficacy is supposed to have direct effect on their achievement goals (Wigfield, 1994). In another study, Taş (2008) found that 1950 7^{th} grade Turkish students' self-efficacy had a significant positive relation to their performance-approach and mastery goals. Thus, students who had higher efficacy also had higher levels of performance-approach and mastery goals. Moreover, demographic factors (e.g. gender, socioeconomic status, or socio-cultural background) are also considered to be antecedents of the achievement goals (Elliot, 1999; Urdan, 1997).

2.2.2 Empirical studies about the predictive utility of achievement goals on the exam performance

There are many studies conducted about achievement goals but most of them are based on the trichotomous and dichotomous models. Among all the four goals, mastery-avoidance goals are the least studied type of goals in literature as it was recently introduced to the achievement goal literature (Elliot & McGregor, 2001). The achievement goals are considered as the proximal predictors of achievement outcomes (Elliot & Sheldon, 1997; Elliot, 1999). However, there are different empirical findings about this in literature. An overview of the empirical works follows.

The greater number of studies using the trichotomous model found that performance-approach goal is a positive predictor, performance-avoidance goal is a negative predictor, and mastery goal orientation is not a significant predictor of college level academic achievement (e.g. Elliot & Church, 1997; Elliot & McGregor, 1999; Elliot, McGregor & Gable, 1999). However, in a study conducted by Church, Elliot, and Gable (2001) by using the trichotomous model, all three achievement goals (mastery, performance-approach, and performance-avoidance) yielded a significant prediction on undergraduate chemistry students' graded performance. In this study, 297 students participated and the mean age of the students was 19.2 (ranging from 17 to ≥ 26). Graded performance for the students was students' final scores procured from the chemistry course professor at the end of the semester. The results of multiple regression showed that performance-approach goals were a positive significant predictor of the graded performance, and so were mastery approach goals. In addition, performance-avoidance goals were a negative significant predictor of students' exam grades.

In Wolter's study (2004) using the trichotomous framework, the purpose was to predict the mathematics course grades of the students by using the goals: performance-approach, performance-avoidance, and mastery (approach). There were 525 7^{th} and 8^{th} grade American students with a mean age of 13.2. The results showed that performance-approach goals were a positive significant predictor of the students' mathematics course grades but performance-avoidance and mastery orientations were not. The results were similar in a study with 458 introductory college chemistry students in the USA conducted by Zusho, Pintrich, and Coppola (2003). One of the purposes of this study was to predict the students' chemistry course grades by using the students' self-report answers regarding mastery and performance goals on the MSLQ (Pintrich et al. 1991). Students' chemistry course grades were determined by summing their quiz score and test scores. The tests included both open-ended and close-ended (multiple choice) questions. The results of the study displayed that none of the goal orientations were significant to predict the students' chemistry course grade points. Taş (2008) searched the relationship between 7^{th} grade students' mastery goals, performance-approach and avoidance goal orientations and science achievement. She worked with 1750 Turkish students. Taş assessed the students' goal orientations by administering Turkish version of the PALS (Midgley et al. 2000) which was adapted into Turkish by the researcher.

However, Taş (2008) found that performance-avoidance goals had a low reliability in this process and thus, omitted this goal orientation from her study. Students' science achievement was measured with a 15-item multiple choice test. The study revealed that students' mastery goals yielded positively significant relation to their science achievement but performance-approach goals yielded insignificant relation.

In another study carried out by Yumuşak (2006) using the MSLQ, the contributions of the intrinsic (mastery) and performance goals to the prediction of 10^{th} grade students' biology achievement in Turkey were investigated. The sample included 2825 students with the mean age of 16.4 years in the study. The study concluded that performance goals negatively predicted the students' biology achievement, whereas mastery goals failed to predict the achievement. Yumuşak, Sungur, and Çakıroğlu (2007) worked with 519 10^{th} grade Turkish students from public schools and aimed to search the contributions of intrinsic (mastery) and extrinsic goal orientations to the students' biology achievement. A 20-item multiple choice biology test including the subjects of 9^{th} grade biology curriculum was developed by the researchers by selecting the items of the test from the standardized tests which were used in previous years to recruit the students into the universities in Turkey and this test was administered to evaluate the students' biology achievement. The MSLQ was also used to assess the students' goal orientations in this study. The researchers' findings were consistent with the results of Yumuşak's study (2006) in which the students' intrinsic (mastery) goal orientations failed to make a statistically significant contribution to their biology achievement whereas the students' extrinsic goal orientation made a statistically significant contribution. Kadıoğlu &

Uzuntiryaki (2008) tried to determine the predictive utility of intrinsic (mastery) and extrinsic goal orientations on students' chemistry achievement in gases and chemical reactions in a study with 359 10th grade Turkish students from public high schools. Students' goal orientations and chemistry achievement in gases and chemical reactions were assessed by Turkish version of the MSLQ and 25-item test formed of multiple choice questions about the gases and chemical reactions respectively. The researchers, on the other hand, found that Turkish students' intrinsic (mastery) goal orientation was a significant predictor of their chemistry achievement in gases and chemical reactions as a result of regression analysis.

As far as 2 x 2 achievement goal framework is concerned, Elliot and McGregor (2001) studied with 182 undergraduates in an introductory level psychology class in the USA to investigate the predictive utility of the four achievement goals. In this study, overall exam performances formed of multiple choice performance and short-answer/essay performance of the students were regressed on the goals. Regression analyses revealed that performance-approach goals were a significant positive predictor of exam performance, while performance-avoidance goals were a significant negative predictor of the exam performance when SAT scores were controlled. Mastery-approach and avoidance goals were not significant in predicting the exam performance.

The study conducted by Finney, Pieper, and Barron (2004) to investigate the predictive utility of the achievement goals in 2x2 framework, on the other hand, indicated different results. This study was conducted in a general academic context rather than in a course-specific context and included 2,014 freshman students in the

USA with the mean age of 18.5 years. Students' GPA scores were used as the general academic outcome. Mastery-approach goals were a positive significant predictor of students' GPA when SAT scores and each of the other goal orientations were controlled. Performance-avoidance goals were a negative significant predictor of students' semester GPA when SAT scores and each of the other goal orientations were controlled. Mastery-avoidance and performance-approach goals produced non-significant results. The overall amount of variance explained in GPA was 7 %. However, the unique variance explained by each goal orientation was less than 1 %.

Review of the empirical studies regarding the achievement goals suggests that the relation between each of the four goal orientations in the goal theory and the achievement is not consistent across different grades and nationalities of students. There also are not many studies conducted to investigate the predictive utility of four achievement goals in 2x2 framework and majority of the studies on this area was conducted at college level (Finney et al. 2004). Thereby, the present study will be important as it has the capacity to shed light on the predictive utility of the four achievement goals on 11^{th} grade Turkish students' chemistry achievement.

CHAPTER 3

PROBLEMS AND HYPOTHESES

This chapter includes the purpose, research questions, hypotheses of the study, and definitions of important terms used in this study.

3.1 The Main Problem

The main purpose of this study was to investigate the contributions of 11^{th} grade state high school Turkish students' chemistry self-efficacy beliefs for cognitive skills, self-efficacy for chemistry laboratory, mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals to their 11^{th} grade chemistry achievement.

3.1.1 Research Questions

1. What is the contribution of 11^{th} grade state high school Turkish students' chemistry self-efficacy beliefs for cognitive skills to their chemistry achievement?

2. What is the contribution of 11^{th} grade state high school Turkish students' self-efficacy beliefs for chemistry laboratory to their chemistry achievement?

3. What is the contribution of 11^{th} grade state high school Turkish students' chemistry mastery-approach goals to their chemistry achievement?

4. What is the contribution of 11th grade state high school Turkish students' chemistry mastery-avoidance goals to their chemistry achievement?

5. What is the contribution of 11th grade state high school Turkish students' chemistry performance-approach goals to their chemistry achievement?

6. What is the contribution of 11th grade state high school Turkish students' chemistry performance-avoidance goals to their chemistry achievement?

3.2 Null Hypotheses

H_0 1: There is no significant contribution of 11th grade state high school Turkish students' chemistry self-efficacy beliefs for cognitive skills to their chemistry achievement.

H_0 2: There is no significant contribution of 11th grade state high school Turkish students' self-efficacy beliefs for chemistry laboratories to their chemistry achievement.

H_0 3: There is no significant contribution of 11th grade state high school Turkish students' chemistry mastery-approach goals to their chemistry achievement.

H_0 4: There is no significant contribution of 11th grade state high school Turkish students' chemistry mastery-avoidance goals to their chemistry achievement.

H_0 5: There is no significant contribution of 11th grade state high school Turkish students' chemistry performance-approach goals to their chemistry achievement.

H_0 6: There is no significant contribution of 11^{th} grade state high school Turkish students' chemistry performance-avoidance goals to their chemistry achievement.

3.3 Definitions of Important Terms

Motivation: "Process whereby goal-directed activity is instigated and sustained" (Pintrich & Schunk, 2002, p. 5).

Achievement Goals: The reasons for engaging in an achievement task (Maehr, 1989). The achievement goal framework is formed of mastery-approach goal, mastery-avoidance goal, performance-approach goal, and performance-avoidance goal (Elliot & McGregor, 2001).

Mastery-approach goals: Goals which are set to learn, understand, and achieve task mastery or improvement (Elliot, 1999).

Master-avoidance goals: Goals which are set not to fail to reach a particular standard of task accomplishment, not to misunderstand the task, not doing it incorrectly, not to forget one has learned or lose their proficiency at a certain task (Elliot & McGregor, 2001).

Performance approach goals: Goals which are set to accomplish competence relative to others (Elliot, 1999).

Performance-avoidance goals: Goals which are set to avoid incompetence relative to others (Elliot, 1999).

Self-Efficacy: “People’s judgments of their capabilities to organize and execute courses of action required to attain designated type of performances” (Bandura, 1986, p.391).

Chemistry self-efficacy for cognitive skills (CSCS): “Students’ beliefs in their ability to use intellectual skills in chemistry” (Çapa Aydın & Uzuntiryaki, 2009, p. 872).

Self-efficacy for chemistry laboratory (SCL): “Students’ beliefs in their ability to accomplish laboratory tasks including skills in both cognitive and psychomotor doamain” (Çapa Aydın & Uzuntiryaki, 2009, p. 872).

Achievement: How well the student does on standardized tests or grades earned (Pintrich & Schunk, 2002).

CHAPTER 4

METHODOLOGY

This chapter is to give thorough information about the methodology used to reach the purpose of the study. The chapter is divided into seven parts: Design of the study, sample of the study, instrumentation, analyses of the study, variables in the study, and finally, assumptions and limitations of the study.

4.1 Design of the study

The overall design of this study is correlational. The aim of correlational studies is to explore relationships among variables or to predict a score on a variable by these relations without any manipulation. Correlational studies do not suggest a cause and effect relationship, instead, they only set the relationship between two or more variables (Fraenkel & Wallen, 2005). In the present study, in an attempt to investigate how well 11^{th} grade Turkish students' chemistry self-efficacy for cognitive skills and laboratory skills, mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals predicted their chemistry achievement, simultaneous multiple regression analysis was used.

4.2 Sample of the study

The target population of the study is all 11th grade students in public high school students in Çankaya district of Ankara. The sample in this study included 604 students (343 females and 261 males) from seven different general public high schools in Çankaya. The convenient sampling method was used in choosing the schools from a total of 18 public high schools in Çankaya district. Participation was voluntary. The students were informed about the study, given the necessary directions about answering the items of the instruments, requested to co-operate with the researcher by being honest in answering the items of the scales and tests, and that their answers would be held confidential and not influence their school grades in any way.

4.3 Instrumentation

Three instruments were used in the study to collect the data: High School Chemistry Self-efficacy Scale (HCSS), Achievement Goal Questionnaire (AGQ), and Chemistry Achievement Test (CAT).

4.3.1 High School Chemistry Self-Efficacy Scale (HCSS)

High School Chemistry Self-efficacy Scale was developed by Çapa Aydın and Uzuntiryaki (2009). The scale assessed students' chemistry self-efficacy beliefs in two dimensions: Chemistry self-efficacy for cognitive skills (CSCS) and self-efficacy for chemistry laboratory (SCL). The content validation of the scale was met by having a group of experts in chemistry, chemistry education, educational psychology, and educational measurement review the items of the scale. In addition, an expert in Turkish examined the items in terms of grammar and readability. Several confirmatory factor analyses were conducted to test the two-factor structure of the scale and to examine factorial invariance accross different school types. The results of the analyses revealed an adequate fit to the data. The final form of the scale was composed of 10 items (item no: 1, 2, 5, 6, 8, 9, 10, 11, 13, 14) for the CSCS and 6 items (item no: 3, 4, 7, 12, 15, 16) for the SCL, making 16 items in total (see Appendix A). It was a self-report questionnaire and students rated on a 9-point scale in which 1 responded to "very poorly" and 9 responded to "very well." The higher the mean value of the scores meant the higher the CSCS and SCL for a student. There were no reverse items in the scale. The Cronbach alpha coefficients for internal consistency of scores were .90 for the CSCS dimension and .92 for the SCL dimension.

4.3.1.1 The validity and reliability of the HCSS for the current study

Confirmatory Factor Analysis (CFA) was conducted to examine the two-factor structure of the scale by using Analysis of Moment Structures (AMOS) 7.0 (Arbuckle & Wothke, 2006). The Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) with 90 % confidence intervals were used to determine the fit indices of the scale. The values of the NNFI and CFI should be higher than .90 for a good fit of the scale (Bentler, 1992; Kline, 1998). In this study, the value of NNFI was found as .89 and the value of CFI was .92 (see the Appendix F for a full output). The values of NNFI and CFI suggested marginally adequate fit of the two-factor model to the data. The values of RMSEA between .08 and .10 show a mediocre fit to the data and those higher than

.10 show a poor fit to the data (MacCallum, Browne, & Sugarawa, 1996). In this study, the value of RMSEA was found as .086 with 90 % confidence intervals of .079 - .093 and showed a mediocre fit. The factor loadings should be higher than .30 in order to be significant (Pallant, 2001). All the factor loadings were higher than .30 and therefore, were significant (see the Figure 4.1). The analyses of reliability showed that the values of Cronbach's alpha for CSCSC and SCL were .85 and .95, respectively, indicating high internal consistency among the items of the scales (Kline, 1999, as cited in Field, 2005).

In conclusion, the HCSS showed an adequate evidence for the factorial validity and reliability of the CSCS and SCL regarding the sample of this present study.

