THE RELATIONSHIP AMONG SECONDARY SCHOOL STUDENTS' ATTITUDES, MOTIVATION AND SELF-EFFICACY BELIEFS TOWARD CHEMISTRY LESSONS

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ABSTRACT

THE RELATIONSHIP AMONG SECONDARY SCHOOL STUDENTS' ATTITUDES, MOTIVATION AND SELF-EFFICACY BELIEFS TOWARD CHEMISTRY LESSONS

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The purpose of this study was to investigate the relationship among secondary school students' attitudes, motivation and self-efficacy beliefs toward chemistry lessons and to determine the effect of grade levels, gender and school type on each dependent variable. The study was conducted during fall semester of 2011–2012 academic year in four high schools which are general public high school, Anatolian public high school, vocational public high school, and general private high school in Ankara. Cluster random sampling method was applied and 813 students taking chemistry course participated to the study. Attitude Scale Toward Chemistry (ASTC), Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV), and High School Chemistry Self Efficacy Scale for cognitive skills (HCSS) were used as measuring instruments. The collected data were analyzed with correlational analysis and with three-way analysis of variance (ANOVA) for each dependent variable.

The results of the analyses displayed that there were high correlations among students' attitudes, motivation, and self-efficacy beliefs toward chemistry lessons. Furthermore, the results showed that school type and gender of the students had ignificant effect on their attitudes, motivation, and self-efficacy beliefs toward chemistry lessons. For instance, students in private public high school had the highest and students in vocational public high school had the lowest attitudes, and girls were more motivated than boys toward chemistry lessons. However, grade level of the students had no significant effect on their attitude, motivation, and self-efficacy beliefs toward chemistry lessons.

Keywords: Attitude, motivation, self-efficacy beliefs, chemistry, school type, gender and grade level.

ÖZ

ORTAÖĞRETİM ÖĞRENCİLERİNİN KİMYA DERSİNE YÖNELİK TUTUM, MOTİVASYON VE ÖZ YETERLİLİK İNANÇLARI ARASINDAKİ İLİŞKİ

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Bu çalışmanın amacı orta öğretim öğrencilerinin kimya dersine yönelik tutum, motivasyon ve öz yeterlilik inançları arasındaki ilişkiyi araştırmak ve sınıf seviyesi, cinsiyet ve okul türünün her bir bağımlı değişken üzerindeki etkisini belirlemektir. Çalışma, Ankara'da 2011–2012 eğitim öğretim yılının güz döneminde, genel lise, Anadolu lisesi, meslek lisesi ve özel lise olmak üzere dört farklı tür okulda yürütülmüştür. Kümeden gelişigüzel örnekleme yöntemi uygulandı ve kimya dersi alan 813 öğrenci çalışmaya katıldı. Bu çalışmada ölçüm araçları olarak Kimya Tutum Ölçeği, Öğrenmede Güdüsel Stratejiler Anketi Türkçe Versiyonu ve bilişsel beceriler için Lise Kimya Öz Yeterlilik Ölçeği kullanıldı. Elde edilen veriler korelasyon analizi ve her bir bağımlı değişken için üç yönlü varyans analizi (ANOVA) kullanılarak analiz edilmiştir.

Analiz sonuçları öğrencilerin kimya derslerine yönelik tutum, motivasyon ve öz yeterlilik inançları arasında yüksek korelasyonlar olduğunu gösterdi. Yine sonuçlar göstermiştir ki, öğrencilerin cinsiyeti ve okul türünün kimya derslerine yönelik tutum, motivasyon ve öz yeterlilik inançları üzerine anlamlı etkileri

bulunmaktadır. Örneğin kimya derslerine yönelik olarak kızlar erkeklerden daha yüksek motivasyona sahiptir. Ancak, öğrencilerin sınıf seviyesinin kimya derslerine yönelik tutum, motivasyon ve öz yeterlilik inançları üzerinde anlamlı bir etkisi yoktur.

Anahtar Kelimeler: Tutum, motivasyon, öz yeterlilik inançları, kimya, okul türü, cinsiyet ve sınıf seviyesi.

To my wife and my lovely son, İbrahim,

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LIST OF ABBREVIATIONS

ATCS	: Attitude Toward Chemistry Scale
CSCS	: High School Chemistry Self-Efficacy Scale for Cognitive Skills
MSLQ	: Motivated Strategies for Learning Questionnaire
MSLQ-TV	: Motivated Strategies for Learning Questionnaire-Turkish Version
ANOVA	: Analysis of variance
PASW	: Predictive Analytics Soft Ware
F	: Fisher's F distribution
Sig.	: Significance
df.	: Degree of Freedom
SD	: Standard deviation
N	: Number of subjects

CHAPTER 1

INTRODUCTION

Affective factors such as attitude, motivation, and self-efficacy are very important constructs for instructional processes and students' learning academic tasks. The effects of these constructs on learning and educational issues have been the concern of many educators and researchers for decades due to the increasing awareness towards their importance. In the current study, three affective factors which are attitudes, motivation, and self-efficacy beliefs were investigated.

An attitude may be defined as an inclination to respond in a favorable or unfavorable manner with respect to a given attitude object (Oskamp and Schultz, 2005). The attitude object for this study was secondary school chemistry lessons. The scope of the present study was limited to chemistry as experienced by students in secondary school rather than chemistry related experiences obtained from out of school. Attitudes are important outcomes of education as well as academic achievement. The educators and researchers have sought the ways to gain students positive attitudes toward lessons due to their importance. Numerous researches have established that attitudes are linked with academic achievement. One of them was the study of Weinburgh (1995). In this study, a high correlation between attitude toward science and science achievement was obtained and attitude could account for approximately 30% of variance in achievement.

Motivation is another important construct which is one of the subject matters of the current study. As attitudes, motivation cannot be observed directly but it can rather be inferred from behaviors such as goal-directed activities and task choices. By the help of this concept, we can understand and explain why people behave as

they do. Motivation has a very important role in learning even though some simple types of learning can occur without motivation. Students with high motivation engage in instructional activities and show greater effort on learning tasks more than the students who have less motivation. Therefore, teachers understand the importance of motivation for learning and try to raise their students' level of motivation, and researchers seek to find out ways to improve students' motivation to learning (Schunk, 2008).

How students become more motivated? This question has been one of the primary concerns of educational studies. There are a lot of influences that make students more motivated. To illustrate, students are more motivated when they observe similar others perform a task. They believe that they can also perform the task. This motivational effect depends on self-efficacy (Bandura, 1986). Thus, the self-efficacy concept which was defined by Bandura (1986) as personal beliefs about one's capabilities to learn or perform actions at designated level has been regarded as a key motivational factor and a crucial concept in educational concerns for several decades. Self-efficacy influences the extent to which students engage in and persist at difficult tasks. Students with high self-efficacy beliefs are apt to establish more difficult goals and are more persistent to succeed these goals compared to students with low self-efficacy beliefs (Schunk, 2000). Similarly, the study of Schraw, Crippen, & Hartley (2006) showed that students with high self-efficacy beliefs tried to come over challenging tasks more and longer than the students with low self-efficacy. On the other hand, students who have low self-efficacy beliefs are inclined to show more academic anxiety (Zimmerman & Martinez-Pons, 1990), to give up more quickly when facing with difficulties, and to show less interest toward school subjects (Usher & Pajares, 2008). Furthermore, previous research studies showed that self-efficacy was a reliable predictor of students' academic achievement (Britner & Pajares, 2006; Cavallo, Potter, & Rozman, 2004; Lau & Roeser, 2002; Pintrich & De Groot, 1990).

Self-efficacy is fundamentally a domain-specific construct as concluded from research studies (Pajares, 1996). In the study of Smith and Fouad (1999), it is

found that self-efficacy is specific to subject areas and show very little generalization across areas. Thus, in the current study, students' self-efficacy beliefs were studied in chemistry as a specific domain.

Developing instruments assessing affective factors is a difficult work that requires a high level of profession. Researchers have developed several instruments in order to assess students' attitudes, motivation and self-efficacy beliefs toward science and chemistry. In the present study, three instruments which are suitable for Turkish culture with high reliability and validity were selected and used for assessing secondary school students' attitudes, motivation, and self-efficacy beliefs toward chemistry lessons. The scope of the current study was limited with the relationships among attitudes, motivation and self-efficacy beliefs, and also the effect of gender, school type, and grade level on these affective factors were investigated.

1.1 The Purpose of the Study

The purpose of this study was to investigate the relationship among secondary school students' motivation, self-efficacy beliefs, and attitudes toward chemistry lessons and to determine the effect of gender, school type, and grade level of the students on each of these variables.

1.2 The Main Problem and Sub-problems

Is there a relationship among three dependent variables which are secondary school students' motivation, self-efficacy beliefs, and attitudes toward chemistry lessons and what is the effect of three independent variables which are gender, school type, and grade level of the students on each of these dependent variables?

The sub-problems related to the main problem of the study are:

1. Is there a relationship between secondary school students' motivation and self-efficacy beliefs toward chemistry lessons?

2. Is there a relationship between secondary school students' motivation and attitudes toward chemistry lessons?

3. Is there a relationship between secondary school students' self-efficacy beliefs and attitudes toward chemistry lessons?

4. Is there a significant difference in the mean "attitude" scores for school type of secondary school students?

5. Is there a significant difference in the mean "attitude" scores for girls and boys?

6. Is there a significant difference in the mean "attitude" scores for grade levels of secondary school students?

7. Is there a significant difference in the mean "self-efficacy belief" scores for school type of secondary school students?

8. Is there a significant difference in the mean "self-efficacy belief" scores for girls and boys?

9. Is there a significant difference in the mean "self-efficacy belief" scores for grade levels of secondary school students?

10. Is there a significant difference in the mean "motivation" scores for school type of secondary school students?

11.Is there a significant difference in the mean "motivation" scores for girls and boys?

12. Is there a significant difference in the mean “motivation” scores for grade levels of secondary school students?

1.3 The Null Hypotheses

The null hypotheses related to the main problem of the study are:

$H_0(1)$: There is no significant relationship between secondary school students’ motivational beliefs and self-efficacy beliefs toward chemistry lessons.

$H_0(2)$: There is no significant relationship between secondary school students’ motivational beliefs and attitudes toward chemistry lessons.

$H_0(3)$: There is no significant relationship between secondary school students’ self-efficacy beliefs and attitudes toward chemistry lessons.

$H_0(4)$: There is no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from Attitude Toward Chemistry Scale.

$H_0(5)$: There is no significant mean difference between male and female students with respect to their scores obtained from Attitude Toward Chemistry Scale.

$H_0(6)$: There is no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from Attitude Toward Chemistry Scale.

$H_0(7)$: There is no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills.

$H_0(8)$: There is no significant mean difference between male and female students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills.

$H_0(9)$: There is no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills.

$H_0(10)$: There is no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version.

$H_0(11)$: There is no significant mean difference between male and female students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version.

$H_0(12)$: There is no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version.

1.4 Definition of Important Terms

Attitude: Attitude is the tendency to think, feel, or act positively or negatively toward objects in our environment (Eagly & Chaiken, 1993).

Self-efficacy: "Self-efficacy is peoples' judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391).

Motivation: "The process of instigating and sustaining goal-directed activities" (Schunk, 2008, p. 523).

Attitude toward chemistry lessons: A learned predisposition to evaluate in certain ways objects, people, actions, situations, or propositions involved in learning chemistry (Gardner, 1975).

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

Motivation toward chemistry lessons: The internal state that arouses, directs, and sustains students' behaviors in order to gain achievement in chemistry lessons (Glynn, Taasoobshirazi & Brickman, 2007).

1.5 Significance of the Study

Attitude, self-efficacy, and motivation are very important constructs and have great importance in education studies. They have significant effect on students' learning and achievement. Especially, it is very clear that these constructs are strongly related with students' science learning and science achievement. Improving these constructs is also noteworthy and key factors in designing curriculum and in designing effective science instruction.

Science education does not only consist of teaching some cognitive concepts, but also it should consist of improving students' affective, attitudinal, and motivational skills like developing attitudes toward science, persisting on studying on a specific task, or being intrinsically motivated to learning. One of the major priorities of science educators should be to help students for developing their science learning by the identification of variables such as attitude, self-efficacy, and motivation. This study can provide a framework for identifying those variables.

In the last three decades the studies about attitudes toward science has gained an importance in literature. Students' attitudes toward science have often been considered as the predictors of students' behaviors about science such as doing

homework and participating science related activities in the class. According to the past studies, attitudinal construct has an influence on students' learning as well as cognitive factors (Koballa and Glynn, 2007). Thus, attitude toward science and chemistry lessons are closely related with students' achievement and this makes the current study important.

One of the most important constructs that affects students' behaviors is their self-efficacy beliefs. There are a lot of studies that show the existence of the close relationship between self-efficacy and students' performance levels on academic tasks including examinations, final grades, lab reports, and papers. Several studies presented that self-efficacy beliefs toward chemistry lessons have positively correlated with chemistry achievement and are significant predictors in explaining chemistry achievement. Therefore, educational researchers give an importance to self-efficacy studies.