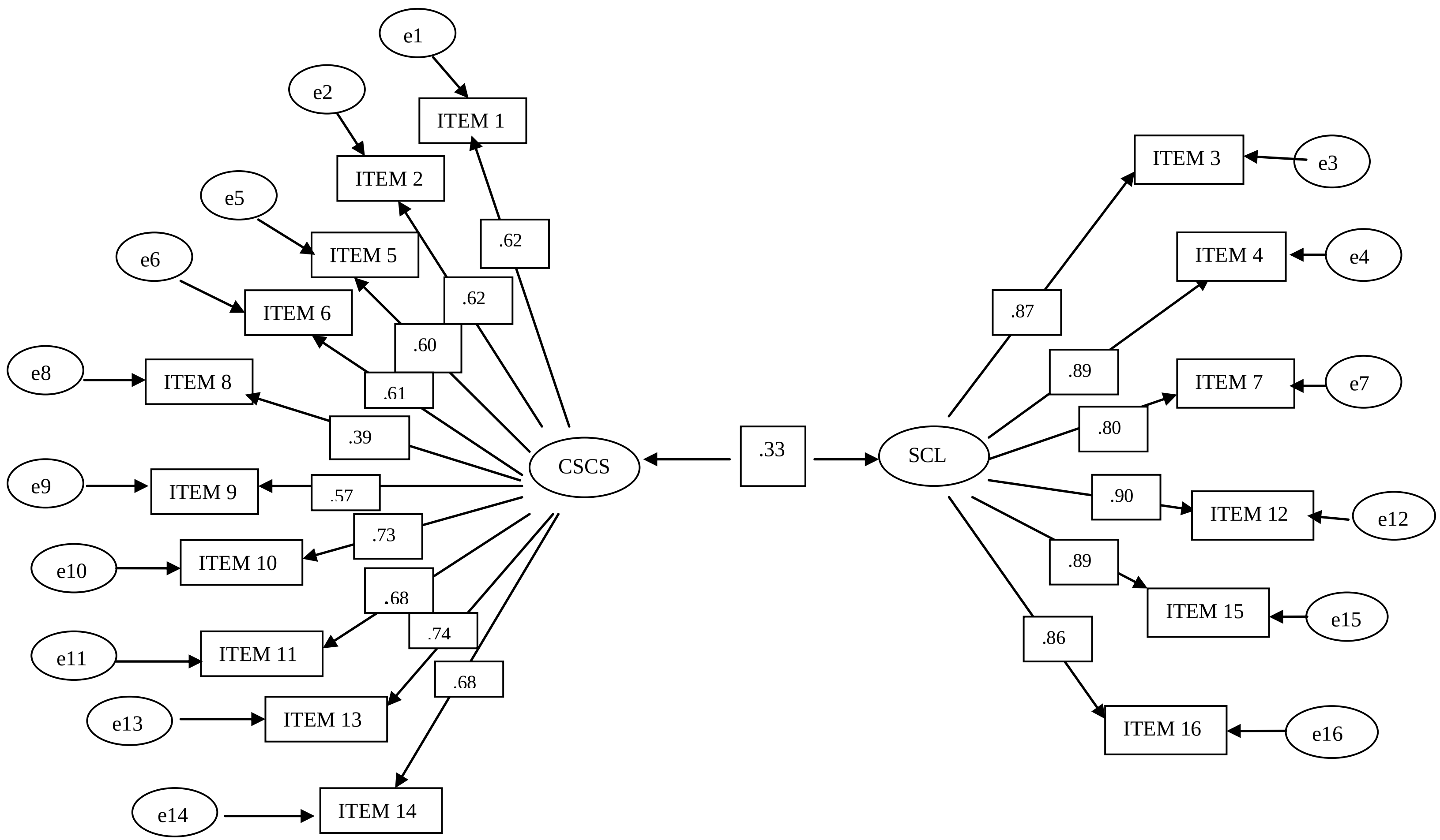


Figure 4.1 CFI of HCSS

CSCS: Chemistry self-efficacy for cognitive skills, SCL: Self-efficacy for chemistry laboratory. All coefficients were significant at ρ < .05. $\chi^2 = 561.23$, df = 103.

4.3.2 Achievement Goal Questionnaire (AGQ)

The Achievement Goal Questionnaire was developed by Elliot and McGregor (2001) for the purpose of assessing students' mastery-approach (items 1, 6, and 8), mastery-avoidance (items 11, 12, and 14), performance-approach (items 3, 4, and 10), and performance-avoidance (items 2, 5, 7, 9, 13, and 15) goals. The instrument was a self-report questionnaire which was a 5-point scale from 1 (never) to 5 (always) and there were no reverse items in the scale. A student's achievement goal score for a specific dimension of the goals was determined by taking the mean of the scores on the items belong to that achievement goal dimension. The higher the mean value for a dimension of achievement goals meant the higher the orientation toward that dimension.

The instrument was adapted into Turkish to by Şenler and Sungur (2007) (see appendix B). CFA was conducted to validate the factor structure of the AGQ. In general, the results of the analysis yielded a good model fit for the achievement goals dimensions. Conbach's alpha coefficients were used to determine the internal consistency of the instrument. The cronbach's alpha coefficients for the subscales were: .84 for the mastery-approach goals, .70 for the mastery-avoidance goals, .68 for the performance-approach goals, and .73 for the performance-avoidance goals. The cronbach's coefficients were suggested to be satisfactory to conduct further studies by using all the dimensions of the achievement goals.

4.3.2.1 The validity and reliability of the AGQ for the current study

CFI, NNFI, and RMSEA with 90 % confidence intervals were used to determine the factorial validity of the model. The value of NNFI was found as .89 and the value of CFI was .92. The values of NNFI and CFI suggested marginally adequate fit of the two-factor model to the data (Bentler, 1992; Kline, 1998). The value of RMSEA was found as .067 with 90 % confidence intervals of .059 - .075 and showed a good fit (MacCallum, Browne, & Sugarawa, 1996). All the factor loadings were higher than .30 and therefore, were significant (see the Figure 4.2). The analyses of reliability showed that the values of Cronbach’s alpha for mastery-approach, performance-approach, mastery-avoidance, and performance-avoidance goals were .79, .77, .75, and .78 respectively which indicates high internal consistency among the items of the scales (Kline, 1999, as cited in Field, 2005).

In conclusion, the AGQ showed an adequate evidence for the factorial validity and reliability of the mastery-approach, performance-approach, mastery-avoidance, and performance-avoidance goals regarding the sample of this present study.

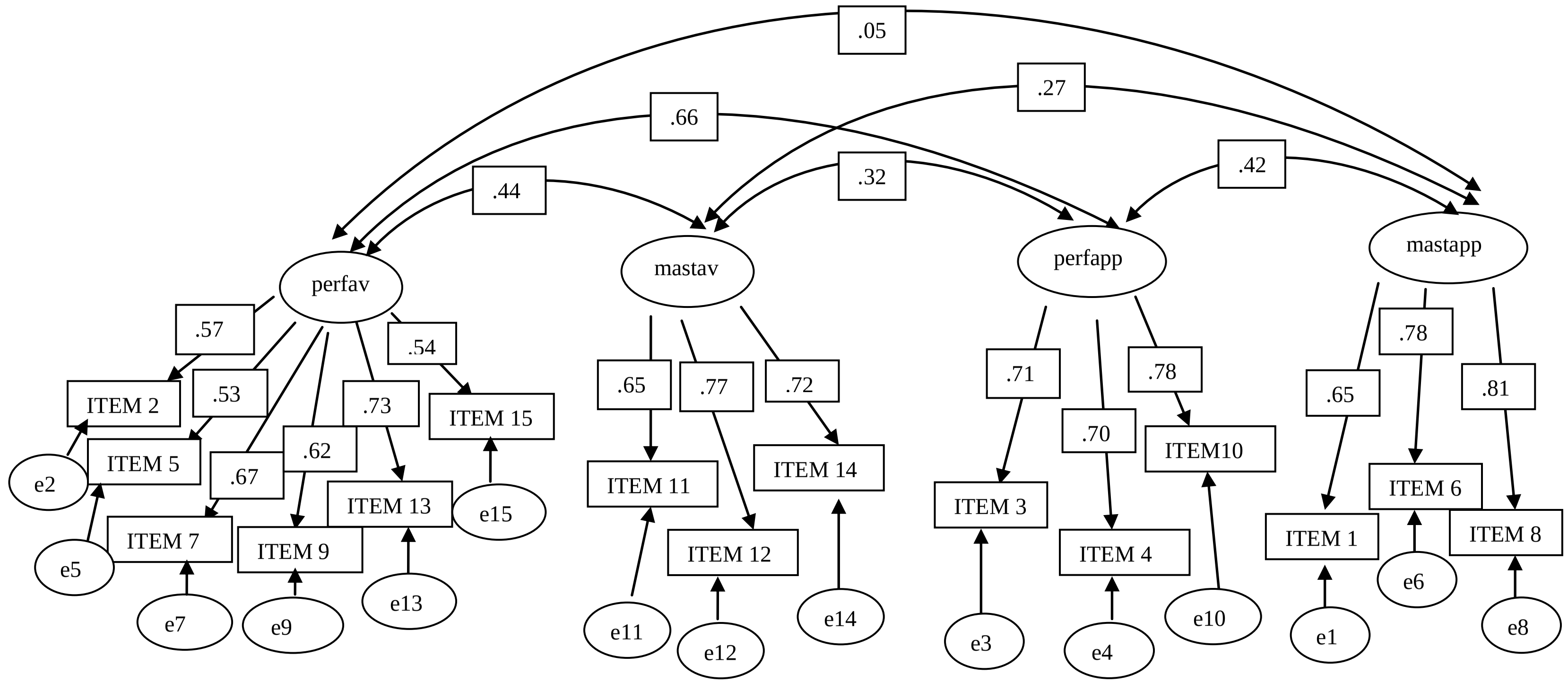


Figure 4.2 CFI of AGQ

perfav: Performance-avoidance goals, mastav: mastery-avoidance goals, perfapp: Performance-approach goals, mastapp: Mastery-approach goals. All coefficients were significant at $\rho < .05$. $\chi^2 = 308.09$, $df = 84$.

4.3.3 Chemistry Achievement Test (CAT)

The researcher of the current study developed the test in order to assess students' chemistry knowledge on the chemistry topics of 11^{th} grade by considering the objectives of national chemistry curriculum for 11^{th} grade students. The test included 33 multiple-choice items on the following subjects: Rate of chemical reactions, chemical equilibrium, solubility equilibrium, acids and bases, and electrochemistry.

During the development of the test, firstly a pool of multiple choice questions (152 items) about the units included in 11^{th} grade chemistry curriculum was generated by examining the chemistry curriculum of the Ministry of National Education (MNE) for 11^{th} graders, university entrance exams, chemistry textbooks (Akbulut, Genç, Güvenç, Üstünışık, Eroğlu, Gerçeker, Kınayoğlu, & Yazıcıoğlu, 2007; Arık, Ülker, & Polat, 2002; Russo & Silver, 2007), master's and doctoral theses conducted in universities (e.g., Balcı, 2006; Bozkoyun, 2004; Kılavuz, 2005; Önder, 2006; Pabuçcu, 2008; Tamer, 2006), and with the help of the researcher's teaching experience. Then, questions were selected from the pool according to measuring different Bloom's learning domains in solving the questions and the weight of the units in the curriculum. Each item in the achievement test was reviewed by four experts in chemistry education and the suggested changes were carried out regarding the content and face validity of the test. Table 4.1 presents the total number of items for each topic. In addition, Appendix D shows instructional objectives and Appendix E presents table of specifications of the CAT.

Table 4.1 Number of questions in CAT with respect to corresponding chapters

Titles of the chapters in 11th grade chemistry curriculum	Number of questions in the CAT
Rates of Chemical Reactions	7
Chemical Equilibrium	8
Solubility Equilibrium	4
Acids and Bases	8
Electrochemistry	8

In the pilot study, the test with 35 items was administered to 233 12th grade students. The purpose of the pilot study was to determine the duration that should be given the students to complete the test, understandability level, and discrimination power of the questions. During the administration, no issues were encountered regarding the understandability of the questions and it was seen that one class period (40-45 minutes) was enough to complete the test by the students.

ITEMAN program was run to analyze the items of the test and check the test reliability. In the ITEMAN analysis, the Biserial index provides information about the item discrimination power. Item discrimination power refers to how good the item discriminates between the students who did well on the test and who did not (Crocker, 2006). The index should be equal or higher than .20 (Crocker & Algina, 1986). Two items (item 10 and 26) did not meet this criterion and they were removed from the test since the objectives of these two items were already met in the other items in the test. The final version of the CAT included 33 items (see the appendix C). The alpha reliability coefficient was found to be .88 for the test.

4.4 Analyses of the study

In an effort to investigate the contributions of 11^{th} grade Turkish students' chemistry self-efficacy for cognitive skills, self-efficacy for chemistry laboratory, mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals to their chemistry achievement, simultaneous multiple regression analysis was conducted by using the PASW (Predictive Analytics SoftWare) Statistics 18. The outcome variable of the study was the CAT achievement and the predictor variables were the CSCS, SCL, mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals of the students. The criterion for the significance of the statistics was held as .05 in all analyses conducted in the current study. Confirmatory factor analyses of the scales in the study were performed by using the Analysis of Moment Structures (AMOS) 7.0 (Arbuckle & Wothke, 1999).

4.5 Variables in the Study

The current study included one dependent and six independent variables (predictors) overall. Dependent variable was students' 11^{th} grade chemistry achievement measured by CAT. Independent variables were chemistry self-efficacy for cognitive skills (CSCS), self-efficacy for chemistry laboratory (SCL), mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals. These variables were assessed by using HCSS and AGQ.

4.6 Assumptions and limitations of the study

4.6.1 Assumptions

The assumptions given below were assumed for the purpose of the current study:

1. The instruments were assumed to be administered under the standard conditions.
2. The students' answers on the instruments were assumed to be sincere.

4.6.2 Limitations of the study

The study was limited to the followings:

1. A convenient sampling method was chosen for the study. Thus, the sample might not be the representative of the population and the results of the study might not be generalized to all 11^{th} grade public high school students in Turkey.

2. Self-report scales were administered to measure the students' self-efficacy beliefs goal orientations. These self-report scales might not be sufficient enough to picture the students' actual beliefs.

3. Since this study concentrated on chemistry domain, the findings might not be generalized to other domains.

4. Because the sample of this study was 11^{th} grade students, the findings of the study might not be generalized to the other grades of students.

5. The CAT included multiple choice questions in this study. Some students might guess the answer on an item without meeting the objectives of the item. In such a situation, the CAT might not provide accurate results for those students.

6. Students might have different self-efficacy beliefs and achievement goals depending on the features of the instructor and instructions. In this study, such characteristics of the learning environment were not considered.

CHAPTER 5

RESULTS

This chapter was formed of four sections: Descriptive statistics of the study, assumptions of simultaneous regression analysis, results of simultaneous regression analysis, and summary of findings.

5.1 Descriptive Statistics of the Study

Descriptive statistics regarding students' mean value of the total scores gained on the chemistry achievement test (CAT), chemistry self-efficacy for cognitive skills (CSCS), self-efficacy for chemistry laboratory (SCL), mastery-approach subscale, mastery-avoidance subscale, performance-approach subscale, and performance-avoidance subscale are presented in table 5.1.

Students' achievement on the CAT was moderate since the mean value for the students' CAT scores (M) was .49 with the standard deviation (SD) of .15. Students reported high levels of mastery-approach goals (M = 4.09, SD = .78) and performance-approach goals (M = 3.57, SD = .99). Students reported moderate levels of CSCS (M = 5.42, SD = 1.32), mastery-avoidance goals (M = 2.92, SD = .96), and performance-avoidance goals (M = 2.82, SD = .86). Moreover, the values of skewness and kurtosis for each variable were around zero, indicating a normal distribution for that variable as suggested by Tabachnick and Fidell (2007).

Table 5.1 Descriptive statistics of the study

	mast_app	mast_avoid	perf_app	perf_avoid	SCL	CSCS	CAT
Mean	4.09	2.92	3.57	2.82	3.52	5.42	.49
Median	4.00	3.00	3.67	2.83	3.00	5.50	.48
Mode	5.00	2.33	4.00	2.67	1.00	5.20	.45[a]
Std. Deviation	.78	.96	.99	.86	2.29	1.31	.15
Skewness	-.79	.09	-.48	-.01	.54	-.06	-.18
Kurtosis	.30	-.32	-.42	-.51	-.92	-.01	-.43
Range	4.00	4.00	4.00	4.00	8.00	9.00	.85
Minimum	1.00	1.00	1.00	1.00	1.00	1.00	.06
Maximum	5.00	5.00	5.00	5.00	9.00	10.00	.91

a. Multiple modes existed. The smallest value was shown. N=604

mast_app: the mean of the total scores gained on the subscale of mastery-approach goals.

mast_avoid: the mean of the total scores gained on the subscale of mastery-avoidance goals.

perf_app: the mean of the total scores gained on the subscale of performance-approach goals.

perf_avoid: the mean of the total scores gained on the subscale of performance-avoidance goals.

CSCS: the mean of the total scores gained on the subscale of CSCS.

SCL: the mean of the total scores gained on the subscale of SCL.

CAT: the mean value of the mean of the total scores obtained from the CAT.

5.2 Assumptions of Simultaneous Regression Analysis

Assumptions of the simultaneous regression analysis were tested before running the analysis. The assumptions tested were: Sample size, multicollinearity, outliers, normality, linearity, homoscedasticity, and independence of residuals (Tabachnick & Fidell, 2007).

The assumption of the required sample size was tested by using the formula "N > 50 + 8m," where m stands for the number of independent variables and N for the sample size (Tabachnick & Fidell, 2007). According to this formula, the minimum number of participants required in this study was 98 for 6 independent variables. In the present study, the number of students participated was 604, which was satisfactory for this assumption.

Multicollinearity happens when high relationships are observed among the independent variables. In order to test this assumption, Pearson correlation coefficients between two independent variables and variance inflation factor (VIF) and tolerance values were calculated. The value of Pearson correlation between two independent variables should not be higher than .90. The value of VIF should not be higher than 4 and tolerance should not be smaller than .20 (Tabachnick & Fidell, 2007). Table 5.2 presents the values of VIF and tolerance and Table 5.3 shows the values of Pearson (bivariate) correlations between the independent variables in this study. As seen in the Table 5.2, none of the variables had a value of VIF higher than 4 and tolerance less than .20. Additionally, none of the variables had a Pearson correlation higher than .90. These results indicated that the assumption of multicollinearity was met in this study.

Table 5.2 Tolerance and VIF values of the independent variables

Independent Variables	Tolerance	VIF
mast_app	.73	1.37
mast_avoid	.82	1.22
perf_app	.62	1.63
perf_avoid	.65	1.53
eff_lab	.88	1.13
eff_cog	.72	1.38

Table 5.3 The bivariate correlations between the independent variables

Variables	1	2	3	4	5	6
1. mast_app	1.000					
2. mast_avoid	.227	1.000				
3. perf_app	.341	.264	1.000			
4. perf_avoid	.047	.348	.509	1.000		
5. eff_lab	.023	.000	.090	.074	1.000	
6. eff_cog	.385	-.020	.252	-.024	.310	1.000

Outliers were described as the standardized residual values fell outside the range of – 3.3 - + 3.3 (Tabachnick & Fidell, 2007). The range of the standardized residual values in this study was – 2.79 - + 2. 63 and indicated that there were no outliers in the study. Another way to test the outliers was using the Mahalanobis distances. The critical chi-square value for six independent variables at the alpha level of .001 was 16.82 (Tabachnick & Fidell, 2007). When the Mahalanobis distances were examined, one outlier was identified. When the outlier was excluded from the study, it was seen that the findings of the study did not significantly differ. For that reason, the outlier was kept in the study.

In order to check the assumption of normality, normal probability plot (P-P) of the regression standardized residuals and the histogram were investigated. As seen in Figure 5.1, the histogram gave a symmetric and bell-shaped distribution which was an indicator of normal distribution or normality. In the P-P plot, there should be minor deviations of the cases from the diagonal line. As seen in figure 5.2, the points lay along the diagonal line in a reasonable manner and thus, indicated no important deviations from normality (Tabachnick & Fidell, 2007).

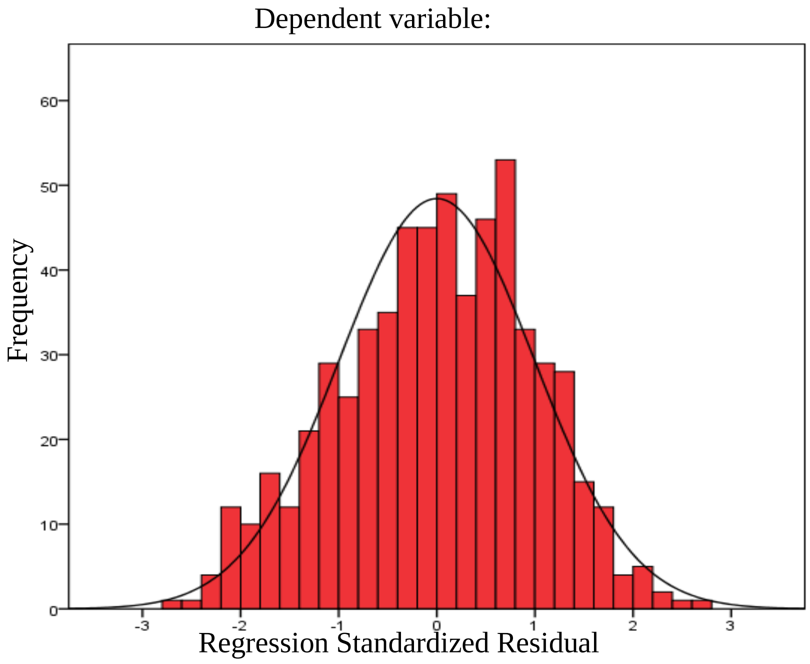


Figure 5.1 Histogram for the CAT

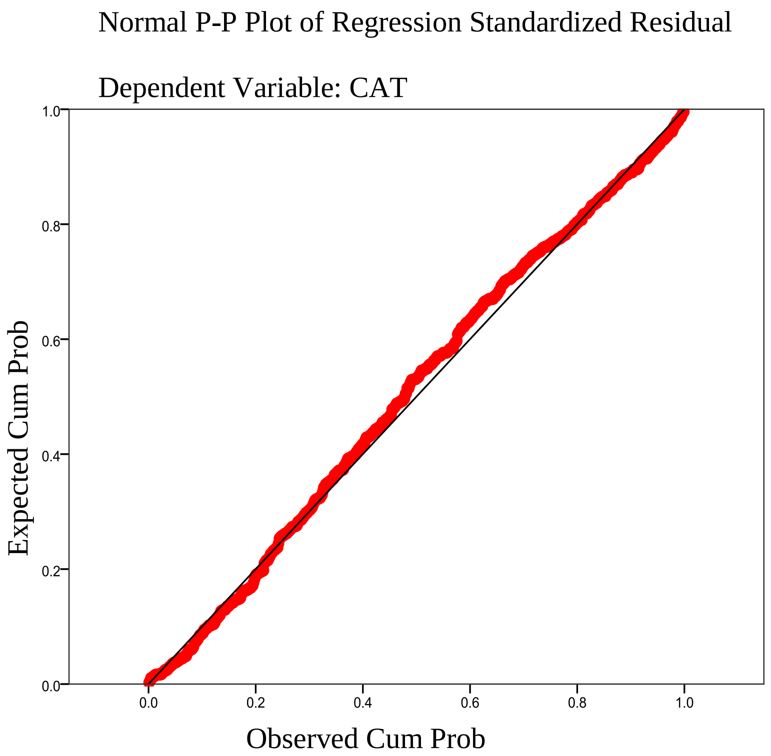


Figure 5.2 Normal Probability Plot for the CAT

The assumptions of linearity and homoscedasticity were tested by using the scatter plot of the standardized residuals. As the distribution of the residuals was reasonably rectangular and most of the scores were collected in the center (see Figure 5.3), the assumptions of linearity and homoscedasticity were met in this study (Tabachnick & Fidell, 2007).

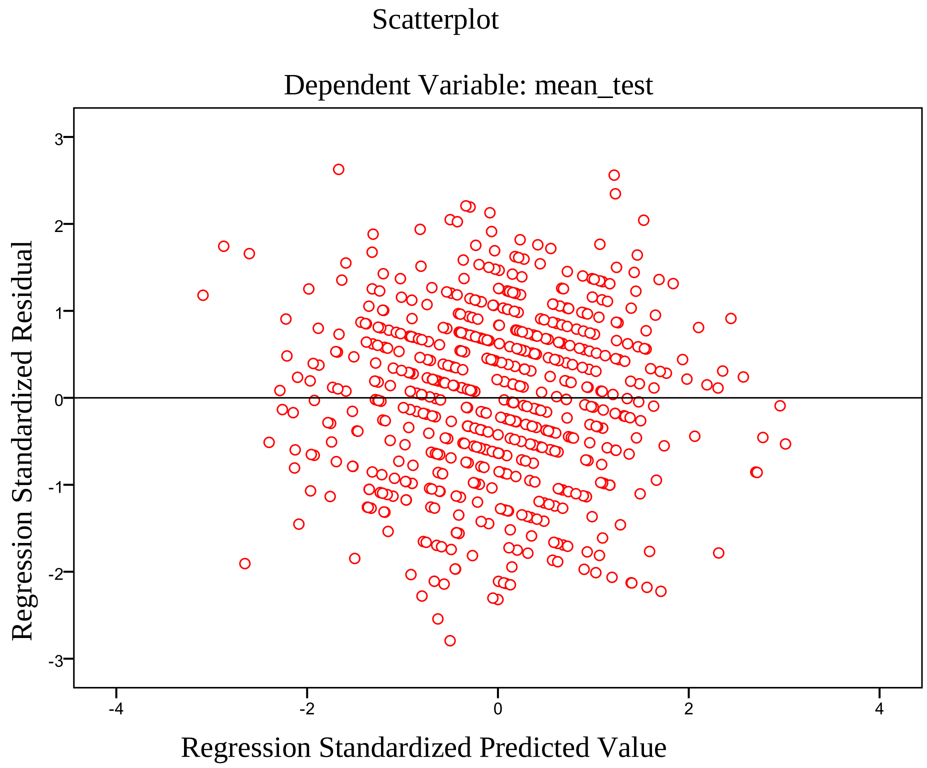


Figure 5.3 Scatterplot of the residuals for the CAT

The assumption of independence of residuals was tested by using Durbin-Watson value. Durbin-Watson value should be close to 2 (Tabachnick & Fidell, 2007). This assumption was met since the Durbin-Watson value in this study was 2.04.

In conclusion, there was no violation in any of the assumptions in this study. Therefore, the analysis of simultaneous regression was conducted.

5.3 Results of Simultaneous Regression Analysis

In order to test the hypotheses of the current study, simultaneous multiple regression was run. The analysis revealed that the correlation between 11^{th} grade students' chemistry achievement and independent variables (chemistry self-efficacy for cognitive skills, self-efficacy for chemistry laboratory, mastery-approach goals, mastery-avoidance goals, performance-approach goals, and performance-avoidance goals) was different from zero and the combined effect of the independent variables explained a significant 9.1 % of variance in the students' 11^{th} grade chemistry achievement ($R = .30$, $F(6, 597) = 9.95$, $p < .05$). Table 5.4 presents the summary of simultaneous regression analysis.

Table 5.4 Summary of Simultaneous Regression Analysis

Independent variables	B	SE	Beta (β)	t
(constant)	.32	.04		8.00
mast_app	.03	.01	.14	3.12**
mast_avoid	-.01	.01	-.07	-1.71
perf_app	.02	.01	.11	2.20*
perf_avoid	-.02	.01	-.12	-2.37*
SCL	.00	.00	-.02	-.58
CSCS	.02	.00	.15	3.28**

Note: Dependent Variable: CAT, SE = Standard Error, R = .30, R^2 = .09, Adjusted R^2 = .08, $^{*}p < .05$, $^{**}p < .01$.

As seen in the Table 5.4, the CSCS, students' mastery-approach goals (β = .14), performance-approach goals (β = .11), performance-avoidance goals (β = -.12), and CSCS (β = .15) made a significant contribution to the students' chemistry achievement (p < .05). Therefore, the null hypotheses 1, 3, 5, and 6 stating that there is no significant contribution of 11^{th} grade state high school Turkish students' chemistry self-efficacy beliefs for cognitive skills (CSCS), mastery-approach goals, performance-approach goals, and performance-avoidance goals to their chemistry achievement, respectively, were rejected. Students' mastery avoidance goals (β = -.07) and self-efficacy for chemistry laboratory (SCL), on the other hand, did not make a significant contribution to the students' chemistry achievement (ρ < .05).

Therefore, the null hypotheses 2 and 4 stating that there is no significant contribution of 11th grade state high school Turkish students' SCL and mastery-avoidance goals to their chemistry achievement, respectively, were failed to be rejected.

Additionally, students' CSCS had the largest beta coefficient ($\beta = .15$, $p < .05$) indicating that the largest unique contribution to explaining the students' chemistry achievement was made by this variable, when the variance accounted by all the other independent variables was controlled. The second largest unique contribution to explaining the students' chemistry achievement was made by students' mastery approach goals ($\beta = .14$, $p < .05$) which had slightly lower beta coefficient than the students' CSCS. The third largest unique contribution to explaining the students' chemistry achievement was made by students' performance-avoidance goals ($\beta = .12$, $p < .05$) and the smallest unique contribution to explaining the students' chemistry achievement was made by students' performance-approach goals ($\beta = .11$, $p < .05$) which had slightly lower beta coefficient than the students' performance-avoidance goals. Moreover, since the sign of beta coefficient was positive for students' CSCS, mastery-approach goals, and performance-approach goals, these variables had a positive relationship with the students' chemistry achievement. Students' performance-avoidance goals, on the other hand, had a negatively signed beta coefficient, and thus, had a negative relationship with the students' chemistry achievement.

Square of the semipartial correlation coefficient for an independent variable gave how much of the total variance in students' chemistry achievement was uniquely accounted by that variable (Tabachnick & Fidell, 2007). According to the Table 5.3, students' mastery-approach goals, performance-approach goals, performance-avoidance goals, and CSCS uniquely accounted for 1.49 %, .74 %, .86 %, and 1.64 % of the total variance in students' chemistry achievement, respectively.

The unstandardized coefficients for mastery-approach goals, performance-approach goals, performance-avoidance goals, and CSCS were .03, .02, -.02, and .02, respectively. The regression equation by using these coefficients is as follows:

$$Y_{CAT} = .03.X_{mast\_app} + .02.X_{perf\_app} - .02.X_{perf\_avoid} + .02.X_{CSCS}$$

5.4 Summary of findings

The findings of the study were summarized below:

1) Students' CSCS, mastery-approach goals, performance-approach goals, and performance-avoidance goals made a significant contribution to the students' chemistry achievement.
2) Students' mastery avoidance goals and SCL did not make a significant contribution to the students' chemistry achievement.
3) Students' CSCS, mastery-approach goals, and performance-approach goals had a positive relationship, whereas the students' performance avoidance goals had a negative relationship with the students' chemistry achievement.
4) The largest unique contribution to explaining the students' chemistry achievement was made by the students' CSCS, when the variance accounted by all the other independent variables was controlled.

5) The largest unique contribution to explaining the students’ chemistry achievement, among the achievement goals, was made by students’ mastery approach goals.

CHAPTER 6

DISCUSSION

This chapter was formed of three sections: The discussion about the results of the current study, implications of the important results, and recommendations for future studies.

6.1 Discussion of the Results

The purpose of this study was to investigate the contributions of 11^{th} grade students' chemistry self-efficacy for cognitive skills (CSCS), self-efficacy for chemistry laboratory (SCL), mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals to their chemistry achievement. One of the results of the study was that 11^{th} grade students' chemistry self-efficacy for cognitive skills (CSCS) was the significant positive predictor of and made the largest contribution to the students' chemistry achievement whereas students' self-efficacy for chemistry laboratory (SCL) was not a significant predictor. Additionally, the students reported lower self-efficacy beliefs on the SCL subscale (M = 3.52) compared to their self-efficacy beliefs on the CSCS subscale (M = 5.42). Self-efficacious students find the difficult tasks as the challenges to be overcome, develop interest in the task, recover easily from the setbacks, and keep a commitment to the task. Thus, efficacious students are expected to have higher levels of achievements in the tasks (Bandura, 1994). The result that the students' CSCS was a positive significant predictor and contributed to their chemistry achievement was in line with this expectation of the study. The findings about the CSCS in present study were also consistent with the results of studies conducted by Kan and Akbaş (2006), Taasoobshirazi and Glynn (2009), Kadıoğlu and Uzuntiryaki (2008), and Zusho, Pintrich, and Coppola (2003). Zusho, Pintrich, and Coppola found that students' self-efficacy was the best predictor of their chemistry course achievement. Taasoobshirazi and Glynn found in their studies that self-efficacy was strongly correlated with successful solution of quantitative chemistry problems. Additionally, Kadıoğlu and Uzuntiryaki (2008) found in their study that Turkish high school students' self-efficacy beliefs made a positive contribution to and were a significant predictor of their chemistry achievement on the subject of gases and chemical reactions. In another study, Kan and Akbaş (2006) also found that Turkish high school students' self-efficacy beliefs toward chemistry were a significant predictor of their chemistry achievement.