Students' motivational variables are viewed as significant predictors of students' classroom learning and science achievement by science educators. Because highly motivated students are likely to show more effort on their lessons than less motivated ones. Motivational variables are closely related with students' science achievement (Pintrich & Schunk, 1996). As a multidimensional construct, motivation has an important effect on students' chemistry achievement and it is also an important component of educational and instructional processes.

Previous studies have mostly focused on the relationship between attitude and achievement, self-efficacy and achievement, motivation and achievement, attitude and teaching methods, self-efficacy and teaching methods, or motivation and teaching methods. This study is different from all these studies in that it searches the relationships among the three variables which are attitude, self-efficacy, and motivation. Moreover, the effect of gender, school type, and grade level of the students on each of these variables is another focus of this research study. Moreover, the study has a specific domain, chemistry; however most of previous studies had general domains. To conclude, previous researchers have not

conducted such a study before and this research study will made an immense contribution to the literature. Finally, besides filling a gap in the literature, this study will add another dimension to the literature for the researchers to conduct further studies about determining the relationship among several affective variables in different domains.

Researchers have never before investigated the relationships among attitudes, motivation and self-efficacy beliefs toward chemistry lessons implemented in secondary schools. Therefore, this study is significant because it will provide empirical evidence about the relationship between three constructs which are motivation, self-efficacy beliefs, and attitudes toward chemistry lessons, and will provide to determine the effect of gender, school type, and grade level of the students on these constructs. If there is a relationship between these dependent variables, and whether this relationship changes according to grade level, gender, and school type, it might be important in secondary school chemistry curriculum design and thus academic achievement of the students (Cheung, 2009). Moreover, in designing courses, students' attitudes, self-efficacy beliefs, and motivation are very important constructs that should be taken into consideration. To sum up, secondary school students' motivation, self-efficacy beliefs and attitude toward chemistry lessons are very important in designing curriculum, designing effective courses, and academic achievement of students.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The review of the related literature is presented in this chapter of the study. The research studies related attitude toward science and chemistry were presented firstly. In the next part, studies about self- efficacy beliefs toward science and chemistry were presented, and the following part focused on research studies on motivational beliefs about science and chemistry briefly.

2.1 Attitude

Attitude is an important construct and has great effect on students' achievement and science learning. It is often taken into consideration as the predictors of students' behaviors about science such as completing assignments and attending class. Koballa and Glynn (2007) stated that according to the research studies, attitudinal construct has an influence on students' learning as well as cognitive factors. Furthermore, in spite of the difficulty, it is possible to change students' attitudes toward science by applying effective science instruction such as hand-on activities, laboratory work, field study, and inquiry oriented lessons.

In this section of the study, firstly definition, components, attributes and importance of the attitude construct are presented and then previous studies about attitudes toward science and attitudes toward chemistry are reviewed.

2.1.1 Definition and Importance of Attitude

In *The Free Dictionary,* a website-dictionary, attitude is defined as "a complex mental state involving beliefs and feelings and values and dispositions to act in

certain ways". Attitudes are internally established beliefs that affect actions of a person and show characteristics of a person, and are learned indirectly through experiences (Schunk, 2008, p.287). Moreover, according to Petty and Cacioppo (1981) attitude is "a general and enduring positive and negative feeling about some person, object or issue" (pp.7). Thus, the sentences like "I love chemistry", "Chemistry experiments are horrible", "I hate my chemistry teacher" and "I enjoy reading books on chemistry" show attitudes denoting the positive and negative feelings of a student about chemistry lessons (Koballa & Crawley, 1985). Furthermore, in literature the terms such as *interest*, *opinion* and *value* were used instead of attitude and the term attitude has been described in several ways (Koballa & Glynn, 2007).

Social psychologists have long considered attitudes having three components which are cognitive, affective, and behavioral. The cognitive component is a formation of some beliefs about the properties of the attitudes' object. This component is evaluated by tests and questionnaires. The affective component of attitude is feelings about attitudes' object and it is evaluated by physiological indices such as heart rate. The last component is the behavioral component is related to the means that people react toward the attitudes' object. This component is assessed by observing behaviors directly (Eagly & Chaiken, 1993). Oppenheim (1992) also explained the components of attitudes as follows: "…an attitude is a state of readiness, a tendency to respond in a certain manner when confronted with certain stimuli….Attitudes are reinforced by beliefs (the cognitive component), often attract strong feelings (the emotional component) which may be lead to particular behavioral intents (the action-tendency component)." (p. 174-175)

Furthermore, researchers have indicated and studied on the attributes of attitudes. They have stated four attributes of attitudes. Firstly, attitudes are persistent over time (Hill, Atwater & Wiggins, 1995; Koballa, 1988). In other words, it takes quite a long time to change, to shape or to develop an attitude. Secondly, attitudes are learned (Koballa, 1988) and exposures to live and symbolic models (Schunk,

2008). The third attribute of attitudes is that attitudes and behaviors are closely related i.e. they are correlated (Koballa, 1988; Shrigley, 1983, 1990). Finally, attitude is a function of personal beliefs (Fishbein & Ajzen, 1975; Ajzen, 1988; Zint, 2002).

One of the desirable outcomes of science education is improving students' attitudes toward science. Changes in attitudes toward science have been extensively studied for a number of reasons. First of all, it is thought that attitude toward science have an effect on future behaviors such as pursuing careers in science, participating science related activities and projects, and enrolling in an elective science course. (Kaballa & Crowley, 1985) Another reason is that attitude toward science is considered to have fulfill basic psychological needs such as knowledge and succession information (Baykul, 1990). Moreover, previous research studies have shown that there is a relationship between attitudes and achievement. Schibeci and Riley (1986) found enough evidence for the proposition that attitudes influence achievement rather than achievement influences attitudes. Students who have positive attitudes toward science apt to have higher scores on achievement tests (Oliver & Simpson, 1988; Weinburg, 1994; Mattern & Schau, 2002) However, in some research studies, weak correlations between attitude and achievement in science and chemistry were reported (Fraser, 1982; Raphael & Wahlstrom, 1987). Fraser (1982) reported that the relation between attitudes and achievement was found to account for only 1% of the variance which indicates that the relationship is quite weak and he proposed that science educators should directly deal with the subject-matter and improve teaching methods, strategies and conditions instead of concentrating on and improving students' attitudes toward science and chemistry. Due to these reasons, further researches should be conducted in order to determine to what extent those variables influence students' attitudes toward science and chemistry.

Furthermore, studying on attitudes is very important from the point of view of curriculum evaluation. Students' attitudes toward lessons are important dependent variables in curriculum evaluation (Fraser, 1979, 1981; Menis, 1982). Therefore,

most people in science education tend to agree that developing a positive attitude toward science should be a crucial aim of the school curriculum (Aiken & Aiken, 1969; Koballa, 1988; Laforgia, 1988).

2.1.2 Studies about Attitude

Gardner (1975) defined attitude toward science as "a learned predisposition to evaluate in certain ways objects, people, actions, situations, or propositions involved in learning science". Moreover according to Koballa and Crawley (1985) attitude toward science may be defined as "a learned, positive, or negative feeling about science that serves as a convenient summary of a wide variety of beliefs about science". In this part of the study, the review of previous research studies about attitudes toward science and chemistry is presented briefly.

For a long time science educators have dealt with the development positive attitudes toward science. Today all science educators agree that in understanding and learning science, developing positive attitudes toward science is very important as well as students' cognitive development. Researchers have made a lot of studies on students' attitudes toward science although it has been very difficult to study on as attitudes cannot be directly observed. Ramsden (1998) made a general conclusion of the research studies related with students' attitudes toward science. First of all, he stated that students consider science as a difficult area and it is not related to the daily lives of people. Secondly, students think that science causes environmental and social problems. Lastly, science is more attractive for boys than girls and in secondary school, students' attitude toward science decreases as grade increases.

Students' attitudes toward science have a close relationship with some variables such as gender difference and grade level. Previous studies have shown that there is relationship between attitudes toward science and science achievement. In the study of Freedman (1997), it is reported that there was a moderate positive correlation (.406) between attitude toward science and science achievement.

Moreover, according to the study of Webster and Fisher (2000), attitudes toward science affect science achievement powerfully. They conducted this study by using the data which was collected as a part of the Third International Mathematics and Science Study (TIMSS). Furthermore, Oliver and Simpson (1988) reported that students' self-concept of their ability in science was positively correlated with their achievement in science lessons.

One of the most important factors that have an effect on students' attitudes toward science is gender. Thus, gender differences in students' attitudes toward science have been an important concern of the researchers. Most of the studies show that males have a more positive attitude than females toward science (Francis & Greer, 1999; Jones, Howe & Rua, 2000; O'Brein & Porter, 1994; Schibeci & Riley, 1986; Simpson & Oliver, 1985). On the other hand, Greenfield (1997) has reported that there is not a difference between males and females in attitudes toward science.

Greenfield (1997) investigated gender differences in students' attitudes toward science. The study was conducted in three public school including 1200 students in grades 9-12. The survey that was used to assess students' attitudes toward science was the Student Attitude Questionnaire. This questionnaire which was developed by Ronald Simpson (Simpson & Troost, 1982) includes several subscales; attitude toward science class, attitude toward science curriculum, science anxiety and science self-concept. The results of the study showed that there is not a significant difference between girls and boys in attitudes toward science but as grade levels increase, attitudes toward science decrease. This situation is especially true for girls rather than boys. Furthermore, boys are more likely to view science as a masculine field of study and they also view that science requires a high level of intelligence.

In the study of Jones, Howe, and Rua (2000), gender differences on students' experiences, interests, and attitudes toward science and scientists were examined. The study reported that in physical sciences such as chemistry and physics, males

tended to have more experience than females in their out of school lives and in biological sciences it was vice versa. Furthermore, the study concluded that males were found to be more interested in physical sciences than females and females showed more interest in the biological sciences than males.

Keeves and Kotte (1995) made a research study about gender differences in science achievement, attitudes and participation across several countries and over time. They found that males had more positive attitudes toward science than females. However, they also found that females were more interested in school and school learning in general. Related with the difficulty in learning science, males thought that it was not difficult to learn science, but according to females, science was difficult to learn. Moreover, they found that in secondary school years, more males enrolled in physics and chemistry courses and more females enrolled in biology courses. It is also reported in the study that male students had higher achievement than female students in physics and chemistry. However, in biology there were significant achievement differences between male and female students.

Several research studies that examined the relationship between attitude toward science and grade level have been conducted. Osborne, Simon, and Collins (2003) made a general conclusion that research indicated a decline in attitudes toward science as the students' ages increase. George (2006) made a study on the relationship between attitude toward science and grade level. George examined changes in two attitudinal dimensions across grade levels. These attitudinal dimensions are students' attitudes towards science and their attitudes about the utility of science. The sample of the study was 444 students from the middle schools and high schools. The results of the study showed that as grades of the students increased, students' attitudes toward science decreased, but students' attitudes about the utility of science increased.

According to the study of Baykul (1990), Turkish students' attitudes toward science lessons significantly decreased from grade 5 through grade 11. In his

study it is also found that attitude scores of mathematics and science courses have significant relations with the scores of subtests of mathematics and science tests in ÖSS (student selection examination for university registration). Moreover, Francis and Greer (1999) examined secondary school students' attitudes toward science in Northern Ireland. They also examined the significance of gender and grade in respect of three sub-dimensions of the attitude scale which are importance of science, science as a career and science in the school curriculum. The sample was 838 male and 711 female secondary school students with a total number of 1549 from 24 schools. The statistical analyses showed that in the level of importance of science, there was no significant difference among grades. However, students in higher grades had less positive attitudes than in lower grades to the career in science and to the place of science in the school curriculum. Furthermore, there was no significant difference in the level of importance of science between males and females. Nevertheless, males had more positive attitudes than females to the career in science and to the place of science in the school curriculum.

The majority of the research studies concerned attitude toward science are in general not in specific like physics, biology, and chemistry. It is necessary to make researches in specific disciplines as attitudes are thought to be domain specific.

Researches have stated that students show different attitudes to chemistry, physics, and biology in school (Barnes et al, 2005; Harvey and Stables, 1986; Hofstein et al., 1977; Kahle and Meece, 1994; Murphy and Whitelegg, 2006; Osborne and Collins, 2001; Spall et al., 2004; Stables and Wikeley, 1997; Steinkamp and Maehr, 1984). Researchers have also stated gender differences in branches of science. Females are in tendency to respond more positively to biological sciences than to physical sciences (Foster, 1967; Gardner, 1975; Johnson, 1987; Kelly, 1988; Ramsden, 1998; Stables, 1990; Stark and Gray, 1999; Warrington and Younger, 2000).Therefore, Spall, Dickson, and Boyes (2004) recommended researcher to differentiate the branches of science and to make researches on specific disciplines of science like chemistry.