Results of the present study contradicted to the results of the Demirdöğen, Uzuntiryaki, and Çapa Aydın's (2009) findings which stated that students' overall grade point average (GPA) was not a significant predictor of their chemistry self-efficacy and. The researchers attributed this result to the usage of the overall GPA as an indicator of achievement. Since self-efficacy judgments were task specific, the students' self-efficacy beliefs might have been a better predictor of their achievement if students' chemistry scores were used instead of overall GPA as an indicator of the achievement.

The result that the students' SCL did not contribute to their chemistry achievement was not surprising since Bandura (1997) noted that mastery experiences were the most forceful source of self-efficacy judgments. This claim has been supported by empirical studies such as Britner & Pajares (2006), Hampton (1998), Klassen (2004), Lent, Brown, Gover, & Nijjer (1996), and Lopez & Lent (1992). In Turkey, chemistry classes, especially in general public high schools, are based on textbooks and solving chemistry problems from the textbooks with little or no chance for the students to carry out experiments in the laboratories. When the way that chemistry classes were conducted in Turkey was considered, the result that the students' SCL did not contribute to their chemistry achievement was not surprising since Bandura (1997) noted that mastery experiences were the most forceful source of self-efficacy judgments. Bandura (1997) suggested that students enroll in activities, evaluate the outcome of these activities, and form their self-efficacy beliefs for engagements in future tasks by using these outcomes and behave in accord with these beliefs formed. The successful outcomes generally lead to confidence but unsuccessful outcomes generally decrease the confidence in behavior. In the present study, the students' little or no experience in laboratories might be a reason for why students' SCL did not contribute to their chemistry achievement. The results are consistent with the findings of Uzuntiryaki and Çapa Aydın (2007)'s study which states no significant relationship between SCL and achievement for college students.

When the descriptive statistics of the achievement goals were checked, it was found that mastery-approach and performance-approach goals were reported at the highest level (M = 4.09 and 3.57, respectively) by the students among the four goals in this study. These findings showed that Turkish students had a higher tendency to try to learn and understand chemistry subjects as well as display their competence to others and earn others' approval. The reason for this result regarding the students' mastery-approach goals might be due to the standardized normative university entrance exam that Turkish students have to take at the end of their senior year of the high school in order to study at a university. Students should master the chemistry subjects well so that they could get the required scores from this exam in order to be able to study their desired subject at their desired university. This was consistent with Sungur and Şenler's (2009) study in which Turkish high school students also reported the mastery-approach and performance-approach goals at the highest level among the four goals for biology classes.

Other findings of the current study were that 11th grade Turkish students' mastery-approach and performance-approach goals were positive significant predictors of the students' chemistry achievement. What is more, mastery-approach goals had the highest significant contribution to the students' chemistry achievement among the achievement goals. In other words, as Turkish students put more effort into mastering chemistry tasks, learning and understanding the chemistry subjects, displaying their ability to others, doing better than the others in the class and earning their parents' or others' approvals, their chemistry achievement level increased. Mastery-approach goals have positively been connected to success (Elliot, 1999).

Therefore, the finding in this study that students' mastery-approach goals were a positive significant contributor to the students' chemistry achievement was not surprising and consistent with Church, Elliot, and Gable (2001), Finney, Pieper, and Barron (2004), and Kadıoğlu and Uzuntiryaki's (2008) studies. Kadıoğlu and Uzuntiryaki (2008) found that Turkish students' intrinsic (mastery) goal orientation was a significant predictor of their chemistry achievement in gases and chemical reactions. Finney et al. (2004) found that mastery-approach goals were a positive significant predictor of students' GPA. The findings of Wolter (2004) and Elliot and McGregor (2001), on the other hand, contradicted with the findings of the present study. Wolter (2004) found that students' mastery (approach) orientations were not significant in predicting their mathematics achievement. Elliot and McGregor (2001) also found that mastery-approach goals were not significant in predicting the exam performance.

Students with performance-approach goals might put too much effort to earn their parents' approval, earn better grades than the other students in the class, or to avoid a punishing situation and end up with a successful accomplishment (Elliot & McGregor, 2001; Elliot, McGregor, & Gable, 1999; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). The finding about Turkish students' performance-approach goals was in line with this idea and also consistent with the findings of Church, Elliot, and Gable (2001), Elliot and McGregor (2001), Elliot, McGregor, and Gable (1999), Harackiewicz, Barron, Pintrich, Elliot, and Thrash (2002), and Wolter's (2004) studies about the performance-approach goals. Elliot and McGregor (2001) found in their study that students' performance-approach goals were a significant positive predictor of their exam performance. Wolter (2004) found that students' performance-approach goals were a positive significant predictor of their mathematics course grades. Taş (2008), on the contrary, found that Turkish the relationship between students' performance-approach goals and their science achievement was non-significant. Finney, Pieper and Barron (2004) also found that students' performance-approach goals produced non-significant results in predicting their GPA.

Performance-avoidance goals, on the other hand, were a negative significant predictor of Turkish students' chemistry achievement. Thus, Turkish students' chemistry achievement level decreased as they tried more for not doing worse than the other students did, for not looking like dumb compared to others, and for not having the lowest grades in class. Performance-avoidance goals have negatively been linked to the exam performance in literature since students are making an effort to avoid a negative possible outcome and the finding about the performance-avoidance goals in this study was consistent with Church, Elliot, and Gable (2001), Elliot and Church (1997), Elliot and McGregor (2001), Elliot, McGregor and Gable (1999), and Finney, Pieper, and Barron's (2004) studies. Elliot and McGregor (2001) found in their studies that performance-avoidance goals were a significant negative predictor of the students' exam performance. Church et al. (2001) also found that performance-approach goals were a positive significant predictor of students' graded chemistry performance, and so were mastery approach goals. In addition, performance-avoidance goals were a negative significant predictor of students' chemistry exam grades. Wolter (2004), however, found that performance-avoidance orientations were not significant in predicting students' mathematics course grades.

Students' mastery-avoidance goals in the current study, on the other hand, did not make a significant contribution to the students' chemistry achievement. This showed that Turkish students' trying more for not failing the chemistry tasks, misunderstanding the task, and not doing it incorrectly did not have any significant relationship with their chemistry achievement. This finding about the mastery-avoidance goals was consistent with the findings about mastery-avoidance goals of Elliot and McGregor (2001) and Finney, Pieper, and Barron's (2004) studies. In both studies, students' mastery-avoidance goals produced non-significant results in predicting their achievement.

These findings about the four achievement goals were in line with the expectations of the study when the characteristics of Turkish educational system were considered. Turkish educational system, as an educational context, is very competitive and exam-oriented because of the standardized normative university entrance exam which is ahead of Turkish high school students. One and a half million students, approximately, take this exam each year and the Higher Educational Council can recruit around 300,000 students into the subject areas of the universities (Güngör, Eryılmaz, & Fakıoğlu, 2007). Thus, it is very important for Turkish high school students to get good grades from their classes and also learn the subjects of the classes well to prepare themselves for this exam so that they can study their desired subject area at highly recognized universities in Turkey and also receive recognition by their parents, peers, and others. Parents also hold the same expectations about the achievement of their high school students. Thereby, it was not surprising that Turkish students' mastery-approach goals (trying to master chemistry tasks) and performance-approach goals (trying to best others in class, earn recognition from their parents and peers) contributed positively to their chemistry achievement in this study. This university entrance exam makes the classrooms competitive and is a very important task for Turkish students. Additionally, the classrooms are focused on mastering the tasks because of this exam. In such an educational system, it was not also surprising that Turkish students' performance-avoidance goals (trying to avoid looking like dumb and having the lowest grades in class) contributed negatively and mastery-avoidance goals (trying to avoid failing the chemistry class and misunderstanding the tasks) had no significant contribution to their chemistry achievement in the current study.

6.2 Implications of the Results

The implications of the study are given below by considering the results of the study.

Turkish students in this study reported low levels of self-efficacy for chemistry laboratory (SCL) and students' SCL did not have a significant contribution to their chemistry achievement. Based on this finding and since mastery experiences are the most powerful sources of self-efficacy beliefs (Bandura, 1997), chemistry teachers in Turkey should provide instructions in which the students can conduct chemistry experiments, write laboratory reports, and gain more experience in chemistry laboratories in order to enhance the students' self-efficacy beliefs for chemistry laboratories.

In addition, the students' chemistry self-efficacy beliefs for cognitive skills (CSCS) among all the independent variables in this study accounted uniquely for the largest part of the total variance in students' chemistry achievement. This finding provided evidence that Turkish students' CSCS was very important for their chemistry achievement. The students, on the other hand, reported moderate levels of CSCS. Thereby, the instructors should try to facilitate the students' CSCS in chemistry classes. For example, the instructors should pay individual attention more to their students in the class (Schunk & Miller, 2002), should also teach the material in ways that students could understand, and relate the instructional designs to the sources of self-efficacy in the progress of teaching to improve the students' self-efficacy beliefs. Moreover, the instructors should provide various instructional tasks that are challenging but also suitable for the students' capabilities to address the individual differences among the students and to make the students think that they are competent enough to learn the subjects of the class in order to enhance the students' self-efficacy judgments (Pintrich & Schunk, 2002).

Since this study revealed that Turkish high school students held high levels of mastery-approach goals toward chemistry and that mastery-approach goals made the largest contribution to the students' chemistry achievement. Therefore, the instructor should hold goals in the class which are suitable for the students' level of understanding and make the students believe that they are capable of reaching those goals in the class. The instructors should also use various instructional methods in teaching to make the students understand the material being taught and also provide feedbacks that are timely, clear, and specific. The feedbacks should also be given in an encouraging context and provided with an action plan for their students to make the students judge their progress toward their goals, repair their faults, and direct their efforts toward the success again so that the students' motivation can be improved.

Finally, teachers play a very important role in performing all these implementations, as they are the providers of the instructional activities, administrator of these activities, and evaluator of students' performance (Cooper, 2002). Therefore, the teachers should extensively be given the necessary in-service trainings about implementing different instructional activities in class, making the classroom context as a facilitator of students' self-efficacy beliefs and different achievement goals, and giving effective feedback to the students.

6.3 Recommendations for further Research

The recommendations for future research are given below.

The results of this study were based on self-report scales which may not capture students' actual beliefs. Therefore, further qualitative research should be carried out to increase the validity of the results. Additionally, chemistry achievement test used in this study included multiple-choice questions only and thus, provided an opportunity for the students to guess the correct answer. Some students might have guessed the correct answer of some questions even though they did not really meet the objectives of the questions. In that case, chemistry achievement scores would not give the actual picture for these students. Thereby, achievement test should include open-ended questions in order to eliminate this possibility.

Random sampling and larger sample size with different grade levels and domains from different types of schools like private high schools, Anatolian high schools, science high schools, etc. can be used to increase the generalizability and reliability of the findings.

Students' achievement goal adoptions may be influenced from the classroom goal structure (Wolters, 2004). Therefore, students' achievement goals can be investigated in relation with their classroom goal structures.

REFERENCES

Akbulut, O., Genç, M., Güvenç, S., Üstünışık, M., Eroğlu, N., Gerçeker,F., Kınayoğlu, N., & Yazıcıoğlu, H. (2007). General Chemistry: High School II. Ankara, Turkey: TED Ankara College Foundation.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology,* 84, 261-271.

Ames, C. & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, 80, 260-267.

Anderman, E. M., Austin, A. C., & Johnson, D. M. (2001). The development of goal orientation. See Wigfield & Eccles 2001. In press.

Anderman, E. M. & Maehr, M. L. (1994). Motivation and schooling in the middle grades. *Review of Educational Research*, 64(2), 287-309.

Anderman, E. M. & Wolters, C. (2006). Goals, values, and affects: influences on student motivation. In P. Alexander & P. Winne (Eds.), Handbook of educational psychology. New York: Simon & Schuster/Macmillan. 2nd ed. In press.

Andrew, S. (1998). Self-efficacy as a predictor of academic performance in science. *Journal of Advanced Nursing*, 27, 596-603.

Arbuckle, J. L. & Wothke, W. (1999). AMOS 4.0 user's guide. Chicago, IL: Smallwaters.

Arık, A., Ülker, N., & Polat, R. (2002). Kimya 2. Izmir, Turkey: Oran Yayincilik.

Balcı, C. (2006). Conceptual change text oriented instruction to facilitate conceptual change in rate of reaction concepts . Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist,* 37, 122-147.

Bandura, A. (1986). Social foundations of thought and action : A social cognitive theory. Englewood Cliffs, NJ : Prentice-Hall.

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), Encyclopedia of human behavior (Vol. 4, pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman [Ed.], Encyclopedia of mental health. San Diego: Academic Press, 1998).

Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: Freeman.

Barker, V. & Millar, R. (1999). Students' reasoning about chemical reactions: What changes occur during a context-based post-16 chemistry course? *International Journal of Science Education*, 21 (6), 645-665.

Bentler, P. M. (1992). On the fit of models to covariances and methodology to the Bulletin. *Psychological Bulletin*, 112, 400-404.

Bong, M. (2009). Age-Related Differences in Achievement Goal Differentiation. *Journal of Educational Psychology*, 101 (4), 879–896.

Bozkoyun, Y. (2004). Facilitating conceptual change in learning rate of reaction concepts. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Britner, S. L. (2008). Motivation in High School Science Students: A Comparison of Gender Differences in Life, Physical, and Earth Science Classes. *Journal of Research in Science Teaching*, 45(8), 955-970.

Britner, S. L. & Pajares, F. (2001). Self-Efficacy Beliefs, Motivation, Race, and Gender in Middle School Science. Journal of Women and Minorities in Science and Engineering, 7 (4), 271-285.

Britner, S. L. & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching*, 43, 485-499.

Butler, R. (1992). What young people want to know when: Effects of mastery and ability goals on interest in different kind of social comparisons. *Journal of Personality and Social Psychology*, 62, 934-943.

Carroll, A., Houghton, S., & Wood, R., Unsworth, K., Hattie, J., Gordon, L., & Bower, J. (2009). Self-efficacy and academic achievement in Australian high school students: The mediating effects of academic aspirations and delinquency. *Journal of Adolescence*, 32, 797-817.

Cavallo, A. M. L., Potter, W. H., & Rozaman, M. (2004). Gender differences in learning constructs, shifts in learning constructs, and their relationship to course achievement in a structured inquiry, yearlong college physics course for life science majors. *School Science and Mathematics*, 104, 288-300.

Cheng, P. & Chiou, W. (2010). Achievement, attributions, self-efficacy, and goal setting by accounting undergraduates. *Psychological Reports*, 106 (1), 1-11.

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology*, 93(1), 43-54.

Cooper, S. M. A. (2002). Classroom choices for enabling peer learning. *Theory into Practice,* 41(1), 53-57.

Covington, V. C. (2000). Intrinsic versus extrinsic motivation in schools : A reconciliation. *Current Directions in Psychological Science*, 9(1), 22-25.