One of the key factors that has an effect on students' understanding learning chemistry is attitudes toward chemistry (Dalgety, Coll, & Jones, 2003; Kan & Akbaş, 2006; Sirhan, 2007; Yücel, 2007). Cukrowska, Staskun, and Schoeman (1999) made a study on the relationship between attitudinal factors and students' academic achievement in the first year chemistry courses. They found a substantial relationship between attitudes toward chemistry and chemistry achievement, and they also found that achievement in chemistry is more dependent on attitudes than aptitudes of the students.

Menis (1989) made an investigation on attitudes toward chemistry and science among upper secondary chemistry students (grade 11 and grade 12) in the United States of America. In the study, an attitude questionnaire was used to reveal students attitudes toward science and chemistry. The questionnaire was composed of 28 items including four sub-scales which are "attitudes toward school", "importance", "careers in science", and "science in school". The overall reliability coefficient (KR-20) was calculated as 0.82 indicating a high reliability. The sample upon which the study was conducted included 2804 grade 11 students and 656 grade 12 students from 156 schools across the United States of America. The findings of the study states that grade 12 students have more positive attitudes toward chemistry and science than grade 11 students in all attitudinal subscales. Generally, most of the students expressed that they have positive attitudes toward the importance of chemistry and they believe that science and chemistry are very important areas in modern times.

In another study of Menis (1983), it is reported that from 1970s to 1980s, there was a sharp decrease in selection of chemistry lessons among high school students in Israel. Thus, the purpose of this study was to examine the attitudes toward chemistry among high school students, aged 15, who had the chance to choose chemistry test in the university entrance examinations in Israel. A chemistry attitude questionnaire including 20 items in a five-point Likert scale was used to assess students' attitudes toward chemistry. The sub-scales of the questionnaire were interest and fascination in chemistry, use of chemistry, enjoyment of

chemistry, and importance of chemistry. The sample of the study was 211 high school students (85 males and 127 females) at the age of 15 from three schools which were considered as upper and upper-middle classes. A modern chemistry curriculum was being conducted and the chemistry program was based on innovative teaching principles in those schools. In the study, it was concluded that there is a significant difference between male and female students in all attitudinal sub-scales. Male students show more positive attitudes toward chemistry lessons than female students. Moreover, it is found that school differences do not have an effect in attitudes toward chemistry. The study concluded that it is very important to develop positive attitudes toward chemistry and teachers should try to improve students' positive attitudes toward chemistry by several means such as fostering curiosity and interest of students, encouraging students in participating laboratory activities, and providing opportunities for self-examination.

Salta and Tzougraki (2003) investigated 11th grade students' attitudes toward chemistry. In this study, the focus was on the importance of chemistry in daily life, the importance, the difficulty, and the interest of chemistry course and the usefulness of chemistry course for future career. In order to assess students' attitudes toward chemistry, an instrument was developed and validated including four subscales which are difficulty, interest, usefulness, and importance. By conducting a pilot study with 70 students at 11th grade from a public high school in Athens, the instrument was formed. It included 30 items with a five-point Likert scale ranging from "strongly disagree" to strongly agree. In the main study the participants were 576 students at 11th grade, 16-17 years old. These students were selected from seven schools in four towns in Greece. Internal reliability coefficient of this scale (Cronbach alpha) was calculated as 0.89 in the pilot study and 0.91 in the main study. The analysis of data showed that students show neutral attitudes regarding interest and difficulty in chemistry course. On the other hand, they have negative attitudes in the usefulness of chemistry course in that chemistry lessons are not useful for their future career and they have positive attitudes regarding the importance of chemistry in their daily life. Moreover, there was no significant difference between boys and girls in the three subscales;

interest, usefulness, and importance related with chemistry. However, boys had more positive attitudes than girls with regard to the difficulty of chemistry lessons. On the one hand, some of the results of this study are similar with those in Menis' study in Israel (1983) such as regarding the importance of chemistry students have a more positive attitude rather than the difficulty, the use and the interest of chemistry lessons. On the other hand, some results are different from Menis' study (1983) in gender differences. Boys have more positive attitude toward chemistry than girls regarding the interest, the use, and the importance to chemistry in Israel but there is not a significant difference in Greece.

In a recent study, Cheung (2009) investigated secondary school students' attitudes toward chemistry. The interaction effect between grade level and gender was the focus of this research. The sample of the study was 954 secondary school students who take chemistry course aged from 16 to 19 in Hong Kong. Students' attitudes were assessed by using an attitude toward chemistry lessons scale which has four subscales: liking for chemistry theory lessons, liking for chemistry laboratory work, evaluative beliefs about school chemistry and behavioral tendencies to learn chemistry. The instrument has 12 items with a seven-point Likert scale and the Cronbach's alpha values for each sub-dimension ranged from 0.76 to 0.86. The findings of the study are as follows. First, by using the statistical analysis, two-way MANOVA, it was concluded that there was a significant main effect for gender, a significant main effect for grade level and a significant interaction effect between grade level and gender was found to be statistically significant. Secondly, males liked chemistry theory lessons more than females in the first two years of secondary school. The only gender related difference of this research study was that. To put it differently, statistically significant differences were limited to first two grades of secondary school and the theory lessons subscale. Another finding of the study was that; male students' attitudes to chemistry lessons as expressed by liking chemistry laboratory work showed a significant decline as grade level increase, but there was no such significant change in female students' attitudes. Finally, for the evaluative beliefs subscale and behavioral tendencies subscale, there was not any significant change across grade level and between genders.

Hofstein, Ben-Zvi and Samuel (1976) studied on secondary school students' attitudes toward chemistry laboratory work in Israel. They found that there was not any significant difference between girls and boys in attitudes toward laboratory work, and 12th grade male and female students show less positive attitudes than 10th and 11th grade students.

Hofstein et al. (1977) was probably the first researchers to make a study on gender differences in secondary school students' attitudes toward chemistry lessons. As an instrument, they used a chemistry attitude scale including 76 items which was adapted by the Physics Attitude Scale used by Tamir et al. (1974). This Likert type scale included four subscales which are the study of chemistry in high school, the social and economic image of chemistry, the role of chemistry at the national-political level and the masculine-feminine image of chemistry. The sample was 300 secondary school students from 11th and 12th grade, aged 16-18, in Israel. The study showed that female students had more positive attitudes toward chemistry than males in all subscales. Moreover, it was reported that with increasing grade level of students, attitudes toward chemistry decrease.

As it is seen in previous research studies related with gender differences in attitudes toward chemistry, different results reported. Some of them report that males show more positive attitudes than females (Menis, 1983; Harvey and Stables, 1986; Barnes et al., 2005). Contrarily, some of them reports that females show more positive attitudes than males (Hofstein et al., 1977; Steinkamp and Maehr, 1984; Dhindsa and Chung, 1999; Shannon et al., 1982). On the other hand, some research studies report that there is not a significant gender differences in attitudes toward chemistry lessons (Salta and Tzougraki, 2004; Cheung, 2009).

Furthermore, students' attitudes toward chemistry lessons across grade levels were rarely studied by researchers. As it is indicated above, Hofstein et al. (1977) found a decrease in the attitudes toward chemistry lessons as students progress from 11th grade to 12th grade. On the other hand, in the study of Menis (1989), it

was reported that grade 12 students have more positive attitudes toward chemistry than grade 11 students. On the other hand, Cheung (2009) reported that in only one of four attitudinal subscales, chemistry laboratory work, male students showed a significant decline as grade level increase but it is not valid for attitudes of female students.

Kan and Akbaş (2006) examined secondary school students' attitudes toward chemistry lessons. The results showed that high school students were inclined to have a positive attitude toward chemistry lessons and there is not a significant difference in students' attitudes toward chemistry lessons between boys and girls. Moreover, 2^{nd} grade high school students showed more positive attitudes toward chemistry lessons than 1^{st} and 3^{rd} grade high school students and attitudes toward chemistry lessons is a significant predictor of chemistry achievement, and it explains 10.4% of the variance of chemistry achievement.

To conclude, grade level and gender differences are important variables that affect attitudes toward science and chemistry lessons. However, different results related with grade level and gender differences in attitudes were obtained in different studies. Thus, further studies should be conducted by the researchers. On the other hand, related literature shows that attitude toward science and chemistry lessons are closely related with students' science achievement. Thus, this makes attitude studies very important for science educators and science teachers should try students to improve positive attitudes toward science lessons.

2.2 Self-Efficacy

Self-efficacy is one of the most important constructs that affects human behaviors. In this part of the study, first of all the definition and sources of self-efficacy were stated in theoretical perspective and then the literature about self-efficacy which is related with science and chemistry lessons were reviewed briefly.

2.2.1 Definition and Sources of Self-Efficacy Beliefs

Bandura defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997). As the founder of social cognitive theory (1986), Bandura was the first to introduce the construct of self-efficacy to the literature. Since then, researchers have made a great many studies on the operation of self-efficacy and its relationships with several educational outcomes including motivation, learning attitude and achievement.

In social cognitive theory, the dynamic interaction of personal, behavioral and environmental factors determine human functioning, and people are involved in their own development and can determine the outcomes of their behaviors. In this regard, Bandura (1997) stated that self-efficacy affects behaviors and environments, and so is influenced by them. Students who have a high sense of self-efficacy about learning are more prone to engage in self-regulation such as setting goals and evaluating own learning processes. Moreover, outcomes of behaviors and inputs from the environment and feedback from teachers can influence self-efficacy (Schunk & Pajares, 2009).

There are some concepts that are similar to self-efficacy. These concepts are self-concept, self-esteem, self-confidence, and outcome expectations. Self-concept is refers to one's collective self-perceptions formed through experiences with and interpretations of the environment and influenced by reinforcements and evaluations by others (Shavelson & Bolus, 1982). Self-efficacy beliefs are cognitive, relatively concept specific and judgments of competence related to future. On the other hand, self-concept beliefs are normative structured in a hierarchical way, and they are self-perceptions related to past. Self-concept is often seen as a multidimensional construct which includes constructs such as self-esteem and self-confidence (Schunk & Pajares, 2009).

The evaluative component of self-concept is self-esteem which can be defined as one's perceived sense of self-worth (Schunk, 2008). Self-esteem beliefs include one's feelings about attainments of tasks (Linnenbrink & Pintrich, 2003). Self-confidence is described as "the extent to which one believes one can produce results, accomplish goals, or perform tasks competently" (Schunk, 2008, p.496). The people who have high sense of self-confidence trust their abilities and believe that they can attain their expectations and desires.

Outcome expectations are beliefs about expected outcomes of behaviors. Self-efficacy and outcome expectations are different concepts. For instance, a student who has high self-efficacy toward chemistry lessons may believe that he has the capability to learn chemistry. Nevertheless, he may also believe that he will not earn good grades from the exams because his chemistry teacher does not like him (Pintrich & Schunk, 1996).

There are four main sources of influence that can develop one's self-efficacy beliefs. These sources are mastery experience, vicarious experiences, social mastery experiences, and physiological and emotional states. Within these four sources, the most powerful one that creates a strong sense of self-efficacy is through mastery experiences or one's interpretations of one's own performance. Successes from a strong belief in one's personal efficacy and failures undermine it. Moreover, a robust sense of efficacy requires experience in overcoming the problems through enduring effort (Bandura, 1997).

Other source of self-efficacy is vicarious experiences provided by social modals (Bandura, 1997). Observing similar other people's achievements enhances observers' self-efficacy and motivates them to try the tasks. In the same vein, observing a failure lowers observers' self-efficacy and dissuades them attempting the task (Schunk, 2008, p.107). Another source of influence that develops self-efficacy is social mastery experiences. The people who are verbally told that they are capable to the task perform greater effort because of the raise in self-efficacy

(Bandura, 1997). This raise in the self-efficacy depends on the credibility and trustworthiness of the persuader (Uzuntiryaki & Aydın, 2009).

The last source of influence develops self-efficacy is physiological and emotional states. According to Bandura (1997), people's judgments about their capabilities also rely partly on their physiological and emotional states such as anxiety, stress, and fatigue. These four sources of information do not effect self-efficacy automatically; they are cognitively evaluated i.e. people weigh and combine personal, behavioral, and environmental factors such as ability, task difficulty, and pattern of successes and failures.

Researchers studied on correlation among these four sources of self-efficacy. They found that mastery experiences were the most powerful determiner of self-efficacy beliefs. Other sources of self-efficacy beliefs are not as strong as mastery experiences in determining self-efficacy beliefs (Bandura, 1997; Britner, 2008; Britner & Pajares, 2006; Hampton, 1988; Klassen, 2004; Usher & Pajares, 2006).

2.2.2 Studies about Self-Efficacy Beliefs

In this part of the study, the review of previous research studies about self-efficacy beliefs toward science and chemistry is presented briefly and respectively. Bandura (1986) theorized that self-efficacy beliefs are significant predictors of the academic successes. Many studies show that there is a close relationship between self-efficacy and academic achievement (Multon et al.,1991; Pajares, 1996; Hampton & Mason, 2003; Pajares & Miller, 1994; Shell et al., 1995).

Self-efficacy has a close relationship with students' performance levels on academic tasks. According to the study of Zimmerman, Bandura, and Martinez-Ponz (1992), students' self-efficacy for academic achievement was predictive of final grades of secondary school students. Moreover, in the study of Pintrich (1999), it is found that students' self-efficacy beliefs had a significant relationship

with their academic performance including final grades, lab reports, examinations and papers.

Dalgety and Coll (2006) defined science self-efficacy as "the perception of ability to undertake science tasks". There are a lot of studies that show the strong relationship between science self-efficacy and science achievement (Andrew, 1998; Pajares, Britner, & Valiente, 2000; Britner & Pajares, 2001, 2006; Kupermintz, 2002; Lau & Roeser, 2002). Students who have higher science self-efficacy achieve higher grades in science lessons (Lent et al., 1984; Rowe, 1988; Williams, 1994). In the study of Lau and Roser (2002), it is found that 10^{th} and 11^{th} grade students' self-efficacy in science is a significant predictor of students' science test scores and science grades. Furthermore, Lavonen and Laaksonen (2009) found that high school students' science related efficacy is a robust predictor of students' science achievement which was indicated by the Program for International Student Assessment (PISA).

Researchers have made a lot of investigations about the relationship between self-efficacy and gender under the guidance of Bandura' social, cognitive theory (Bandura, 1986), which emphasizes the crucial role of self-efficacy beliefs in human behaviors. It has been reported that males have higher self-efficacy than females toward science (Anderman & Young, 1994; Pajares, 1996; Pintrich & De Groot, 1990; Zimmermen & Martinez-Pons, 1990). However, Lau and Roeser (2002) found that female students had higher science grades and self-efficacy than males. Moreover, according to the literature, students' attitudes toward science affect their science self-efficacy beliefs (Jones & Young, 1995; Talton & Simpson, 1986; Smist & Owen, 1994; Liu, Hsieh, Cho, & Schallert, 2006).

In the study of Schunk and Hanson (1985), it was reported that students who anticipated having less difficulty in learning to solve the problems inclined to learn more than students who expected having difficulty. Furthermore, several studies have reported that students' self-efficacy beliefs influence their learning as well as their motivation (Brophy, 1983; Pintrich and De Groot, 1990).

Britner (2008) investigated the level of contributions of the four sources of self-efficacy to high school students' science self-efficacy beliefs and the possible differences in these variables among life, physical, and Earth science classes. A total number of 502 students (233 male and 269 female) from all grades (9^{th}, 10^{th}, 11^{th}, and 12^{th}) participated to the study from a public high school in United States. The Sources of Science Self-Efficacy Scale was used to collect data. This instrument consists of four subscales that measure the effects of mastery experiences, vicarious experiences, social persuasions, and physiological states with a total of 29 items. Students' grades at the end of the semester were used as science achievement in the each of science class. In the analyses, MANOVA was conducted to reveal gender differences, and multiple regression analyses were conducted in order to determine weather science self-efficacy predicted science achievement or not. According to the analyses, it was found that in the classes of Earth science females got higher grades and reported greater self-efficacy than males, in the classes of life science females got higher grades but did not report greater self-efficacy, however, in physical science classes there were not any significant gender differences in grades and in self-efficacy. Besides, in all science classes, science self-efficacy significantly predicted course grades for males and females. Moreover, mastery experiences were the only significant predictor of self-efficacy for males. On the other hand, in Earth science classes, mastery experiences were significant predictors, but in life and physical science classes, social persuasion, vicarious experiences, and physiological states were better predictors of science self-efficacy for females.

Researchers should concentrate on specific areas of science like chemistry, biology and physics; because self-efficacy is a task and domain specific construct. However, most of the studies about self-efficacy beliefs have been related with science in general. Çapa, Aydın and Uzuntiryaki (2009) defined chemistry self-efficacy as "students' perceptions of their ability to use intellectual skills in chemistry and accomplish laboratory tasks including skills in both cognitive and psychomotor domain". Dalgety and Coll (2006) found that students who have

high sense of self-efficacy toward chemistry are not confident in all aspects of chemistry. For example, students have less confidence in having experimental designs and tutoring other students whereas they have high confidence in summarizing a work from a written chemistry subject.

Uzuntiryaki and Çapa Aydın (2007) investigated the relationship between high school students' chemistry self-efficacy beliefs and their chemistry achievement. 150 10th grade public high school students participated to the study. Chemistry achievement was measured by a chemistry achievement test Chemistry and self-efficacy beliefs were measured by Chemistry Self-Efficacy Scale including two subscales: self-efficacy for cognitive skills and self-efficacy for laboratory skills in chemistry class. The results of correlational analysis revealed that there was a significant correlation between chemistry self-efficacy beliefs in cognitive skills and chemistry achievement. On the other hand, the correlation between students' self-efficacy for laboratory skills and chemistry achievement was not significant.

Moreover, Taasoobshirazi and Glynn (2009) conducted a study with 101 college students who took general chemistry course for science majors. They found a high correlation between chemistry self-efficacy and chemistry achievement in solving quantitative problems. However, Demirdöğen, Uzuntiryaki and Çapa Aydın (2009), did not find a statistically significant correlation between chemistry self-efficacy and GPA of students who took general chemistry course in public universities.

Recently, Şenay (2010) conducted a study with 604 11^{th} grade high school students in Turkey. High School Chemistry Self-Efficacy Scale for cognitive skills (CSCS) and an achievement test including 33 multiple choice items about rate of chemical reactions, chemical equilibrium, solubility equilibrium, acids and bases, and electrochemistry were used as instruments. The results of multiple regression analysis showed that 11^{th} grade students' self-efficacy beliefs toward chemistry lessons had a positive relationship with their chemistry achievement and it was a significant predictor in explaining chemistry achievement.

In the study of Kadıoğlu and Uzuntiryaki (2008) with 359 10th grade Turkish high school students, it was found that self-efficacy for learning chemistry was a significant predictor of chemistry achievement on the subject of gases and chemical reactions. Furthermore, Kan and Akbaş (2006) examined secondary school students' self-efficacy beliefs toward chemistry lessons. The study was conducted with 819 students including 1st, 2nd, and 3rd grades from 10 high schools in the city center of Mersin in different districts. A scale was developed in order to evaluate students' self-efficacy beliefs including 22 items in a five-point Likert type scale. The reliability coefficient, Cronbach's alpha, of the entire scale was found as 0.91. Factor analysis showed that the scale had three sub-dimensions the reliability coefficients of these sub-dimensions were obtained as 0.88, 0.82, and 0.77. The statistical analyses showed that male students have higher self-efficacy beliefs than females toward chemistry lessons and self-efficacy toward chemistry is a significant predictor of chemistry achievement and accounted for 8% of the variance. They also found that there are significant differences in high school students' self-efficacy beliefs toward chemistry lessons across grade levels. They reported that 10th grade students have higher self-efficacy beliefs toward chemistry lessons than other grades.

In another study, Smist (1993) developed a Science Self-Efficacy Questionnaire (SSEQ) to assess high school students' self-efficacy beliefs in science. The questionnaire included 27 items related with biology, chemistry, physics, and laboratory self-efficacies. Cronbach's alpha reliability coefficients for those subscales changed from .85 to .93. The participants were 430 college students in Massachusetts in United States of America. A hierarchical multiple regression and matched t-test analyses were conducted. The analyses showed that there were not any significant differences with respect to gender, and high school students' chemistry self-efficacy beliefs are significant predictors of chemistry achievement, explaining 16% of variance. Moreover, in the study of Morgil and Seçken (2004), it was reported that there is a significant correlation between gender and attitude toward chemistry course. Besides, they found that male

teacher candidates have higher self-efficacy beliefs toward chemistry than female teacher candidates.

In a recent study, Kurbanoglu and Akin (2010) investigated relationship between students' self-efficacy beliefs and attitudes toward chemistry. 395 first year major undergraduate students from four universities participated to the study. The Chemistry Attitudes Scale was used to measure students' attitudes and the Motivated Strategies for Learning Questionnaire was used to measure students' self-efficacy. In the study, it was found that chemistry attitudes were positively correlated with chemistry self-efficacy ($r = .34$). By path analysis, it was also found that self-efficacy had a direct and positive effect on chemistry attitudes.

As it is seen from the review of literature, self-efficacy construct has been the area of interest of many scientists and there have been a lot of studies conducted on this specific area. It was reported that self-efficacy had a crucial influence on students' academic achievement and it was also a very important component of educational and instructional issues. Therefore, more educational research studies on self-efficacy construct should be conducted.

2.3 Motivation

As a multidimensional construct, motivation is one of the most important variables that affect human behaviors. In this part of the study, first of all the definitions, theoretical perspectives and approaches were presented and afterwards the literature about motivation which is related with science and chemistry lessons were reviewed briefly.

2.3.1 Definition and Theoretical Approaches

In the literature motivation has been defined in several ways. Pintrich and Schunk (2002) defined motivation as "the process whereby goal-directed activity is instigated and sustained" (p. 5) and they stated that besides being a product,

motivation is mostly a process and thus it can be inferred from students' behaviors, cannot be directly observed. They also stated that academic motivation and performance are reciprocally related, that is students' performance affect academic motivation and students' academic motivation affects their performance. As an alternative definition, Glynn, Taasoobshirazi and Brickman (2007) defined motivation as "the internal state that arouses, directs, and sustains students' behaviors toward achieving certain goals". Moreover, according to Brophy (1987, p. 205-206), motivation to learn is "a student tendency to find academic activities meaningful and worthwhile and to try to derive the intended academic benefits from them".

In literature, there are several theoretical approaches to motivation as it is a multidimensional construct. These historical approaches are behavioral, humanistic, cognitive and social (Koballa & Glynn, 2007). These approaches are explained separately by science educators and psychologists. Based upon the features of each approach, however, some science educators have combined some of them such as social-cognitive theory (Pintrich, 2003).

Behavioral theories say that environmental events such as rewards and punishments make people motivated. If behaviors are reinforced regularly, they tend to be repeated in the future (Schunk, 2008). Intrinsic and extrinsic motivation are important motivational constructs. Motivation to do something for its own sake is intrinsic motivation, whereas motivation to do something for reasons external to the task is extrinsic motivation (Pintrich and Schunk, 2002). For example, in a competition, a student who carries out a chemistry laboratory project may enjoy it and may also be motivated by the expectation of receiving an award. Here, student's enjoyment is an intrinsic motivation and expectation of receiving an award is an external motivation.

People's capabilities and potentialities are the focus of humanistic theories because people try to find ways to control their lives and make choices (Schunk, 2008). From the point of view of humanistic approach, the meaning of motivation

is prompting people's inner resources such as their sense of competence, self-actualization, and self-esteem (Woolfolk, 2004). According to Schunk (2007, p. 460), "motivation is important for attaining basic needs, but greater choices are available when attempting to maximize one's potential". It is very important to understand Maslow's theory so as to understand humanistic approach. Maslow (1970) proposed that most of the human behaviors are performed in order to satisfy needs. These needs are hierarchical. In the hierarchy of needs, lower ones should be satisfied before higher ones. On the hierarchy, the lowest needs are physiological and it continues with safety needs, belongingness (love) needs, esteem needs and the need for self-actualization respectively. Lower-level needs must be satisfied adequately before higher-level needs.

Contrary to the behavioral theories, which say that environmental events such as rewards and punishments motivate people, cognitive theories say that motivation is internal. Intrinsic motivation is in the foreground as people are active and curious about events and try to solve their problems. Among cognitive theories Weiner's attribution theory has been extensively applied to the motivation studies (Pintrich and Schunk, 2002). Attribution theory says that people are tend to seek information to form attributions which are defined as perceived causes of outcomes and since attributions affect behaviors, beliefs and emotions, they are important from motivational perspective (Schunk, 2008). Weiner (2000) classified attributions under three causal dimensions which are locus of control, stability and controllability. Locus of control refers the location of the cause internal or external to the person, stability means weather causes change over time or not, and controllability refers weather the person can control the cause such as personal skills or cannot control the cause such as other people's actions or luck.

Social approach of motivation focuses on interpersonal relations in community and it emphasizes on the involvement in activities in community. The main issue of this approach is the notion of identity because every person in the community has his/her own identity and people are motivated to learn the values of the

community to maintain and preserve their identity as community members (Lave and Wenger, 1991).