Crocker, L. (2006). Introduction to measurement theory. In J. L. Green, G. Camilli, and P. B. Elmore (Eds.), Handbook of complementary methods is education research. Mahwah, NJ: Lawrence Erlbaum Associates, Inc., Publishers.

Crocker, L., & Algina, J. (1986). Introduction to classical and modern test theory. New York: Holt, Rinehart and Winston.

Çapa Aydın, Y. & Uzuntiryaki, E. (2009). Development and psychometric evaluation of the high school chemistry self-efficacy scale. *Educational and Psychological Measurement*, 69, 868-880.

Dalgety, J & Coll, R. K. (2006). Exploring first-year science students' chemistry self-efficacy. *International Journal of Science and Mathematics Education*, 4, 97–116.

Demirdöğen, B., Uzuntiryaki, E., & Çapa Aydın, Y. (2009). Freshmen students' chemistry self-efficacy in relation to goal orientation, gender, and academic achievement. Proc. Annual meeting of the National Association for Research in Science Teaching (NARST), 1-6, Garden Grove.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, 41, 1040-1048.

Dweck, C. S. & Leggett, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review*, 95, 256-273.

Eccles, J. S. & Midgley, C. M. (1989). Stage environment fit: developmentally appropriate classrooms for young adolescents. In C Ames and R Ames (Eds.), Research on Motivation in Education, (pp. 139–86), San Diego, CA: Academic.

Elliot, A. J. (1994). Approach and avoidance achievement goals: An intrinsic motivation analysis. Unpublished doctoral dissertation, University of Wisconsin, Madison, WI.

Elliot, A. (1997). Integrating the "classic" and "contemporary" approaches to achievement motivation: A hierarchical model of achievement motivation. In M. Maehr & P. Pintrich (Eds.), Advances in motivation and achievement (Vol.10, pp. 243-279), Greenwich, CT: JAI Press.

Elliot, A. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, 34(3), 169-189.

Elliot, A. & Church, M. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, 72, 218-232.

Elliot, A. & Dweck, C. S. (1988). Goals: An approach to motivation and achievement, *Journal of Personality and Social Psychology,* 54, 5-12.

Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology*, 70, 968-980.

Elliot, A. J. & McGregor, H. A. (1999).Test anxiety and the hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, 76, 628-644.

Elliot, A. J. & McGregor, H. A. (2001). A 2x2 achievement goal framework. *Journal of Personality and Social Psychology*, 80(3), 501-519.

Elliot, A. J., McGregor, H., & Gable, S. (1999).Achievement goals, study strategies, and exam performance: A mediational analysis. *Journal of Educational Psychology*, 91, 549-563.

Elliot, A. J. & Murayama, K. (2008). On the measurement of achievement goals: Critique, illustration, and application. *Journal of Educational Psychology*, 100(3), 613–628.

Elliot, A. & Sheldon, K. (1997). Avoidance achievement motivation: A personal goals analysis. *Journal of Personality and Social Psychology*, 73, 171-185.

Elliot, A. J. & Thrash, T. M. (2001). Achievement goals and the hierarchical model of achievement motivation. *Educational Psychology Review*, 13 (2), 2001.

Field, A. (2005). Discovering statistics using SPSS (2^{nd} edition). London: Sage Publications.

Finney, S. J., Pieper, S. L., & Barron, K. E. (2004). Examining the psychometric properties of the achievement goal questionnaire in a general academic context. *Educational and Psychological Measurement*, 64 (2), 365-382.

Forster, J., Higgins, E., & Idson, L. (1998). Approach and avoidance strength during goal attainment: Regulatory focus and the "goal looms larger" effect. *Journal of Personality and Social Psychology*, 75, 1115-1131.

Fraenkel, J. R. & Wallen, N. E. (2005). How to design and evaluate research in education (6th ed.). New York, NY: McGraw-Hill.

Güngör, A. A., Eryılmaz, A., & Fakıoğlu, T. (2007). The relationship of freshmen's physics achievement and their related affective characteristics. *Journal of Research in Science Teaching*, 44 (8), 1036-1056.

Hampton, N. Z. (1998). Sources of academic self-efficacy scale: An assessment tool for rehabilitation counselors. *Rehabilitation Counseling Bulletin*, 41, 260-277.

Harackiewicz, J., Barron, K., Carter, S., Lehto, A., & Elliot, A. (1997). Determinants and consequences of achievement goals in the college classroom. *Journal of Personality and Social Psychology*, 73, 1284-1295.

Harackiewicz, J., Barron, K., & Elliot, A. (1998). Rethinking achievement goals: When are they adaptive for college students and why? *Educational Psychologist*, 33, 1-21.

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. (2002). Revision of achievement goal theory: necessary and illuminating. *Journal of Educational Psychology*, 94, 638–45.

Kadıoğlu, C. & Uzuntiryaki, E. (2008). Motivational factors contributing to Turkish high school students' achievement in gases and chemical reactions. *Proc. American Educational Research Association (AERA) Annual Meeting*, 1, New York, ERIC Document Reproduction Service No. ED.506765.

Kan, A. & Akbaş, A. (2006). Affective Factors That Influence Chemistry Achievement (Attitude and Self Efficacy) and The Power Of These Factors To Predict Chemistry Achievement-I. *Journal of Turkish Science Education*, 3 (1), 76-85.

Kaplan, A., Middleton, M. J., Urdan, T., & Midgley, C. (2002). Achievement goals and goal structures. In C Midgley (Eds.), Goals, Goal Structures, and Patterns of Adaptive Learning (pp. 21–55). Hillsdale, NJ: Erlbaum.

Kaplan, A. & Midgley, C. (1997). The effect of achievement goals: Does level of perceived academic competence make a difference? *Contemporary Educational Psychology*, 22, 415-435.

Kılavuz, Y. (2005). The effects of 5e learning cycle model based on constructivist theory on tenth grade students' understanding of acid-base concepts . Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Klassen, R. (2004). A cross cultural investigation of the efficacy beliefs of South Asian immigrant and Anglo non-immigrant early adolescents. *Journal of Educational Psychology*, 96, 731-742.

Kline, R. B. (1998). Priciples and practice of structural equation modeling. New York: Guilford.

Kupermintz, H. (2002). Affective and conative factors as aptitude resources in high school science achievement. *Educational Assessment*, 8, 123-137.

Lapan, R.T., Shaughnessy, P., & Boggs, K. (1996). Efficacy expectations and vocational interests as mediators between sex and choice of math/science college majors: A longitudinal study. *Journal of Vocational Behaviour*, 49(3), 227–291.

Lau, S. & Roeser, R. W. (2002). Cognitive abilities and motivational processes in high school students' situational engagement and achievement in science. *Educational Assessment*, 8, 139-162.

Lavonen, J. & Laaksonen, S. (2009). Context of teaching and learning school science in Finland: Reflections on PISA 2006 results. *Journal of Research in Science Teaching*, 46(8), 922-944.

Lent, R.W., Brown, S.D., Gover, M.R., & Nijjer, S.K. (1996). Cognitive assessment of the sources of mathematics self-efficacy: A thought-listing analysis. *Journal of Career Assessment*, 4, 33–46.

Linnenbrink, E. A. & Pintrich, P. R. (2003).The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading and Writing Quarterly*, 19, 119-137.

Lopez, F.G., & Lent, R.W. (1992). Sources of mathematics self-efficacy in high school students. *The Career Development Quarterly*, 41, 3–12.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1, 130-149.

Maehr, M. (1989). Thoughts about motivation. In C. Ames & R. Ames (Eds.), Research on motivation in education (Vol. 3, pp. 299-315). New York: Academic Press.

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation, and academic achievement. *Annual Review of Psychology,* 57, 487–503.

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology*, 80, 514–523.

Meece, J. L. & Holt, K. (1993). A pattern analysis of students' achievement goals. *Journal of Educational Psychology*, 85 (4), 582-590.

Middleton, M. & Midgley, C. (1997). Avoiding the demonstration of lack of ability: An underexplored aspect of goal theory. *Journal of Educational Psychology*, 89. 710-718.

Midgley, C., Kaplan, A., Middleton, M., Maehr, M. L., Urdan, T., Anderman, L. H., Anderman, E., & Roeser,R. (1998). The Development and Validation of Scales Assessing Students' Achievement Goal Orientations. *Contemporary Educational Psychology*, 23, 113–131.

Midgley, C., Maehr, M. L., Hicks, L., Roeser, R., Urdan, T., Anderman, E., & Kaplan, A. (1996). The Patterns of Adaptive Learning Survey (PALS), University of Michigan, Ann Arbor.

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L.,Freeman, K. E., Gheen, M., Kaplan, A., Kumar, R., Middleton, M. J., Nelson, J., Roeser, R., & Urdan, T. (2000). Manual for the Patterns of Adaptive Learning Scales. University of Michigan, Ann Arbor.

Miller, R., Greene, B., Montalvo, G., Ravindran, B., & Nichols, J. (1996). Engagement in academic work: The role of learning goals, future consequences, pleasing others, and perceived ability. *Contemporary Educational Psychology*, 21, 388-422.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38, 30-38.

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91, 328-346.

Nicholls, J. G. (1989). The Competitive Ethos and Democratic Education, Harvard University Press,Cambridge, MA.

Nolen, S. (1988). Reasons for studying: Motivational orientations and study strategies. Cog. Instr. 5: 269–287.

Önder, İ. (2006). The effect of conceptual change approach on students' understanding of solubility equilibrium concept. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Özkan, Ş. (2003). The roles of motivational beliefs and learning styles on tenth grade students' biology achievement. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Pabuçcu, A. (2008). Improving 11th grade students' understanding of acid-base concepts by using 5e learning cycle model. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Pajares, F. (1996). Self-efficacy beliefs in achievement settings. *Review of Educational Research*, 66, 543-578.

Pajares F. (2002). Overview of social cognitive theory and of self-efficacy. Retrieved from http://www.emory.edu/EDUCATION/mfp/eff.html, last accessed date: 18/01/2010.

Pajares, F., Britner, S.L., & Valiante, G. (2000). Relation between achievement goals and self-beliefs of middle school students in writing and science. *Contemporary Educational Psychology*, 25, 406–422.

Pajares, F. & Miller, M. D. (1994). The role of self-efficacy and self-concept beliefs in mathematical problem-solving: A path analysis. *Journal of Educational Psychology*, 86, 193-203.

Pajares, F. & Valiante, G. (2002). Students' self-efficacy in their self-regulated learning strategies: A developmental perspective. *Psychologia*, 45(4), 211-221.

Pallant, J. (2001). SPSS survival manual: A step by step guide to data analysis using SPSS for Windows (2nd edition). Buckingham: Open University Press.

Phan, H. P. (2009). Relations between goals, self-efficacy, critical thinking and deep processing strategies: a path analysis. *Educational Psychology*, 29 (7), 777–799.

Pintrich, P. (2000a). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology*, 25, 92–104.

Pintrich, P. (2000b). Multiple goals, multiple pathways: the role of goal orientation in learning and achievement. *Journal of Educational Psychology,* 92, 544–555.

Pintrich, P. (2000c). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. Pintrich, and M. Zeidner (Eds.), Handbook of self regulation: theory, research, and applications (pp. 451-502). San Diego, CA: Academic Press.

Pintrich, P. R. & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82 (1), 33-40.

Pintrich, P. & Garcia, T. (1991). Student goal orientation and self-regulation in the college classroom. In Maehr, M., and Pintrich, P. (eds.) Advances in Motivation and Achievement Vol. 7, JAI Press, Greenwich, CT, pp. 371–402.

Pintrich, P. & Schunk, D. (1996). Motivation in Education: Theory, Research & Applications, Ch. 3.Englewood Cliffs, NJ: Prentice-Hall.

Pintrich, P. R. & Schunk, D. H. (2002). Motivation in education : Theory, research, and applications. Upper Saddle River, NJ : Merrill Prentice Hall.

Pintrich, P. R. & Schunk, D. H. (2008). Motivation in education: theory, research, and applications. N.J. : Merrill.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ). Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching and Learning. The University of Michigan.

Roeser, R. W., Midgley, C., & Urdan, T. C. (1996). Perceptions of the school psychological environment and early adolescents' psychological and behavioral functioning in school: the mediating role of goals and belonging. *Journal of Educational Psychology*, 88, 408–22.

Russo, S. & Silver, M. (2007). Introductory Chemistry.San Francisco, CA: Pearson Benjamin Cummings.

Schunk, D. H. (1989). Self-efficacy and cognitive achievement: Implications for students with learning problems. *Journal of Learning Disabilities*, 22, 14-22.

Schunk, D. H. (1990). Introduction to the special section on motivation and self-efficacy. *Journal of Educational Psychology*, 82(1), 3-6.

Schunk, D. H. (1991) . Self-efficacy and academic motivation. *Educational psychologist*, 26, 207 – 231.

Schunk, D. H. (1995). Self-efficacy and education and instruction. In J. E. Maddux (Ed.), Self-efficacy, adaptation, and adjustment: Theory, research, and application (pp. 281-303). New York, NY: Plenum.

Schunk, D. H. & Miller, S. D. (2002). Self-efficacy and adolescents' motivation. In F. Pajares & T. Urdan (Eds.), Academic motivation of Adolescents (pp. 29-53). Greenwich, CT: Information Age Publishing.

Schunk, D. H. & Pajares, F. (2002). The development of academic self-efficacy. In A. Wigfield & J. Eccles (Eds.), Development of achievement motivation (pp.15-31). San Diego, CA: Academic.

Shell, F. D. & Husman, J. (2001). The multivariate dimensionality of personal control and future time perspective bBeliefs in achievement and self-regulation. *Contemporary Educational Psychology*, 26, 481–506.

Skaalvik, E. (1997). Self-enhancing and self-defeating ego orientations: Relations with task and avoidance orientation, achievement, self-perceptions, and anxiety. *Journal of Educational Psychology*, 89, 71-81.

Smiley, P. & Dweck, C. (1994). Individual differences in achievement goals among young children. *Child Development*, 65, 1723-1743.

Smith, P. L. & Fouad, N. A. (1999). Subject-matter specificity of self- efficacy, outcome expectancies, interest, and goals: Implications for the social cognitive model. *Journal of Counseling Psychology*, 46, 461-471.

Steinberg, L., Brown, B. B., & Dornbusch, S. M. (1996). Beyond the classroom: Why school reform has failed and what parents need to do. New York, NY: Simon & Schuster.

Sungur, S. & Şenler, B. (2009). An analysis of Turkish high school students' meta-cognition and motivation. *Educational research and evaluation*, 15(1), 45-62.

Taasoobshirazi, G. & Glynn, S. M. (2009). College students solving chemistry problems: A theoretical model of expertise. *Journal of Research in Science Teaching*, 46(10), 1070-1089.

Tabachnick, B. G. & Fidell, L. S. (2007). Using multivariate statistics (3rd edition). New York, NY: HarperCollins.

Tamer, İ. Ü. (2006). Effect of conceptual change texts accompanied with analogies on promoting conceptual change in acid and base concepts. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Taş, Y. (2008). The interplay of students' perceptions of classroom goal structures, personal goal orientations and learning related variables. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Urdan, T.(1997). Achievement goal theory: Past results, future directions. In M. Maehr & P. Pintrich (Eds.), Advances in motivation and achievement (Vol. 10,pp.243-29). Greenwich, CT: JAI.

Urdan, T. & Maehr,M. (1995). Beyond a two-goal theory of motivation and achievement: A case for social goals. *Review of Educational Research*, 65, 213–243.

Usher, E. L. & Pajares, F. (2006). Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemporary Educational Psychology*, 31, 125-141.

Uzuntiryaki, E. & Çapa Aydın, Y. (2007). The relationship between high school students' chemistry self-efficacy and chemistry achievement. Proc. 2nd European Variety in Chemistry Education, Prague, 81-83, Charles University, Prague.