Table 2.1 Four Approaches to Motivation

	Behavioral	Humanistic	Cognitive	Social
Source of Motivation	Extrinsic	Intrinsic	Intrinsic	Intrinsic
Important Influences	Reinforcers, rewards, incentives, and punishers	Need for self-esteem, self - fulfillment, and self-determination	Beliefs, attributions for success and failure, expectations	Engaged participation in learning communities; maintaining identity through participation in activities of group
Key Theorists	Skinner	Maslow, Deci	Weiner, Graham	Lave, Wenger

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In motivational framework, social cognitive theory states that there are some important constructs that explains people's motivation. One of them is self-efficacy which is explained in detail in this study previously. Another motivational construct is goal orientation which has been characterized as intrinsic and extrinsic goals. Intrinsic (learning) goal orientation focuses on mastery in a specific task, curiosity or challenge, whereas extrinsic (performance) goal orientation focuses on reward or other people's approvals. Intrinsic goals focus on people's dealing with processes and strategies that help them to improve their skills and capabilities (Ames, 1992). On the contrary, extrinsic goals focus attention on accomplishing tasks and these goals do not need deal with the importance of the strategies or processes related with task (Schunk, 2008). Self-determination, another motivational construct, is the ability to have choices and control to a degree over what and how we do it (Reeve, Hamm, and Nix, 2003). The self- determination view focuses on the internalization of social values. There may be several social values that controls and do not fit with a person's pursuits for self-determination, but they may produce good behavior and social

functioning. With continuing and developing processes these external motivators may be internalized by the people (Schunk, 2008).

2.3.2 Studies about Motivation

Researchers have studied on the motivational constructs extensively due to the fact that it has been considered as a crucial variable on educational studies. In literature, it was predominantly stated that the motivational constructs are closely related with students' academic achievement, and they were also determined as crucial components of educational and instructional processes. A lot of researchers have focused on the effect of gender, school type, and grade level variables on motivational constructs as well as the effect of motivation on students' academic achievement.

In the study of Yavuz (2006), students' motivational traits which are achievement, curiosity, consciousness and sociability were investigated. Both gender and grade level differences were investigated. 1927 girls and 1748 boys were the sample of the study with a total number of 3685 in elementary schools in Turkey. The results of the study indicated that there was a significant difference between boys and girls in motivational traits. Girls are more achiever, curious, conscientious, and sociable than boys. Another finding of the study was that students' motivational trait scores decrease as the grade level increase.

Previous research studies proposed that gender differences have also an important effect on motivation of students. In the study of Meece and Jones (1996), it is concluded that girls do not have enough motivational attributes and confidence that is needed to promote their learning in science and mathematics. Similarly, Dweck (1986) suggested that in developing motivational attributes to facilitate science and mathematics achievement girls show fewer tendencies than boys. On the contrary, in the study of Simpson and Oliver (1985, 1990), it is found that girls are more motivated to science achievement than boys at each grade level that were studied in both secondary school and elementary school. Özkan (2003)

conducted a study about effect of gender differences on motivation of students. In his study, Motivate Strategies for Learning Questionnaire (MSLQ) and a biology achievement test were used in instrumentation. 980 secondary school students in 10^{th} grade participated to the study. The results of this study showed that among subscales of motivation construct, self-efficacy belief scores of male students were higher than females; however, intrinsic goal orientation and test anxiety scores of female students were higher than males.

Furthermore, Zeyer (2010) investigated the impact of gender and science-orientation on the motivation to learn. The sample was 44 high school students (22 male and 22 female) from upper secondary level in Switzerland. The students were from 17 to 19 years old from science-oriented and non-science-oriented classes. In order to measure motivation to learn science, Science Motivation Questionnaire was used. The questionnaire includes 30 items and it reflects five basic motivational constructs that includes intrinsic and extrinsic motivation, goal orientation, self-determination, self-efficacy, and assessment anxiety. Since the questionnaire was translated and adapted to adolescents, the internal consistency reliability Cronbach's alpha value was calculated and found .872 indicating a high internal consistency. The correlational analysis showed that there was not a significant difference in motivation to learn science for gender and for science-orientation even if the analysis was restricted to the science students.

The effect of school type on student motivation has been investigated by several researchers. Urdan and Schoenfelder (2006) reviewed studies to find out the effect of school and classroom processes on student motivation. They reported that motivation of students increased when they are cared, supported and when they are encouraged to control their learning environment. So, it can be inferred that the type of school has a direct effect on students' motivation.

Many researchers reported that students' motivation in science decreases as grade level increase. Anderman and Young (1994) and Zusho, Pintrich and Copolla (2003) reported that there was a decrease in motivation in science and

mathematics with years of schooling and it is noticeable especially in the period of early adolescence. Furthermore, Tuan, Chin, and Sheih (2005) showed that motivation was a potential source of variance on students' science knowledge achievements. They reported that students' motivation could explain from 7% to 16% variance on the science knowledge test.

In a recent study, Eryılmaz, Yıldız, and Akın (2011) investigated the relationship between secondary school students' attitudes toward physics laboratories and their motivation levels of class engagement in physics lessons. A total of 294 high school students (114 male and 180 female) between the ages of 14-17 participated to the study in Ankara in Turkey. As instruments, two scales were used; Scale of Attitude Towards Physics Laboratory and Scales of Motivation-Amotivation for Class Engagement. The former had an internal consistency value of .89 and the latter one had .91. Simple regression analyses were used in the analysis of the data. It is found that the students who had positive attitudes toward physics laboratory had high motivation for class engagement. In other words, motivation of class engagement in physics lessons significantly explains attitudes toward physics laboratory.

Kadıoğlu and Uzuntiryaki (2008) made an investigation on motivational factors that contributes to chemistry achievement. The sample of this study was a total of 359 tenth grade secondary school students enrolled in chemistry course at three public secondary schools in Ankara, capital of Turkey. The instruments that were used to gather data were two tests. The first one is an achievement test about the gases and chemical reactions including 25 multiple choice items. KR 21 reliability coefficient of the test was calculated as .78. The other test was motivated strategies for learning questionnaire. The test was originally developed by Pintrich et al. (1991) and Sungur (2004) translated and adapted into Turkish. This instrument 31 items with a seven point likert-type scale. The subscales of the test were intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. The Cronbach's alpha reliability coefficient values for these subscales changes from

.54 to .86. In analyzing data multiple regression correlation was conducted with the six motivational subscales as predictors of students' chemistry achievement on the subject of gases and chemical reactions. The results of the analyses showed that 11% of the variance in chemistry achievement was accounted by three variables which are intrinsic goal orientation, self-efficacy for learning and performance, and test anxiety. These three variables were found to be significant predictors of the students' chemistry achievement in the gases and chemical reactions. Among these predictors, intrinsic goal orientation and test anxiety had negative influence and self-efficacy for learning and performance had positive influence.

According to the qualitative research of Chittleborough, Treagust, and Mocerino (2002), first year university chemistry students are not motivated for learning chemistry. They were only motivated to learn chemistry in order to pass the exams. Moreover, Nieswandt (2007) made a research in order to explore the relationship between affective and cognitive variables in grade 9 chemistry students. 73 high school students participated to the study. The study reported that there was no significant effect of students' affective variables which are situational interest and student chemistry specific self-concept on their understanding of chemistry concepts.

In a recent study, Devetak and Glazar (2010) investigated the relationship between students' intrinsic motivation for learning chemistry, formal reasoning abilities, and chemical knowledge. A total of 386 students attending second year of the general type of secondary school participated to the study in Slovenia. The average of the students' age was 16.3. The sample represented an urban population including several socioeconomic statuses. In gathering data the tests used were Chemical Knowledge Test, Test of Logical Thinking and Intrinsic Motivation for Learning Science Questionnaire. Chemical Knowledge Test includes 19 items and its internal consistency reliability Cronbach's alpha value was calculated as .80. Test of Logical Thinking is a 10 item group paper-pencil test, and it had a high reliability (Cronbach's alpha was .85). Intrinsic Motivation

for Learning Science Questionnaire is a five-point Likert type scale including 125 items. The reliability coefficient of this test was calculated as .78. The results of the study showed that there was a moderate but statistically significant correlation between students' intrinsic motivation, formal reasoning abilities, and chemical knowledge at submicroscopic level.

Vrtacnik, Jurisecic, and Savec (2010) investigated the relationship between high school students' motivational profiles and chemistry achievement. A total of 361 high school students (164 males and 197 females) having an average age of 16.36 participated to the study. The participants were from urban and rural population with mixed socioeconomic status and were randomly selected from ten high schools in Slovenia. A questionnaire was designed to assess different components of students' motivation for learning chemistry such as intrinsic motivation and academic self-concept. It included 31 items with a five point Likert type scale. The results showed that students' motivational profiles were very important for their academic achievement. Students from good quality motivation group had greater achievements in chemistry lessons than the students from bad quality motivation group.

In the study of Zusho and Pintrich (2003), the role of motivation in the learning of college chemistry was examined. They tried to find out how motivational processes predict students' chemistry achievement and how students' motivation changes over time. For the purposes of this study motivational components were limited and stated as self-efficacy, task value beliefs, goal orientation, and affect that is defined as in terms of interest and anxiety. The sample was 458 college students (243 female and 215 male) who enrolled in the introductory chemistry course in a university in the USA. During one semester, participants completed three surveys. The first one consisted demographic questions and items evaluating their self-efficacy and task value beliefs. The second and the third questionnaires evaluated students' goal orientations, self- efficacy, task value beliefs, interest and anxiety. Seven items for self-efficacy, five items for task value, six items for mastery goal orientation, ten items for performance goal orientation, and ten items

for anxiety and interest affects were used to evaluate students' motivational traits. The internal consistency reliability alpha values for each trait changed between .84 and .94. All of the items with a five-point Likert type scale were adapted from the Patterns of Adaptive Learning Survey (PALS) and Motivated Strategies for Learning Questionnaire (MSLQ). Participants' SAT-mathematics scores were used as their prior achievements and introductory chemistry course grades at the end of the semester were used as their final achievements. In order to determine the change in students' motivation over the semester, repeated measures analyses of variance were conducted on all of the motivational traits. The findings suggested that students' motivation levels, especially self-efficacy, task value, and performance goals, decreased during the semester. Moreover, to understand the relationship between motivational processes and achievement in chemistry, correlational analyses were conducted. The results showed that adaptive motivational beliefs such as self-efficacy and task value were positively related with final course grades, and maladaptive motivational beliefs like anxiety were negatively related with final course grades. Finally, a hierarchical regression analyses were conducted with all motivational measures, and it is reported that prior knowledge, self-efficacy beliefs, task value beliefs were significant predictors of chemistry course performance. A notable point was that, of those predictors, self-efficacy was the best predictor even after controlling for students' prior achievement.

Akbaş and Kan (2007), made an investigation about the impact of the affective factors, which are motivation and anxiety, on secondary school students' chemistry achievement. In the research study, the sample was 819 secondary school students (422 females and 397 males) at all grades (1^{st}, 2^{nd}, and 3^{rd}) from 10 high schools located in the city center of Mersin in Turkey. Two questionnaires which were developed by researchers for chemistry course were used to collect data. The motivation scale included 23 items and anxiety scale included 19 items. For the former scale factor analysis was conducted to get evidences for construct validity, and four dimensions explaining 63.14% of variance of motivation were obtained. Besides, in order to obtain evidences for reliability, Cronbach's alpha

reliability coefficient was calculated as .78 and test-retest reliability was calculated as .92 for the entire scale. On the other hand, for the latter scale two dimensions explaining 46.87% of variance obtained from the factor analysis. Cronbach's alpha reliability coefficient was calculated as .77 and test-retest reliability was calculated as .90. Analyses of variances and multiple regression analyses were conducted. The results showed that there was not any significant difference between genders in the motivation for chemistry lessons, however in the anxiety affective factor, girls were significantly had higher level of anxiety for chemistry lessons than boys. Moreover, motivation and anxiety for chemistry lessons were significant predictors of chemistry achievement explaining 6% and 15% of the variances respectively. Finally, there were significant differences between 1st and 3rd grade students regarding both the motivation and the anxiety for chemistry lessons.

From the review of literature about motivation, it is clear that researchers have been widely studied on this construct from very different point of views and perspectives. As a multidimensional construct, motivation has a crucial influence on students' academic achievement and it is also a crucial component of educational and instructional processes. Thus, more and more educational research studies on motivation construct should be conducted.

The summary of literature showed that students' attitudes, self-efficacy beliefs, and motivation toward science and chemistry lessons are important factors determining their academic achievement. Moreover, these variables are closely related with students' gender, school type and grade level variables. In designing courses and curriculum, students' attitudes, self-efficacy beliefs, and motivation are very important constructs that researchers and educators should consider. Therefore, in this study the relationship between these dependent variables and their change with respect to aforementioned independent variables were studied in the domain of chemistry.

CHAPTER 3

METHODOLOGY

This chapter represents information about the methodology used in the study. The chapter consists of six parts: population and sampling, variables, instruments, data collection, analysis of data, and assumptions and limitations of the study.

3.1 Population and Sampling

In this study a target population would be all secondary school students taking chemistry course in Ankara in Turkey. Due to the demographic, socio-economic, and socio-cultural differences among districts in Ankara, such a generalization may not be justifiable. This study may be generalizable to the all secondary school students who take chemistry course in Etimesgut district in Ankara. Thus, the accessible population in this study is secondary school students who take chemistry course in Etimesgut district.

Cluster random sampling method was applied as a sampling method owing to its effectiveness in studies whose accessible population consists of large numbers of clusters. Schools which were considered as clusters were randomly selected from Etimesgut district. Students participated to the study voluntarily.

There are fourteen public and two general private high schools in Etimesgut district. Among the public high schools, four of them are general high schools, four of them are Anatolian high schools, and six of them are vocational high schools. The sample of this study includes students from randomly selected four different types of high schools which are general public high school, Anatolian public high school, vocational public high school, and general private high school.

A total number of students who participated the study is 813 which is more than 10% of the 9th, 10th, 11th, and 12th grade students taking chemistry course in Etimesgut district. Table 3.1 represents some demographic information of the students.

Table 3.1 Some demographic characteristics of the subjects. (N_{total} = 813)

	Grade Level								Gender			
	9		10		11		12		Male		Female	
School Type	N	%	N	%	N	%	N	%	N	%	N	%
General public high school	86	25.52	56	30.60	73	32.74	30	42.86	142	36.98	103	24.01
Anatolian public high school	84	24.92	47	25.68	44	19.73	11	15.71	93	24.22	93	21.68
Vocational public high school	87	25.82	54	29.51	91	40.81	15	21.43	84	21.87	163	37.99
General private high school	80	23.74	26	14.21	15	6.72	14	20.00	65	16.93	70	16.32
TOTAL	337	100,0	183	100,0	223	100,0	70	100,0	384	100,0	429	100,0

3.2 Variables

3.2.1 Independent Variables

In this study there were three independent variables: school type, gender, and grade level. These variables were considered as categorical variables.

School type: This variable classifies the school of the students' that they are attending as "general high school", "Anatolian high school", "vocational high school", or "private high school".

Gender: This variable labels the gender of the students as male or female.

Grade level: This variable labels the students' grade levels as 9th grade, 10th grade, 11th grade, or 12th grade.

3.2.2 Dependent Variables

The dependent variables of this study were motivation toward chemistry lessons, chemistry self-efficacy for cognitive skills, and attitude toward chemistry lessons. These variables were considered as quantitative variables and were measured by ASTC, MSLQ-TV, and CSCS.

3.3 Instruments

In this study three instruments were used to collect data: Attitude Scale Toward Chemistry (ASTC), Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV), and High School Chemistry Self-Efficacy Scale for Cognitive Skills (CSCS).

3.3.1 Attitude Scale Toward Chemistry (ASTC)

This instrument was developed by Geban et al. (1994) to measure students' attitudes toward chemistry as a school subject. The type of scale in this instrument is five point likert type (fully agree, agree, undecided, partially agree, and fully disagree). It consists of 15 items in Turkish language. The reliability of the scale was found to be 0.92 in the current study (see Apendix A).

The Kaiser-Meyer-Oklin (KMO) value of the current study is calculated as 0.94. This value indicates that the sample is adequate to conduct factor analysis because it is greater than the recommended value of 0.60 (Keiser, 1970, 1974). Furthermore, the observed significance level is 0.00 for Bartlett's test of sphericity (Bartlett, 1954) supporting the factorability of correlation matrix. According to KMO value and Bartlett's test result, a factor analysis for the data can be conducted. The factor analysis yielded three factors in eigenvalues, but this was not meaningful, on the other hand, the scatter plot showed two factors. Therefore, the factor analysis was conducted again through fixing two factors.

The factors are named as *enjoyment* and *importance of chemistry*. The result is presented in Table 3.2.

Table 3.2 Factor analysis result of ASTC

Factors	Item numbers
Enjoyment	1, 4, 6, 7, 8, 9, 13, 14, 15
Importance of chemistry	2, 3, 5, 10, 11, 12

Item loadings on enjoyment and importance of chemistry factors are presented in Table 3.3.

Table 3.3 Loading of items to the factors

Items	Components	
	1	2
Item 13	.77	.197
Item 7	.73	.379
Item 6	.72	.185
Item 1	.72	.418
Item 9	.71	.095
Item 4	.70	.361
Item 8	.65	.359
Item 15	.63	.370
Item 14	.55	.248
Item 12	.19	.761
Item 11	.26	.754
Item 10	.31	.723
Item 2	.43	.593
Item 5	.50	.559
Item 3	.12	.527

The eigenvalues of the factors are presented in Table 3.4. According to the table, two factors explain 56% of the total variance.

Table 3.4 Eigenvalues and explained variance for the factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.228	48.183	48.183	7.228	48.183	48.183
2	1.163	7.755	55.938	1.163	7.755	55.938
3	1.036	6.904	62.843			
4	.708	4.718	67.560			
5	.637	4.246	71.806			
6	.579	3.859	75.665			
7	.548	3.655	79.320			
8	.515	3.430	82.750			
9	.493	3.287	86.038			
10	.436	2.905	88.943			
11	.419	2.796	91.738			
12	.381	2.543	94.281			
13	.335	2.232	96.513			
14	.295	1.969	98.482			
15	.228	1.518	100			

Furthermore, in order to obtain reliability evidence, the Cronbach's alpha reliability coefficients for the enjoyment and importance of chemistry subscales were calculated and found as .90, and .82 respectively.

To sum up, factor analysis is conducted for the purpose of obtaining evidence for construct related validity of Attitude Scale Toward Chemistry. According to the results, by factor analysis, satisfying construct related validity of the questionnaire is presented.

3.3.2 High School Chemistry Self-Efficacy Scale for Cognitive Skills (CSCS)

Çapa Aydın and Uzuntiryaki (2009) developed High School Chemistry Self-efficacy Scale (HCSS) to assess high school students' self-efficacy beliefs related with chemistry. The scale had two dimensions: chemistry self-efficacy for cognitive skills and self-efficacy for chemistry laboratory. The former dimension was assessed by 10 items with a reliability $\alpha = .90$ and the latter dimension was

assessed by 6 items with a reliability α = .92. It was a self-report questionnaire with a nine-point likert scale from “very poorly” to “very well”.
The questionnaire used in this study is *chemistry self-efficacy for cognitive skills* dimension of HCSS which is called as High School Chemistry Self-Efficacy Scale for Cognitive Skills (CSCS) (see Apendix C). In the current study, the reliability (Cronbach’s alpha value) of the scale was found to be 0.89.

In order to provide evidence for construct related validity, factor analysis is conducted. Sampling adequacy was tested by the Kaiser-Meyer-Oklin (KMO) value which was 0.91 indicating the sample is enough to conduct factor analysis (Keiser, 1970, 1974). Moreover, Bartlett’s test of sphericity (Bartlett, 1954) has a significance level of 0.00 supporting the factorability of correlation matrix. Thus, it can be concluded that factor analysis can be conducted.

Only one factor, self-efficacy, was expected to be obtained, and the factor analysis yielded one factor as anticipated. The eigenvalues of the factor are presented in Table 3.5. According to the table, one factor explains 50% of the total variance.

Table 3.5 Eigenvalues and explained variance for the factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.032	50.316	50.316	5.032	50.316	50.316
2	.844	8.442	58.758			
3	.726	7.265	66.023			
4	.618	6.180	72.203			
5	.599	5.989	78.192			
6	.534	5.337	83.528			
7	.479	4.787	88.316			
8	.433	4.334	92.650			
9	.378	3.780	96.430			
10	.357	3.570	100			

By conducting factor analysis, construct related validity evidence is supported for High School Chemistry Self-Efficacy Scale for Cognitive Skills (CSCS).

3.3.3 Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV)

Motivated Strategies for Learning Questionnaire was developed by Pintrich and De Groot (1990) to assess the students' motivational beliefs and to measure their self-regulated learning. It includes two sections: motivational belief section and self-regulated learning section and five subscales. Each section includes 22 items in seven-point Likert type scale from "not at all true of me" to "very true of me". Table 3.6 shows these two sections and their subscales.

Table 3.6 Motivational belief and self-regulated learning sections and subscales of MSLQ

Section	Subscale
Motivational Belief	1. Intrinsic Value
	2. Self-Efficacy for Learning and Performance
	3. Test Anxiety
Self-Regulated Learning	1. Cognitive Strategy Use
	2. Self-Regulation

Pintrich et al. (1991) stated that the sections of this instrument can be used separately according to the needs**.** Özkan (2003) adapted this instrument into Turkish for biology lessons. In this study, only motivational belief section of the instrument was used in order to assess students' motivational beliefs. The 22 items of three subscales of the MSLQ which are intrinsic value, self-efficacy for learning and performance, and test anxiety were translated and adapted into Turkish and this scale is called as "Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV)". Internal reliability coefficient of this scale (Cronbach alpha) was calculated as .88. The reliability coefficients and the number of items of each scale is represented in Table 3.7.

Table 3.7 Reliability coefficients (Cronbach alpha) and the number of items of each scale

Subscale	Cronbach alpha value	Number of items
Intrinsic Value	.82	11
Self-Efficacy for Learning and Performance	.79	7
Test Anxiety	.74	4

This instrument (MSLQ-TV) is different from MSLQ in several ways. First of all, only motivational belief section of the instrument which includes intrinsic value, self-efficacy for learning and performance, and test anxiety subscales were translated and adapted into Turkish. Secondly, the original questionnaire is a seven-point likert type, but the adapted form is a five-point likert scale questionnaire from "fully agree" to "fully disagree". Moreover, the items of MSLQ are field independent, but MSLQ-TV is specific to biology class.

The questionnaire used in the current study (see Appendix B) is different from MSLQ-TV which was translated and adapted by Özkan (2003) in that the domain is chemistry instead of biology. In this study, the reliability coefficient (Cronbach alpha value) of the current scale was calculated as 0.89. Furthermore, in spite of the fact that Özkan did not report about weather she conducted factor analysis or not, she stated that there are three factors. Thus, a factor analysis was conducted in the current study to determine the factors of the instrument.

The Kaiser-Meyer-Oklin (KMO) value of the current study is 0.93 indicating the sample is adequate to conduct factor analysis as it exceeds the recommended value of 0.60 (Keiser, 1970, 1974). Besides, for Bartlett's test of sphericity (Bartlett, 1954) the observed significance level is 0.00 supporting the factorability of correlation matrix. According to KMO measure and Bartlett's test result we can conduct a factor analysis for the data. The factor analysis yielded three factors. Result is presented in Table 3.8.

Table 3.8. Factor analysis result of MSLQ-TV

Factors	**Item numbers**
Intrinsic Value	1, 4, 5, 6, 7, 10, 11, 13, 14, 15, 17, 19, 21
Self-Efficacy for Learning and Performance	2, 8, 9, 16, 18
Test Anxiety	3, 12, 20, 22

In Table 3.6, the number of items for each factor was reported in Özkan's study. However, two items are different from her study according to the current results. These items should be item 1 and item 13 because these items were loaded both on intrinsic value and self-efficacy for learning and performance factors as it is presented in Table 3.9. These two items were included to the intrinsic value factor.

Table 3.9 Loading of items to the factors

Items	Components		
	1	2	3
Item 21	.801	.035	-.027
Item 4	.793	.130	-.073
Item 5	.751	.114	.188
Item 15	.743	.175	.073
Item 14	.657	.194	-.006
Item 19	.648	.320	.074
Item 11	.570	.360	-.073
Item 6	.561	.341	.273
Item 17	.521	.361	-.017
Item 7	.513	.193	.141
Item 10	.489	.216	-.234
Item 13	.452	.434	.295
Item 1	.418	.372	-.140
Item 9	.187	.768	-.002
Item 16	.136	.752	.040
Item 18	.263	.710	.152
Item 8	.509	.541	.263
Item 2	.422	.437	-.099
Item 20	-.02	.090	.779
Item 12	.209	.036	.740
Item 3	.043	-.122	.642
Item 22	-.155	.167	.611

The eigenvalues of the factors are presented in Table 3.10. According to the table, three factors explain 51% of the total variance. The factors obtained from the analysis are named according to the Özkan's study.

Table 3.10 Eigenvalues and explained variance for the factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.481	34.005	34.005	7.481	34.005	34.005
2	2.292	10.416	44.421	2.292	10.416	44.421
3	1.431	6.504	50.926	1.431	6.504	50.926
4	.976	4.435	55.360			
5	.890	4.044	59.404			
6	.836	3.799	63.203			
7	.813	3.697	66.899			
8	.731	3.323	70.222			
9	.664	3.019	73.242			
10	.626	2.846	76.087			
11	.557	2.531	78.619			
12	.543	2.469	81.087			
13	.518	2.354	83.442			
14	.505	2.294	85.736			
15	.478	2.172	87.908			
16	.453	2.059	89.968			
17	.426	1.936	91.903			
18	.397	1.804	93.708			
19	.377	1.714	95.421			
20	.353	1.605	97.026			
21	.333	1.514	98.540			
22	.321	1.460	100			

Furthermore, in order to obtain reliability evidence, the Cronbach's alpha reliability coefficients for intrinsic value, self-efficacy for learning and performance, and test anxiety sub-dimensions were calculated and found as .89, .79, and .69 respectively.