Vandewalle, D. (1997). Development and validation of a work domain goal orientation instrument. *Educational and Psychological Measurement*, 57, 995-1015.

Weiner, B. (1986). An attributional theory of motivation and emotion. New York: Springer-Verlag.

Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology*, 82,616-622.

Wentzel, K. (1989). Adolescent classroom goals, standards for performance, academic achievement: An interactionist perspective. Journal of Educational Psychology, 81, 131–142.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational psychology review*, 6, 49-78.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology*, 96(2), 236–250.

Wolters, C.A. & Rosenthal, H. (2000). The relation between students' motivational beliefs and their use of motivational regulation strategies. *International Journal of Educational Research*, 33 (7-8), 801-820.

Yumuşak, N. (2006). Predicting academic achievement with cognitive and motivational variables. Unpublished Master's thesis, Middle East Technical University, Ankara, Turkey.

Yumuşak, N., Sungur, S., & Çakıroğlu, J. (2007). Turkish High School Students' Biology Achievement in Relation to Academic Self-Regulation. *Educational Research and Evaluation*, 13(1), 53-69.

Zeldin, A. L. & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research Journal*, 37, 215-246.

Zimmerman, B. J. & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment . *American Educational Research Journal*, 31,845-862.

Zusho, A., Pintrich, P.R., and Coppola, B. (2003). Skill and will: the role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education*, 25 (9), 1081-1094.

APPENDIX A

HIGH SCHOOL CHEMISTRY SELF-EFFICACY SCALE

		yetersiz		çok az yeterli		biraz yeterli		oldukça yeterli		çok yeterli
1.	Kimya kanun ve teorilerini ne derecede açıklayabilirsiniz?	1	2	3	4	5	6	7	8	9
2.	Kimya problemlerini çözerken uygun formül kullanmada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
3.	Laboratuvarda deney prosedürünü uygulamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
4.	Laboratuvar araç-gereçlerini ne kadar iyi kullanabilirsiniz?	1	2	3	4	5	6	7	8	9
5.	Kimya ve diğer bilimler arasında ilişki kurmada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
6.	Atomun yapısını tasvir etmede ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
7.	Laboratuvar sırasında verileri yorumlamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
8.	Periyodik tabloyu kullanarak elementlerin özelliklerini tanımlamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9

9.	Element ve bileşiklerin formüllerini okumada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
10.	Kimyasal denklemleri yorumlamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
11.	Maddenin tanecikli yapısını açıklamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
12.	Laboratuvar düzeneğini ne kadar iyi kurabilirsiniz?	1	2	3	4	5	6	7	8	9
13.	Kimyadaki temel kavramları tanımlamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
14.	Kimya ile ilgili grafik ve çizelgeleri yorumlamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
15.	Laboratuvar sırasında veri toplamada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9
16.	Temel bulguları özetleyen laboratuvar raporu yazmada ne kadar iyisiniz?	1	2	3	4	5	6	7	8	9

APPENDIX B

ACHIEVEMENT GOAL QUESTIONNAIRE

	Hiçbir	Nadiren	Bazen	Çoğunlukla	Her zaman
1. Kimya derslerinin içeriğini mümkün olduğunca iyi anlamak benim için önemlidir.					
2. Kimya derslerinde amacım sınıftaki diğer öğrencilerden daha kötü performans sergilemekten kaçınmaktır.					
3. Kimya derslerinde diğerlerine göre daha başarılı olmak benim için önemlidir.					
4. Diğer öğrencilerden daha iyisini yapmak benim için önemlidir.					
5. Kimya derslerinde amacım başarısız olmaktan kaçınmaktır.					
6. Kimya derslerinden mümkün olduğunca çok şey öğrenmek istiyorum.					
7. Kimya derslerinde beni sıklıkla motive eden şey, diğerlerinden daha kötü performans sergileme korkusudur.					

8. Kimya derslerinde verilen her şeyi tam olarak öğrenmek arzusundayım.					
9. Kimya derslerinde beni sıklıkla motive eden şey başarısız olma korkusudur.					
10. Kimya derslerinde amacım, diğer pek çok öğrenciden daha iyi bir not almaktır.					
11. Kimya derslerinde öğrenebileceğimden daha azını öğrenmekten korkuyorum.					
12. Bazen Kimya derslerinin içeriğini istediğim kadar iyi anlayamayacağımdan korkuyorum.					
13. Kimya derslerindeki tek amacım diğerlerinden daha başarısız olmanın önüne geçmektir.					
14. Kimya derslerinde öğrenilecek her şeyi öğrenemeyebileceğimden sıklıkla endişe duyuyorum.					
15. Kimya derslerinde sadece başarısız olmaktan kaçınmak istiyorum.					

APPENDIX C

CHEMISTRY ACHIEVEMENT TEST

Numarası: ____________________________ Cinsiyet : Kız □ Erkek □

Okulu : ____

Lütfen yukarıda istenen tüm bilgileri eksiksiz doldurunuz.

11. Sınıf Başarı Testi

Bu test 11.sınıf kimya dersi konularıyla ilgili çoktan seçmeli 33 sorudan oluşmaktadır. Doğru olduğunu düşündüğünüz yalnız bir seçeneği işaretleyiniz. Lütfen her soruyu cevaplayınız. Teşekkür ederiz.

1. $2Y_{(g)} + X_{(g)} \rightarrow C_{(g)}$

Yukarıda verilen reaksiyon için, 100°C de aşağıdaki tabloda verilen değerler toplanmıştır.

X in başlangıç derişimi (M)	Y nin başlangıç derişimi (M)	C nin başlangıç oluşum hızı (M/s)
0.01	0.01	$1.2x10^{-6}$
0.02	0.01	$4.8x10^{-6}$
0.04	0.01	$19.2x10^{-6}$
0.04	0.02	$19.2x10^{-6}$

Bu reaksiyonun hız denklemi nedir?

A) $k.[X]^2$ B) $k.[X]^2.[Y]$ C) $k.[Y]$ D) $k.[X].[Y]^2$ E) $k.[Y]^2$

2. I. adım: $X_{(k)} + 2Y_{(g)} \rightarrow Z_{(g)} + 2T_{(g)}$ (Yavaş)
   II. adım: $2R_{(g)} + Z_{(g)} \rightarrow 2Q_{(g)}$ (Hızlı)

   Mekanizmasına sahip tepkimede, aşağıdaki işlemlerden hangisi tepkime hızını **değiştirmez?**

   A) Y nin derişimini artırmak
   B) Tepkime ortamının sıcaklığını artırmak
   C) X i toz haline getirmek
   D) Z nin derişimini artırmak
   E) Tepkime ortamına uygun bir katalizör ilave etmek

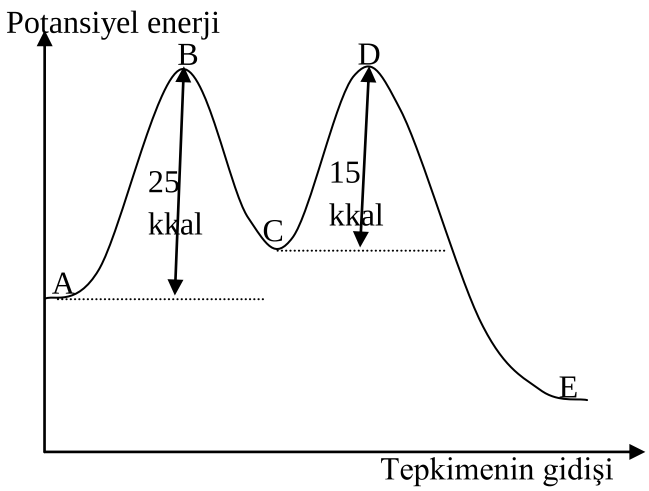
3. $H_{2(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$ tepkimesinin mekanizması aşağıdaki gibidir.

   I.adım: $I_{2(g)} \rightarrow 2I_{(g)}$ (hızlı)
   II.adım: $2I_{(g)} + H_{2(g)} \rightarrow 2HI_{(g)}$ (yavaş)

   Buna göre aşağıdakilerden hangisi dogrudur?

A) $I_{(g)}$ bir ara üründür.
B) I. adımın aktifleşme enerjisi daha yüksektir.
C) Tepkime hızını I. adım belirler.
D) H_2 nin başlangıç derişimi iki katına çıkarılırsa, tepkimenin hızı değişmez.
E) Tepkime ikinci dereceden bir tepkimedir.

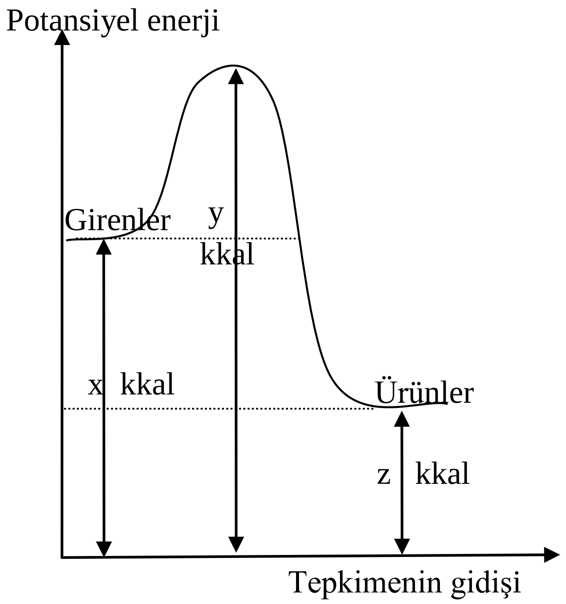
4.



Yukarıda verilen grafik bir tepkimeye aittir. Bu tepkime için aşağıda verilen yargılardan hangisi doğrudur?

A) C → E tepkimesi, hızı belirleyen adımdır.
B) A → E tepkimesi endotermiktir.
C) C ara üründür.
D) Tepkime mekanizması üç adımlıdır.
E) A ve E, aktifleşmiş komplekslerdir.

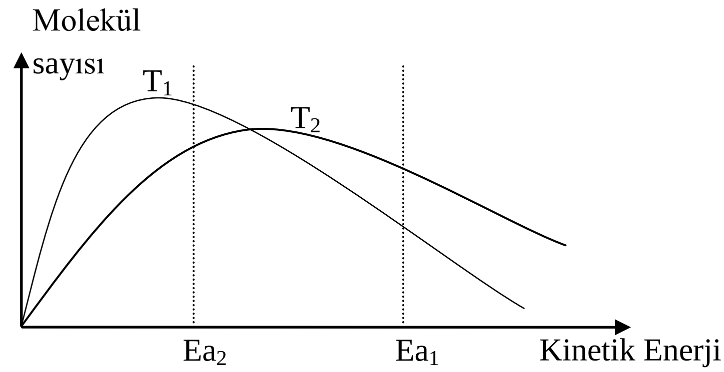
5.



Yukarıdaki şekilde bir tepkimenin potansiyel enerji diyagramı verilmiştir. Diyagrama göre, bu tepkimeyle ilgili aşağıda verilen ifadelerden hangisi doğrudur?

A) Tepkimenin entalpi değişimi x dir.
B) Aktifleşmiş kompleksin potansiyel enerji değeri y dir.
C) İleri tepkimenin aktifleşme enerjisi x-z dir.
D) Ürünlerin potansiyel enerjisi y-z dir.
E) İleri tepkime endotermiktir.

6.



Bir kapta bulunan X gazı, $2X_{(g)} \rightarrow Y_{(g)}$ tepkimesine göre Y gazına dönüşmektedir. X moleküllerinin başlangıç koşullarındaki sıcaklığı T_1, eşik enerjisi Ea_1; son durumdaki sıcaklığı T_2 ve eşik enerjisi de Ea_2 dir. Buna göre, tepkimenin birinci durumdan ikinci duruma geçmesi için aşağıdakilerden hangisi yapılmıştır?

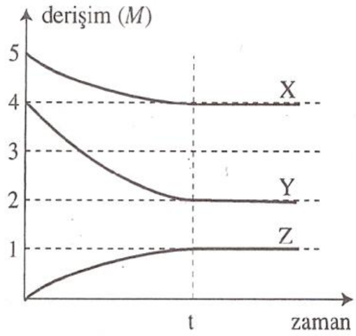
A) Yalnız sıcaklık artırılmıştır.
B) Yalnız katalizör eklenmiştir.
C) Sıcaklık düşürülmüş ve katalizör eklenmiştir.
D) Yalnız sıcaklık düşürülmüştür.
E) Sıcaklık artırılmış ve katalizör eklenmiştir.

7. I. $2NO_{(g)} + F_{2(g)} \rightarrow 2NOF_{(g)}$
II. $C_{(k)} + CO_{2(g)} \rightarrow 2CO_{(g)}$
III. $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$

Tepkimeleri sabit hacimli kaplarda ve sabit sıcaklıkta gerçekleştiriliyor. Bu tepkimelerden hangisinin ya da hangilerinin hızları basınç değişimi gözlenerek ölçülebilir?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I ve III

8.



Sabit hacim ve sıcaklıkta gaz fazında dengeye ulaşan bir tepkimede, derişimlerin zamana göre değişimi yandaki grafikteki gibidir. Buna göre, tepkime için aşağıdakilerden hangisi doğrudur?

A) Tepkime denklemi $X_{(g)} + Y_{(g)} \leftrightarrows Z_{(g)}$ şeklindedir.
B) t anında ileri ve geri tepkime hızları eşittir.
C) t anında mikroskobik değişimler durmuştur.
D) Tepkimenin denge sabiti 1/8 dir.
E) Tepkime için, $K_P = K_d \cdot (RT)$ dir.

9. $2SO_{2(g)} + O_{2(g)} \leftrightarrows 2SO_{3(g)}$ $\Delta H = -48$ kkal

Sabit hacimli bir kapta gerçekleşen yukarıdaki denge tepkimesi için aşağıdakilerden hangisi doğrudur?

A) Minimum enerji eğilimi SO_2 oluşumunu destekler.
B) Tepkime kabına O_2 gazı eklenirse, dengedeki SO_2 derişimi artar.
C) SO_3 yüksek sıcaklıkta daha kararlıdır.
D) Tepkime kabına SO_3 gazı eklenmesi, tüm maddelerin derişiminde artışa neden olur.
E) Sıcaklığın artırılması , dengenin ürünler tarafına kaymasına neden olur.

10. $H_{2(g)} + CO_{2(g)} \leftrightarrows H_2O_{(g)} + CO_{(g)}$

Tepkimesinin belli bir sıcaklıkta denge sabiti, $K_d = 2$ dir. Bu sıcaklıkta 1 litrelik tepkime kabına 0.4 mol H_2O, 0.5 mol CO, 0.1 mol CO_2 ve 0.1 mol H_2 gazları konulursa, aşağıdakilerden hangisi doğru olur?

A) Sistem dengededir.
B) İleri yönde tepkime oluşarak denge kurulur.
C) Dengede CO derişimi 0.5 M dan büyük olur.
D) Sistem daha çok CO_2 oluşturarak dengeye ulaşır.
E) Denge kurulduğunda, K_d değeri 2'den farklıdır.

11. Bir tepkimenin dengede olabilmesi için,

I. sabit sıcaklık
II. kapalı sistem
III. ileri ve geri tepkime hızlarının eşitliği

koşullarından hangisi ya da hangileri gereklidir?