In summary, the purpose of conducting factor analysis is to present a construct related validity evidence for Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV) in chemistry domain. The analysis did not give exactly the same result with Özkan's study in terms of the items belonging to the

factor, but very similar result was obtained. It can be concluded that construct related validity of the questionnaire is supported through factor analysis.

3.4 Data Collection

In this study, the participants were 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students who take chemistry course from four types of school. During 2011-2012 fall semester, the three questionnaires were administered to the entire classes at one time. The students were given the necessary directions about answering the items of the instruments and they were informed about the importance of the study. Moreover, it was declared that participation to the study was not compulsory and they ensured that their answers would be kept confidential. There was not any time restriction about completing the questionnaires and only one lesson hour was fairly enough for the students to complete the questionnaires. After the students completed the questionnaires, data were entered into PASW (Predictive Analytics Soft Ware) Statistics 18 program.

3.5 Analysis of Data

The data obtained from questionnaires include demographic information of the students and their responses to the questionnaires. All data were transferred to computer environment as a PASW (Predictive Analytics Soft Ware) data file. Both descriptive and inferential statistics were used to analyze the data.

3.5.1 Descriptive Statistics

Descriptive statistics was used to give information about the sample. The mean, the standard deviation, the skewness, and the kurtosis of the dependent variables for each scale of the instruments and demographic information about the sample were calculated.

3.5.2 Inferential Statistics

Inferential statistics was used to make generalization based on findings of the sample. Three way analysis of variance (ANOVA) was used to determine the effect of gender, school type, and grade level of the students on motivation toward chemistry lessons, chemistry self-efficacy for cognitive skills, and attitude toward chemistry lessons respectively. Furthermore, correlational analyses were conducted in order to investigate the relationships among secondary school students' motivation, self-efficacy beliefs, and attitudes toward chemistry lessons.

Related with the questionnaires used in the study, reliability and validity evidences sought. In order to obtain construct related validity evidence, factor analyses were conducted for each questionnaire. Moreover, reliability analyses were conducted for each questionnaire and for their subscales that were obtained from factor analyses.

3.6 Assumptions and Limitations

3.6.1 Assumptions

The following assumptions have been made in this study:

1. Participants were responded the items of the instruments sincerely, consciously, and truthfully.
2. The instruments were administered under standard conditions.
3. There was no interaction between participants during answering the items of the instruments.
4. Participants' beliefs and opinions were exactly measured by the questionnaires.
5. Reliability and validity of all instruments were accurate enough to permit accurate assumptions.

3.6.2 Limitations

The following limitations were relevant to this study:

1. Validity of the study was limited to the sincereness of the answers given to the items of the instruments.
2. Validity of the study was limited to the reliability of the instruments that were used in the study.
3. The subjects of the study were limited to 813 secondary school students.
4. This study was limited to chemistry domain. Thus, the findings of this study might not be generalized to other domains.
5. Cluster random sampling method was applied in this study. Thus, the sample might not be the representative of the population.

CHAPTER 4

RESULTS AND CONCLUSIONS

This chapter presents the results of analyses of hypotheses stated previously and conclusions. Correlational analysis and analysis of variance (ANOVA) were conducted to test the hypotheses. In correlational analysis the level of significance was 0.01 and in ANOVA the hypotheses were tested at a significance level of 0.05.

4.1. Analyses of Correlations

In order to determine the relationships that might exist between the dependent variables which are attitude toward chemistry lessons, chemistry self-efficacy for cognitive skills, and motivation toward chemistry lessons, Pearson Correlation Analyses were conducted. Pearson product-moment correlation coefficients (r) were calculated and the results are presented on Table 4.1.

Table 4.1. Pearson product-moment correlation coefficients (r)

		ATTITUDE	SELF-EFFICACY	MOTIVATION
ATTITUDE	Pearson Correlation	1	.554*	.736*
	Sig. (2-tailed)		0	0
SELF-EFFICACY	Pearson Correlation	.554*	1	.617*
	Sig. (2-tailed)	0		0
MOTIVATION	Pearson Correlation	.736*	.617*	1
	Sig. (2-tailed)	0	0	

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

Cohen (1988) suggests that if Pearson product-moment correlation coefficient (r) is greater than .50, there is a high correlation between the variables. Thus, results of the study indicated that students' motivation toward chemistry lessons, chemistry self-efficacy for cognitive skills, and attitude toward chemistry lessons were significantly and positively correlated with each other. Students' attitudes toward chemistry were significantly correlated with their motivation toward chemistry lessons ($r = .736$, $p<.01$), and chemistry self-efficacy for cognitive skills ($r = .554$, $p<.01$). Besides, students' motivation toward chemistry lessons were significantly correlated with their chemistry self-efficacy for cognitive skills ($r = .617$, $p<.01$). The scatter plot showing the relationships among those variables are shown on the Figure 4.1.

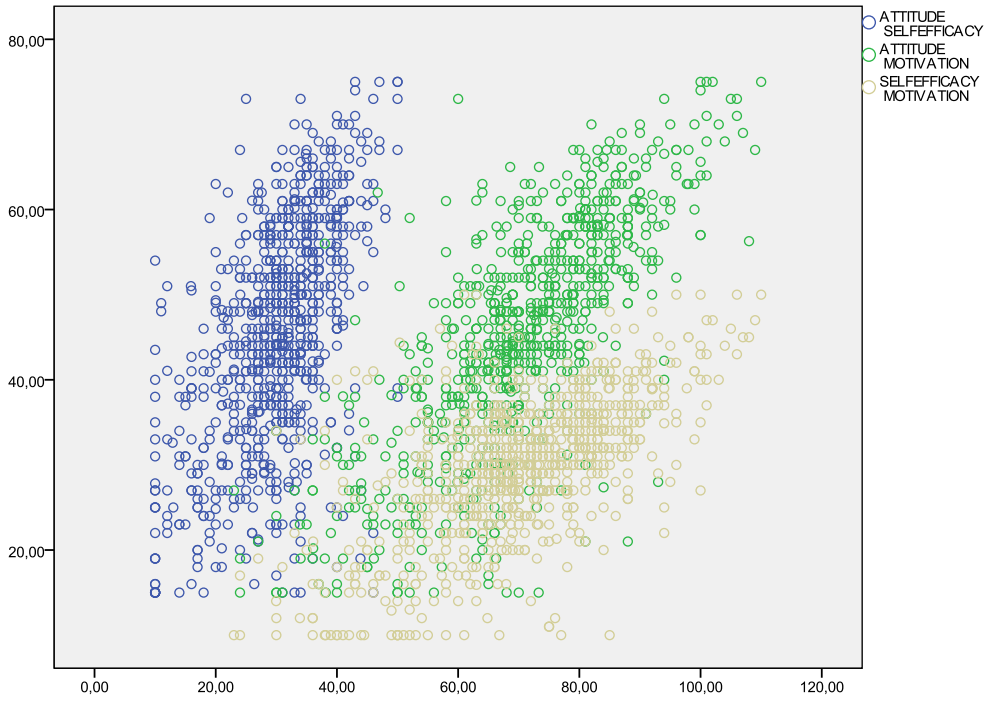

Figure 4.1 Scatterplot

The null hypotheses related to the relationships among motivation toward chemistry lessons, chemistry self-efficacy for cognitive skills, and attitude toward chemistry lessons are as follows:

$H_0(1)$: There is no significant relationship between secondary school students' motivational beliefs and self-efficacy beliefs toward chemistry lessons.
$H_0(2)$: There is no significant relationship between secondary school students' motivational beliefs and attitudes toward chemistry lessons.
$H_0(3)$: There is no significant relationship between secondary school students' self-efficacy beliefs and attitudes toward chemistry lessons.

To conclude, the results of analyses of correlations showed that all these three hypotheses were rejected.

4.2. Analyses of Variance (ANOVA)

In order to determine the effect of gender, school type, and grade level of the students on their attitude toward chemistry lessons, chemistry self-efficacy for cognitive skills, and motivation toward chemistry lessons, three separate three-way analysis of variance (ANOVA) were conducted and the assumptions of ANOVA were tested for three different groups of data. The reason why we did not conduct a multivariate analysis of variance (MANOVA) was that the multicollinearity assumption could not be met.

4.2.1 Assumptions for ANOVA

There are three assumptions for ANOVA: independence of observations, normality, and homogeneity of variances. These assumptions were tested for each separate three way ANOVAs. For the independence of observations which means that one students' score should not provide any clues as to how any other of the other students should score (Morgan et. al., 2004), three questionnaires were administered to all group of students and they were informed that each student should answer the items individually during the administration process. By this way, the independence of the observation assumption was tried to be met in the study.

To test the normality assumption, skewness and kurtosis values was used. Skewness is a measure of deviation level of the values in a distribution from the mean value, and kurtosis is the measure of the flatness of a distribution. According to Bachman (2004), skewness and kurtosis values are considered excellent between +1 and -1 but a value between +2 and -2 is also acceptable. As seen from Table 4.2, the values were all between acceptable ranges so normality assumption was met.

Table 4.2 Descriptive statistics of gain scores of ASTC, MSLQ-TV, and CSCS

	Mean	SD	Skewness	Kurtosis
ASTC	45.165	13.318	-0.221	-0.567
MSLQ-TV	70.471	14.664	-0.319	0.358
CSCS	29.988	8.206	-0.415	0.109

Furthermore, in order to check the assumption of normality, histograms and normal probability plots (P-P) were investigated for the three dependent variables of the study. As seen in Figure 4.2, Figure 4.4, and Figure 4.6, the histograms gave a symmetric and bell-shaped distribution indicating normal distribution. In the P-P plots seen in Figure 4.3, Figure 4.5, and Figure 4.7, the points lay along the diagonal line reasonably, and this indicated that there were not important deviations from normality (Tabachnick & Fidell, 2007).