A) Yalnız I B) Yalnız II C) I ve II D) II ve III E) I, II ve III

12. $A_{2(g)} + 2B_{2(g)} \leftrightarrows AB_{3(g)} + AB_{(g)}$ $K_1 = 8$

$AB_{2(g)} \leftrightarrows AB_{(g)} + \frac{1}{2} B_{2(g)}$ $K_2 = 2$

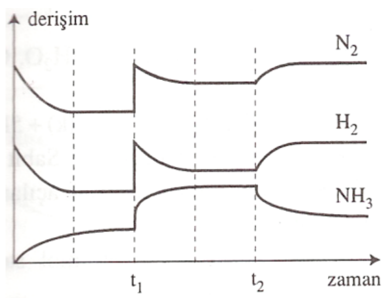
Yukarıda aynı sıcaklıkta bulunan iki denge tepkimesi ve denge sabiti (K) değerleri verilmiştir. Buna göre aynı sıcaklıkta,

$$2A_{2(g)} + 5B_{2(g)} \leftrightarrows 2AB_{3(g)} + 2AB_{2(g)}$$

tepkimesinin denge sabiti kaçtır?

A) 32 B) 16 C) 4 D) 2 E) 1

13.



$N_{2(g)} + 3H_{2(g)} \leftrightarrows 2NH_{3(g)}$ $\Delta H = -22$ kkal

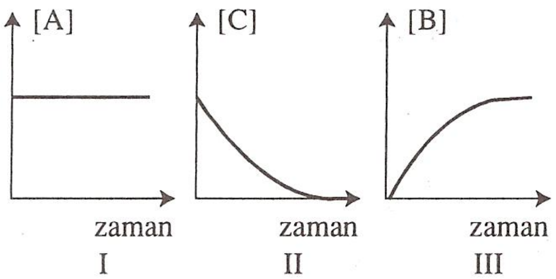
Tepkimesi dengede iken $t_1$ve t_2 anlarında yapılan iki ayrı değişikliğin derişimler üzerindeki etkisi grafikteki gibidir.Buna göre, t_1 ve t_2 anlarında yapılan değişiklikler için aşağıdakilerden hangisi doğrudur?

	t_1	t_2
A)	sabit sıcaklıkta hacmi azaltmak	sıcaklığı azaltmak
B)	sıcaklığı artırmak	sabit hacimde H_2 gazı eklemek
C)	sabit hacimde N_2 gazı eklemek	sabit hacimde NH_3 gazı eklemek
D)	sabit sıcaklıkta katalizör eklemek	sabit hacimde N_2 gazı eklemek
E)	sabit sıcaklıkta hacmi azaltmak	sıcaklığı artırmak

14. Kapalı bir kaba A ve C maddeleri konularak,

$A_{(k)} + B_{(g)} \leftrightarrows C_{(g)}$

yukarıdaki tepkimede verilen dengenin kurulması sağlanıyor. Kaptaki dengenin kurulmasına kadar geçen zaman içerisinde, bu tepkime için aşağıda çizilen grafiklerden hangisi ya da hangileri doğrudur?



A) Yalnız III B) Yalnız II C) I ve II D) I ve III E) I, II ve III

15. $X_{(suda)} + Y_{(k)} \leftrightarrows 2Z_{(suda)} + R_{(k)}$

Tepkimesinin denge bağıntısı $K_d = \frac{[Z]^2}{[X]}$ şeklindedir. Bu tepkimeyle ilgili olarak,

I. Denge heterojendir.
II. K_d nin birimi L/mol dür.
III. Sistem dengeye ulaşırken, R nin derişimi artar.

yargılarından hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II ve III

16. Sabit sıcaklıkta çözünmüş maddesi ile çözünmeden kalan katısı arasında dengeye sahip olan bir sulu çözelti için, aşağıdakilerden hangisi **kesinlikle** söylenebilir?

A) Seyreltiktir. B) Doymuştur. C) Derişiktir.
D) Doymamıştır. E) Aşırı doymuştur.

17. 25°C de, $X_2Y_{(k)}$ nin sudaki çözünürlüğü $2x10^{-4}$ mol/L dir. X_2Y katısı suda ısı alarak çözündüğüne göre, aşağıda verilen yargılardan hangisi **yanlıştır?**

A) 25°C de X_2Y için $K_ç = 2x10^{-3}$ tür.
B) X_2Y nin 10°C deki $K_ç$ değeri 25°C dekinden küçüktür.
C) Sıcaklık değiştirilmeden X_2Y çözeltisine saf su eklenirse, $K_ç$ değeri değişmez.

D) 25°C de, doymuş X_2Y çözeltisinde XZ katısı çözünürse, X_2Y nin çözünürlüğü azalır.
E) 25°C de katısıyla dengede olan X_2Y çözeltisinin sıcaklığı 50°C ye çıkarılırsa, çözeltideki toplam iyon derişimi artar.

18. 25°C de, $2x10^{-5}$M $CaCl_2$ çözeltisine eşit hacimde $2x10^{-5}$M Na_2SO_4 çözeltisi ekleniyor. 25°C de $CaSO_4$ için $K_ç= 6.1x10^{-5}$ olduğuna göre,

I. Son çözeltide $CaSO_4$ katısı çöker.
II. $CaSO_4$ için, $K_ç = [Ca^{+2}].[SO_4^{-2}]$ eşitliğiyle hesaplanabilir.
III. Son çözelti doymamıştır.

Yukarıda verilen yargılardan hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız III C) I ve III D) II ve III E) I, II ve III

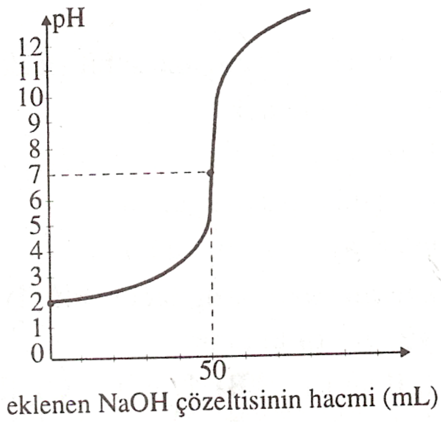
19. İyon derişimleri eşit olan Cu^{+2} , Cd^{+2} ve Fe^{+2} iyonlarını içeren çok seyreltik bir çözeltiye, damla damla S^{-2} iyonlarını içeren çözelti ilave ediliyor.

I. CdS için $K_ç= 1 x 10^{-27}$
II. FeS için $K_ç= 1 x 10^{-18}$
III. CuS için $K_ç= 1 x 10^{-36}$

Yukarıdaki değerler verildiğine göre, CdS, FeS, ve CuS katılarının çökelmeye başlama sırası aşağıdakilerden hangisidir?

A) I, II, III B) II, I, III C) III, I, II
D) I, III, II E) III, II, I

20.



100mL HCl çözeltisine damla damla NaOH çözeltisi eklenerek karıştırılıyor. Kaptaki HCl çözeltisinin pH değerinin, eklenen NaOH çözeltisinin hacmine göre değişimini gösteren titrasyon grafiği yanda verilmiştir. Buna göre;

I. Kaptaki çözeltiye 50mL NaOH çözeltisi eklendiğinde, dönüm noktası gerçekleşmiştir.
II. HCl çözeltisinin başlangıç $[H^+]$ değeri 0.02M dır.
III. Kaba 60mL NaOH eklendiğinde, kaptaki çözelti bazik olur.

yargılarından hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II ve III

21. Aynı sıcaklıkta CH_3COOH çözeltisinde CH_3COONa katısı çözülüyor. Oluşan çözelti için;

I. Tampon çözeltidir.
II. Çözeltiye asit ya da baz eklenmesiyle oluşan pH değişimine karşı dirençlidir.
III. Eşlenik asit-baz çifti olan CH_3COOH ve CH_3COO^- içerir.

yargılarından hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

22. HCl ve NaOH çözeltileri ile ayrı ayrı tepkime veren ve suda çözünmeyen bir metal oksiti, aşağıdaki türlerden hangisine örnektir?

A) Anfoter oksit B) Asit oksit C) Bazik oksit
D) Peroksit E) Nötr oksit

23. X: Kuvvetli asit- zayıf baz
Y: Zayıf asit- kuvvetli baz
Z: Kuvvetli asit- kuvvetli baz

ile oluşturulmuş tuzlardır. Bu tuzların sulu çözeltileri için;

I. Üçü de elektrik akımını iletir.
II. X ve Z baz özelliği gösterir.

III. Y asit özelliği gösterir.

yargılarından hangisi ya da hangileri doğrudur?

A) Yalnız II B) Yalnız I C) I ve II D) II ve III E) I, II ve III

24. Asitler ve bazlarla ilgili aşağıda verilen yargılardan hangisi doğrudur?

A) Asitler, mavi turnusol kağıdını kırmızıya çevirirler.
B) Bazların sulu çözeltilerinde 25°C’ de, $[H^+]$ değeri $1x10^{-7}$ M dan büyüktür.
C) Bazların sulu çözeltileri elektriği iletmez.
D) Bazların formüllerinde her zaman OH^- iyonu bulunur.
E) Asit çözeltilerinin 25°C’ deki pH değeri 7 den büyüktür.

25. I. NH_3 bir asittir.
II. Aynı sıcaklıkta HCl, HF’ye göre daha kuvvetli bir asittir.
III. KOH, NaOH a göre daha kuvvetli bir bazdır.

($_{19}K$, $_{11}Na$, $_{17}Cl$, $_{9}F$)

Yukarıda verilen yargılardan hangisi ya da hangileri doğrudur?

A) Yalnız III B) Yalnız II C) II ve III D) I ve II E) I, II ve III

26. 25°C de bulunan 100mL, X çözeltisinde pH=12 dir. Bu çözelti için;

I. Zayıf asit çözeltisidir.
II. $[OH^-]= 10^{-2}$ M dır.
III. H^+ derişimi OH^- derişiminden büyüktür.

yargılarından hangisi ya da hangileri doğrudur?

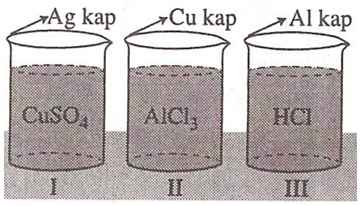
A) Yalnız II B) Yalnız III C) I ve II D) II ve III E) I ve III

27. Asidik ortamda gerçekleşen,

$NO^-_{3(suda)} + H^+_{(suda)} + 3e^- \rightarrow NO_{(g)} + H_2O_{(s)}$ yarı tepkimesi en küçük tam sayılarla denkleştirildiğinde, H_2O nun katsayısı kaç olur?

A) 2 B) 4 C) 6 D) 13 E) 15

28.



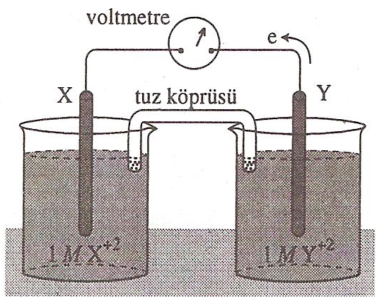
Bazı iyonların elektron alma eğilimlerinin sırası şöyledir:

$Ag^{+} > Cu^{+2} > H^{+} > Al^{+3}$

Buna göre, yukarıdaki kapların hangisi ya da hangilerinde bir reaksiyon gerçekleşir?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

29.



Yandaki pilde elektronlar ok yönünde hareket ettiğine göre, aşağıdakilerden hangisi bu pil için doğrudur?

A) X anottur.
B) Katot tepkimesi $Y^{+2}_{(suda)} + 2e^{-} \rightarrow Y_{(k)}$ şeklindedir.
C) X^{+2} indirgendir.
D) Aynı sıcaklıkta Y nin yükseltgenme potansiyeli X ten daha yüksektir.
E) Tuz köprüsünde katyonlar, Y nin batırıldığı çözeltiye doğru hareket ederler.

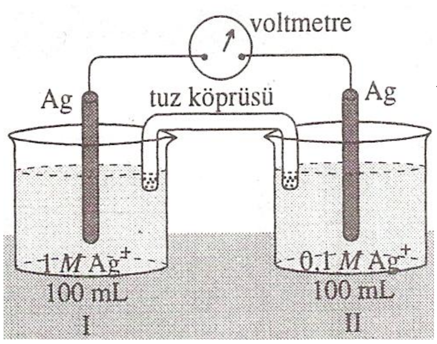
30. $Mg^{+2}_{(suda)} + 2e^{-} \rightarrow Mg_{(k)}$ E°= -2.37V

$Ag^{+}_{(suda)} + e^{-} \rightarrow Ag_{(k)}$ E°= +0.80V

Olarak verildiğine göre, Mg – Ag piliyle ilgili aşağıda verilen yargılardan hangisi doğrudur? (Ag: 108 g/mol)

A) Pil potansiyeli 3.10 V dir.
B) Pilin şeması $Mg_{(k)} / Mg^{+2}_{(suda)} // Ag^{+}_{(suda)} / Ag_{(k)}$ şeklindedir.
C) Pil gerilimini artırmak için, ortamın sıcaklığı artırılmalıdır.
D) Net pil tepkimesi, $Mg^{+2}_{(suda)} + 2Ag^{+}_{(suda)} \rightarrow Mg_{(k)} + 2\ Ag_{(k)}$ şeklindedir.
E) Dış devreden 1mol elektron aktığında, katotta 10.8g Ag toplanır.

31.



Yandaki derişim pili için aşağıdaki ifadelerden hangisi doğrudur?

$Ag^{+}_{(suda)} + e^{-} \rightarrow Ag_{(k)}$ $E° = + 0.80$ V

A) I. kaptaki Ag^{+} derişimi zamanla artar.
B) $E°_{pil} = + 0.80$ V dir.
C) Her iki kaptaki Ag^{+} derişimleri eşit olduğunda, pil gerilimi sıfır olur.
D) I. kaba 100mL arı su eklenirse pil gerilimi artar.
E) Pil çalışırken I. kaptaki $Ag_{(k)}$ elektrot kütlesi azalır.

32. I. $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$
II. $2NaOH_{(suda)} + H_2SO_{4(suda)} \rightarrow Na_2SO_{4(suda)} + 2H_2O_{(s)}$
III. $Ca_{(k)} + 1/2O_{2(g)} \rightarrow CaO_{(k)}$

Yukarıda verilen reaksiyonlardan hangisi ya da hangileri redoks reaksiyonudur?

A) Yalnız I B) Yalnız II C) I ve II D) I ve III E) II ve III

33. Bir redoks tepkimesindeki maddelerle ilgili olarak;

I. Yükseltgenen, elektron verir.
II. Indirgenen, elektron alır.
III. Yükseltgen, elektron alır.

Yargılarından hangisi ya da hangileri doğrudur?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

APPENDIX D

INSTRUCTIONAL OBJECTIVES

Instructional Objectives of Rates of Chemical Reactions

1. To explain apply the principles of the collisison theory.
2. To apply the principles of the collisison theory.
3. To define the activation energy.
4. To discriminate the conditions for a successful collision to occur.
5. To identify the position of an activation energy on a graph of potential energy of particles versus reaction ccordinate.
6. To identify the position of an activation energy on a graph of kinetic energy versus reaction ccordinate.
7. To deduce the rate law from the change in concentrations of the reactants of a reaction.
8. To distinguish the rate determining step in a reaction mechanism.
9. To identify the intermediates in a reaction mechanism.
10. To determine the order of a reaction.
11. To explain the effect of temperature and surface area on reaction rate.
12. To explain the function of a catalyst in a reaction.
13. To identify a catalyst in a reaction mechanism.

14. To recognize the factors affecting the reaction rate and explain their effect on the rate.

Instructional Objectives of Chemical Equilibrium

1. To define what chemical equilibrium is.
2. To explain what it means for a chemical reaction to come to the equilibrium.
3. To distinguish the conditions which are necessary to achieve the equilibrium.
4. To explain the graphical change of the concentrations of reactants and products in time for both homogeneous and heterogeneous reactions as the reaction proceeds.
5. To write the expression of the equilibrium constant when given the chemical equation for either a homogeneous or heterogeneous equilibrium system.
6. To calculate the value of K_c .
7. To predict which direction a reaction will proceed towards in order to reach the equilibrium by using the reaction quotient (Q_c).
8. To relate the value of the equilibrium constant (K_c) to the value of K_P.
9. To calculate the value of new K_c when the coefficients of the equilibrium reaction are changed.
10. To calculate the value of K_c for a reaction which is written as the sum of two or more other reactions.
11. To determine which direction the reaction will proceed towards to reach the new equilibrium when the temperature of the system is changed by using the Le Chatelier's principle.

12. To determine which direction the reaction will proceed towards to reach the new equilibrium when the concentrations of the substances in the reaction are changed by using the Le Chatelier's principle.
13. To determine which direction the reaction will proceed towards to reach the new equilibrium when the pressure or volume of the system is changed by using the Le Chatelier's principle.
14. To explain the effect of a catalyst on the equilibrium.
15. To describe the factors affecting the value of the equilibrium constant.
16. To determine the new equilibrium concentrations of the substances in a reaction when the system at equilibrium is disturbed by the addition / subtraction of a substance to / from the system, or change of the temperature of the system, or change of the volume / pressure of the system, or adding a catalyst to the system.

Instructional objectives of solubility equilibrium

1. To explain the equilibrium established between a solid and its solution.
2. To write the mathematical expression for the solubility product constant, K_{sp}.
3. To recognize the factors that control the solubility equilibrium.
4. To apply the principles of solubility equilibrium.
5. To calculate K_{sp} from solubility.
6. To calculate the solubility from K_{sp}.
7. To predict the precipitation of ions in a solution by comparing the value of the ion product (I.P.) to the value of K_{sp}.

8. To explain the common-ion effect on the solubility of substances.
9. To apply the principles of fractional precipitation.

Instructional Objectives of Acids and bases

1. To define acids and bases according to Arrhenius definition.
2. To define acids and bases according to Brønsted-Lowry definition.
3. To identify the properties of acids and bases.
4. To distinguish acids and bases according to pH or pOH values.
5. To solve problems related to pH and pOH.
6. To compare the strengths of different acids and bases.
7. To distinguish neutralization reactions.
8. To identify the differences between strong acids/bases and weak acids/bases.
9. To apply the principles of the titration of strong acids and bases.
10. To identify the differences between the reactions of active metals with strong acids and bases.
11. To identify the salt formed at the end of the neutralization reactions as acidic, basic, and neutral.
12. To explain hydrolysis.
13. To explain the properties of buffer solutions.
14. To identify the oxides as acidic, basic, neutral, or amphoteric.

Instructional objectives of electrochemistry

1. To distinguish the redox reactions.

2. To identify the oxidizing and reducing agents in a redox reaction.
3. To arrange metals in order of increasing/decreasing metallic activities by considering the corrosive powers of metals , vice versa.
4. To explain how a galvanic cell operates.
5. To explain the functions of electrodes and salt bridge in a galvanic cell.
6. To predict half-cell reactions of a given net cell reaction, vice versa.
7. To label the electrodes as the anode and cathode in an electrochemical cell.
8. To predict the direction of motion of electrons in a galvanic cell.
9. To calculate the overall cell potential by using the half-cell potentials.
10. To write the cell notation of a galvanic cell.
11. To explain how a concentration cell operates.
12. To balance redox reactions given in an acidic or a basic medium.
13. To predict how a cell potential changes by changing the temperature, pressure of the medium, and the concentrations of ions.
14. To apply the principles of how an electrolytic cell operates.
15. To predict the type of substances that will be collected at the anode and cathode of an electrolytic cell by considering the tendency of the elements/ions to be oxidized/reduced.

APPENDIX E

TABLE OF SPECIFICATIONS

Table E.1 Table of Specifications

Objectives / Topics	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Rates of chemical reactions			Item 5	Item 2, Item 4, Item 7	Item 1	Item 3, Item 6
Chemical Equilibrium		Item 11	Item 8	Item 9, Item 15	Item 12	Item 10, Item 13, Item 14
Solubility Equilibrium			Item 19		Item 18	Item 16, Item 17
Acids and Bases	Item 22, Item 24	Item 21, Item 23	Item 20	Item 26	Item 25	
Electrochemistry		Item 33	Item 27, Item 32	Item 28	Item 29, Item 30	Item 31
Total number	2	4	6	7	6	8
Total Percentage	6.1 %	12.1 %	18.2 %	21.2 %	18.2 %	24.2 %

APPENDIX F

AMOS FULL OUTPUT

Output for self-efficacy

The model is recursive.
Sample size = 604

Your model contains the following variables:

Observed, endogenous variables

Efficacy 1
Efficacy 2
Efficacy 5
Efficacy 6
Efficacy 8
Efficacy 9
Efficacy 10
Efficacy 11
Efficacy 13
Efficacy 14
Efficacy 3
Efficacy 4
Efficacy 7
Efficacy 12
Efficacy 15
Efficacy 16

Unobserved, exogenous variables

F1
e1
e2
e5
e6
e8
e9

e10
e11
e13
e14
F2
e3
e4
e7
e15
e16
e17

Variable counts

Number of variables in your model: 34
Number of observed variables: 16
Number of unobserved variables: 18
Number of exogenous variables: 18
Number of endogenous variables: 16

Parameter summary

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	18	0	0	0	0	18
Labeled	0	0	0	0	0	0
Unlabeled	14	1	18	0	16	49
Total	32	1	18	0	16	67

Notes for Model

Number of distinct sample moments: 152
Number of distinct parameters to be estimated: 49
Degrees of freedom (152 - 49): 103

Result

Minimum was achieved
Chi-square = 561.228
Degrees of freedom = 103
Probability level = .000

Maximum Likelihood Estimates

Regression Weights:

			Estimate	S.E.	C.R.	Label
Efficacy 1	←	CSCS	1.000			
Efficacy 2	←	CSCS	.945	.074	12.793	
Efficacy 5	←	CSCS	1.083	.087	12.409	
Efficacy 6	←	CSCS	1.181	.094	12.575	
Efficacy 8	←	CSCS	1.067	.124	8.591	
Efficacy 9	←	CSCS	1.071	.090	11.961	
Efficacy 10	←	CSCS	1.264	.087	14.466	
Efficacy 11	←	CSCS	1.192	.087	13.639	
Efficacy 13	←	CSCS	1.289	.088	14.679	
Efficacy 14	←	CSCS	1.192	.087	13.707	
Efficacy 3	←	SCL	1.000			
Efficacy 4	←	SCL	1.084	.035	30.815	
Efficacy 7	←	SCL	.882	.035	25.372	
Efficacy 12	←	SCL	1.034	.032	31.833	
Efficacy 15	←	SCL	.990	.032	31.340	
Efficacy 16	←	SCL	.899	.031	29.300	

Standardized Regression Weights:

			Estimate
Efficacy 1	←	CSCS	.624
Efficacy 2	←	CSCS	.622
Efficacy 5	←	CSCS	.599
Efficacy 6	←	CSCS	.609
Efficacy 8	←	CSCS	.391
Efficacy 9	←	CSCS	.572
Efficacy 10	←	CSCS	.731
Efficacy 11	←	CSCS	.675
Efficacy 13	←	CSCS	.745
Efficacy 14	←	CSCS	.679
Efficacy 3	←	SCL	.873
Efficacy 4	←	SCL	.886
Efficacy 7	←	SCL	.800
Efficacy 12	←	SCL	.899

			Estimate
Efficacy 15	←	SCL	.892
Efficacy 16	←	SCL	.863

Intercepts:

	Estimate	S.E.	C.R.	Label
Efficacy 1	4.654	.070	66.447	
Efficacy 2	6.162	.066	92.770	
Efficacy 5	5.219	.079	65.993	
Efficacy 6	5.609	.085	66.095	
Efficacy 8	5.168	.119	43.357	
Efficacy 9	5.467	.082	66.789	
Efficacy 10	5.822	.076	76.945	
Efficacy 11	5.397	.077	69.914	
Efficacy 13	5.278	.076	69.856	
Efficacy 14	5.445	.077	70.986	
Efficacy 3	3.402	.106	32.031	
Efficacy 4	3.721	.114	32.774	
Efficacy 7	3.834	.102	37.473	
Efficacy 12	3.399	.107	31.890	
Efficacy 15	3.573	.103	34.751	
Efficacy 16	3.209	.096	33.259	

Covariances:

			Estimate	S.E.	C.R.	Label
SCL	⇔	CSCS	.804	.123	6.562	

Correlations:

			Estimate
SCL	⇔	CSCS	.329

Variances:

	Estimate	S.E.	C.R.	Label
CSCS	1.151	.143	8.063	
SCL	5.181	.385	13.442	
e1	1.807	.114	15.833	
e2	1.625	.103	15.806	
e5	2.417	.151	16.011	
e6	2.731	.171	15.939	
e8	7.244	.428	16.917	
e9	2.714	.168	16.183	
e10	1.602	.110	14.561	
e11	1.958	.128	15.354	
e13	1.531	.107	14.352	
e14	1.912	.125	15.304	
e3	1.619	.112	14.484	
e4	1.673	.119	14.063	
e7	2.276	.144	15.775	
e15	1.313	.097	13.560	
e16	1.299	.094	13.851	
e17	1.428	.097	14.741	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	49	561.228	103	.000	5.449
Saturated model	152	.000	0		
Independence model	16	5866.610	136	.000	43.137

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.904	.874	.920	.894	.920
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.757	.685	.697
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	458.228	387.671	536.296
Saturated model	.000	.000	.000
Independence model	5730.610	5483.278	5984.269

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.931	.760	.643	.889
Saturated model	.000	.000	.000	.000
Independence model	9.729	9.503	9.093	9.924

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.086	.079	.093	.000
Independence model	.264	.259	.270	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	659.228	662.071		
Saturated model	304.000	312.819		
Independence model	5898.610	5899.538		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	1.093	.976	1.223	1.098
Saturated model	.504	.504	.504	.519
Independence model	9.782	9.372	10.203	9.784

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	138	150
Independence model	17	19

Execution time summary

Minimization: .031

Miscellaneous: .343

Bootstrap: .000

Total: .374

Output for achievement goals

The model is recursive.

Sample size = 604

Your model contains the following variables:

Observed, endogenous variables
goal1
goal6
goal8
goal3
goal4
goal10
goal11
goal12
goal14
goal2
goal5
goal7
goal9
goal13
goal15
Unobserved, exogenous variables

mastapp
e1
e6
e8
perfapp
e3
e4
e10
mastav
e11
e12
e14
perfav
e2
e5
e7
e9
e13
e15

Variable counts

Number of variables in your model:	34
Number of observed variables:	15
Number of unobserved variables:	19
Number of exogenous variables:	19
Number of endogenous variables:	15

Parameter Summary

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	19	0	0	0	0	19
Labeled	0	0	0	0	0	0
Unlabeled	11	6	19	0	15	51
Total	30	6	19	0	15	70

Number of distinct sample moments:	135
Number of distinct parameters to be estimated:	51
Degrees of freedom (135 - 51):	84

Result (Default model)

Minimum was achieved

Chi-square = 308.093

Degrees of freedom = 84

Probability level = .000

Maximum Likelihood Estimates

Regression Weights:

			Estimate	S.E.	C.R.	Label
goal1	←	Mastery-approach	1.000			
goal6	←	Mastery-approach	1.378	.096	14.399	
goal8	←	Mastery-approach	1.456	.101	14.475	
goal3	←	Performance-approach	1.000			
goal4	←	Performance-approach	.848	.058	14.538	
goal10	←	Performance-approach	1.155	.074	15.580	
goal11	←	Mastery-avoidance	1.000			
goal12	←	Mastery-avoidance	1.073	.083	12.947	
goal14	←	Mastery-avoidance	1.047	.082	12.807	
goal2	←	Performance-avoidance	1.000			
goal5	←	Performance-avoidance	.841	.083	10.184	
goal7	←	Performance-avoidance	1.088	.091	11.957	
goal9	←	Performance-avoidance	1.020	.089	11.416	
goal13	←	Performance-avoidance	1.231	.098	12.535	
goal15	←	Performance-avoidance	.906	.088	10.264	

Standardized Regression Weights:

			Estimate
goal1	←	Mastery-approach	.654
goal6	←	Mastery-approach	.776
goal8	←	Mastery-approach	.811
goal3	←	Performance-approach	.711
goal4	←	Performance-approach	.699
goal10	←	Performance-approach	.782
goal11	←	Mastery-avoidance	.652
goal12	←	Mastery-avoidance	.766
goal14	←	Mastery-avoidance	.715
goal2	←	Performance-avoidance	.573
goal5	←	Performance-avoidance	.531
goal7	←	Performance-avoidance	.673
goal9	←	Performance-avoidance	.625
goal13	←	Performance-avoidance	.730
goal15	←	Performance-avoidance	.536

Intercepts:

	Estimate	S.E.	C.R.	Label
goal1	4.200	.034	124.367	
goal6	4.033	.039	102.762	
goal8	4.026	.040	101.546	
goal3	3.489	.050	70.148	
goal4	3.884	,043	90.611	
goal10	3.319	.052	63.510	
goal11	3.090	.050	61.839	
goal12	2.927	.046	64.215	
goal14	2.750	.048	57.702	
goal2	3.083	.053	57.761	
goal5	3.503	.048	72.287	
goal7	2.407	.049	48.648	
goal9	2.743	.050	54.967	
goal13	2.583	.052	50.128	
goal15	2.593	.052	50.245	

Covariances:

			Estimate	S.E.	C.R.	Label
Mastery-approach	⇔	Performance-approach	.196	.029	6.890	
Mastery-approach	⇔	Mastery-avoidance	.116	.025	4.746	
Performance-avoidance	⇔	Mastery-approach	.021	.021	1.022	
Performance-approach	⇔	Mastery-avoidance	.221	.041	5.444	
Performance-avoidance	⇔	Performance-approach	.430	.050	8.672	
Performance-avoidance	⇔	Mastery-avoidance	.267	.040	6.730	

Correlations:

			Estimate
Mastery-approach	⇔	Perfromance-approach	.418
Mastery-approach	⇔	Mastery-avoidance	.269
Performance-avoidance	⇔	Mastery-approach	.052
Perfromance-approach	⇔	Mastery-avoidance	.318
Performance-avoidance	⇔	Perfromance-approach	.660
Performance-avoidance	⇔	Mastery-avoidance	.445

Variances:

	Estimate	S.E.	C.R.	Label
Mastery-approach	.294	.036	8.136	
Performance-approach	.753	.083	9.055	
Mastery-avoidance	.639	.082	7.795	
Performance-avoidance	.563	.080	7.000	
e1	.392	.028	14.212	
e6	.368	.035	10.460	
e8	.325	.036	8.964	
e3	.737	.056	13.126	
e4	.566	.042	13.408	
e10	.638	.059	10.842	
e11	.865	.065	13.384	
e12	.517	.054	9.631	
e14	.669	.058	11.540	
e2	1.153	.074	15.518	
e5	1.016	.064	15.881	
e7	.807	.057	14.229	
e9	.916	.061	14.952	
e13	.747	.057	13.034	
e15	1.144	.072	15.852	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	51	308.093	84	.000	3.668
Saturated model	135	.000	0		
Independence model	15	2956.299	120	.000	24.636

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.896	.851	.922	.887	.921
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.700	.627	.645
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	224.093	174.175	281.596
Saturated model	.000	.000	.000
Independence model	2836.299	2662.857	3017.067

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.511	.372	.289	.467
Saturated model	.000	.000	.000	.000
Independence model	4.903	4.704	4.416	5.003

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.067	.059	.075	.000
Independence model	.198	.192	.204	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	410.093	412.873		
Saturated model	270.000	277.359		
Independence model	2986.299	2987.117		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.680	.597	.775	.685
Saturated model	.448	.448	.448	.460
Independence model	4.952	4.665	5.252	4.954

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	209	230
Independence model	30	33

Execution time summary

Minimization: .031

Miscellaneous: .327

Bootstrap: .000

Total: .358