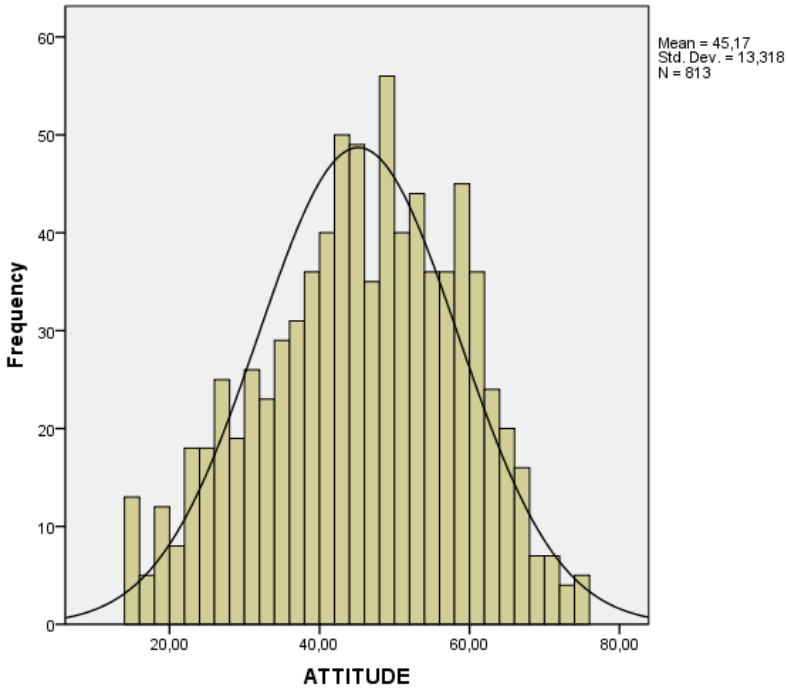

Figure 4.2 Histogram

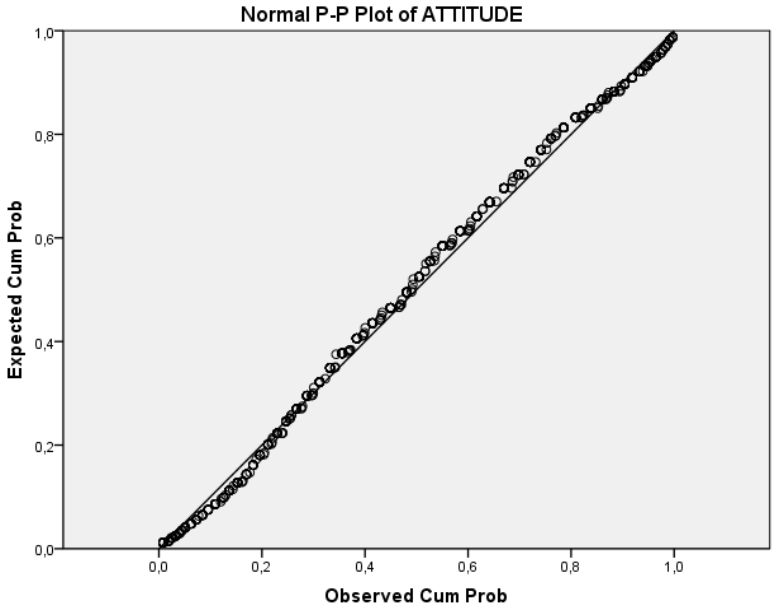

Figure 4.3 P-P plot

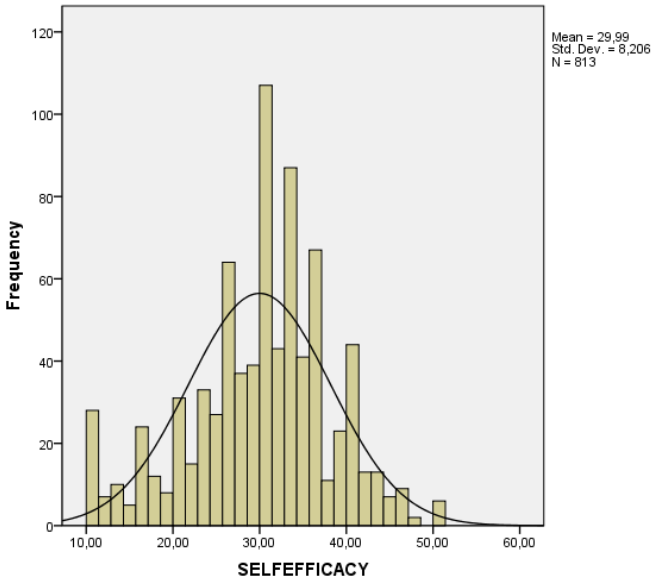

Figure 4.4 Histogram

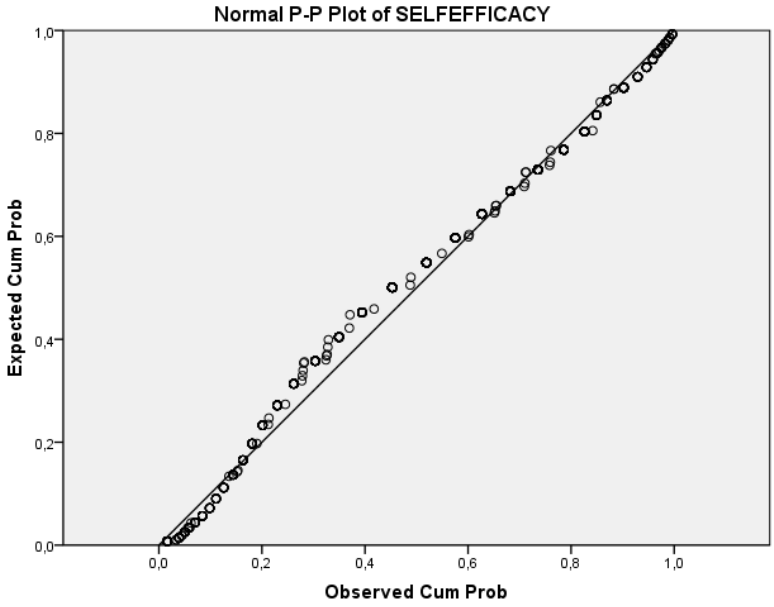

Figure 4.5 P-P plot

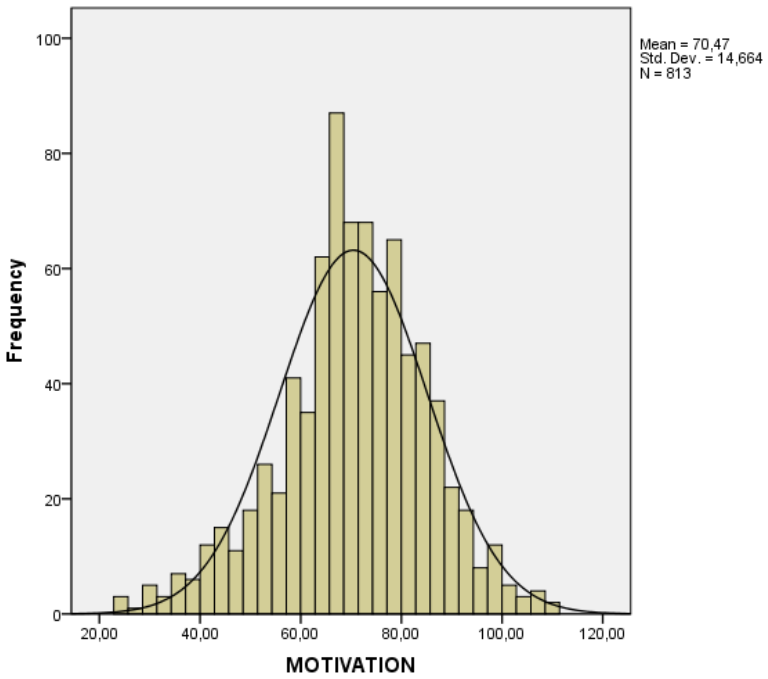

Figure 4.6 Histogram

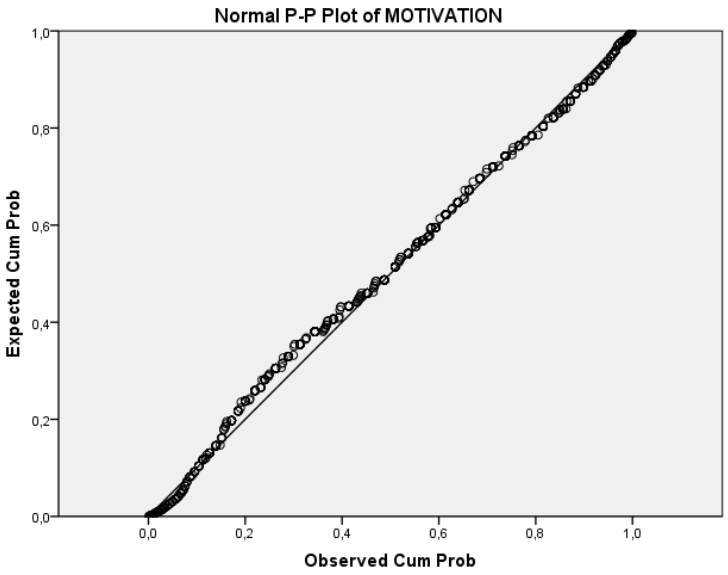

Figure 4.7 P-P plot

The third and the last assumption for ANOVA is homogeneity of variances. Levene's test was used in order to check the homogeneity of variances assumption. Table 4.3 presents Levene's Test results. Unfortunately, this assumption was violated for each separate three way ANOVAs.

Table 4.3 Levene's test of equality of error variances

Dependent variable	F	df1	df2	Sig.
Gain-ASTC	1.634	31	781	0.017
Gain-CSCS	2.945	31	781	0
Gain-MSLQ-TV	1.929	31	781	0.002

However, Morgan et. al., (2004) stated that even if the homogeneity of variances assumption was violated, ANOVA might still be able to be used because it is a robust analysis.

After examining the assumptions of ANOVA, three separate three-way ANOVA was conducted to investigate the effect of the three independent variables (school type, grade level and gender) on the dependent variables measured by ASTC, MSLQ-TV, and CSCS.

4.2.2 ANOVA for Attitude toward Chemistry Lessons

Three-way ANOVA results with respect to the dependent variable of attitude toward chemistry lessons were displayed in Table 4.4.

Table 4.4 Tests of between-subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
gender	695.321	1	695.321	5.031	.025	.006	.610
grade level	1140.272	3	380.091	2.750	.042	.010	.667
school type	19524.757	3	6508.252	47086	.000	.153	1.000
gender * grade level	418.597	3	139.532	1.009	.388	.004	.276
gender * school type	194.752	3	64.917	.470	.704	.002	.145
grade * school type	9306.245	9	1034.027	7.481	.000	.079	1.000
gender * grade level * school type	2588.465	9	287.607	2.081	.029	.023	.875
Error	107950.166	781	138.220				
Total	1802449.866	813					
Corrected Total	144017.324	812					

The results indicated that there were significant mean differences that come from grade level, gender, and school type, and there were significant effect of interactions between these independent variables on attitudes toward chemistry lessons.

The fourth null hypothesis stated that there was no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from Attitude Toward Chemistry Scale. Table 4.4 showed that there were significant mean differences among school types ($F(1,781) = 5.031$, $p < .05$). So, fourth hypothesis was rejected. In order to see which school types significantly differ from the other ones, post hoc analysis indicating multiple

comparisons was conducted as shown in Table 4.5. According to this table, there were significant mean differences between all types of school students with respect to their scores obtained from Attitude Toward Chemistry Scale except the difference between general pubic high school and Anatolian public high school

Table 4.5 Multiple comparisons for school type variable

(I) SCHOOL TYPE	(J) SCHOOL TYPE	Mean Difference (I-J)	Std. Error	Sig.
General	Anatolian	-.5578	1.14337	.962
	Vocational	8.9364	1.06008	.000
	Private	-4.4597	1.26017	.002
Anatolian	General	.5578	1.14337	.962
	Vocational	9.4942	1.14137	.000
	Private	-3.9019	1.32928	.018
Vocational	General	-8.9364	1.06008	.000
	Anatolian	-9.4942	1.14137	.000
	Private	-13.3961	1.25835	.000
Private	General	4.4597	1.26017	.002
	Anatolian	3.9019	1.32928	.018
	Vocational	13.3961	1.25835	.000

The Table 4.6 showed that general private high school students had the highest attitude scores, and students of vocational public high school had the lowest attitude scores.

Table 4.6 Means and standard deviations of ASTC scores for school types

School Type	Mean	SD
General	47,0120	12,35357
Anatolian	47,5698	12,80151
Vocational	38,0756	12,48060
Private	51,4717	11,73380

The fifth null hypothesis stated that there was no significant mean difference between male and female students with respect to their scores obtained from Attitude Toward Chemistry Scale. Table 4.4 showed that there was significant mean differences between genders (F (3,781) = 47.086, p < .05). So, fifth hypothesis was rejected. Figure 4.8 displayed that girls had higher attitude scores than boys.

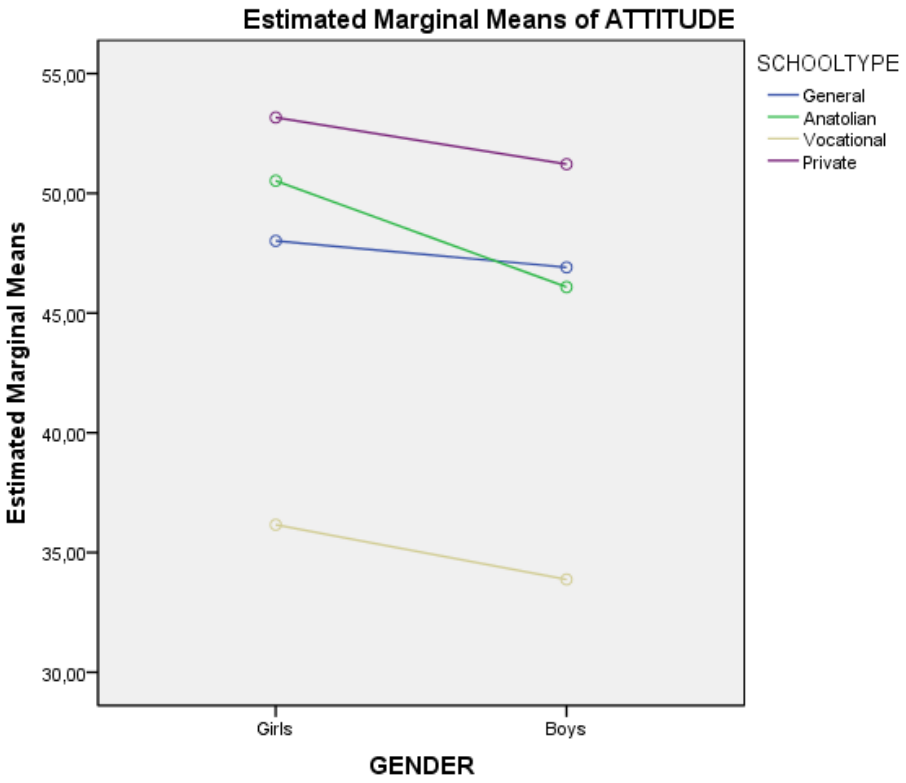

Figure 4.8 Profile plot for gain scores of ASTC

The sixth null hypothesis stated that there was no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from Attitude Toward Chemistry Scale. Table 4.4 showed that there was significant mean differences among grade levels (F (3,781) = 2.750, p < .05). So, sixth hypothesis was rejected. In order to see which grade levels significantly differ from the other ones, post hoc analysis indicating multiple comparisons was conducted as displayed in Table 4.7. However, according to this table, there was no significant mean difference between 9th, 10th, 11th, and 12th grade students

with respect to their scores obtained from Attitude Toward Chemistry Scale. It might be due to the fact that p value was so close to the significance level (p=.042, α=.05).

Table 4.7 Multiple comparisons for grade level variable

(I) GRADE	(J) GRADE	Mean Difference (I-J)	Std. Error	Sig.
9th Grade	10th Grade	-.8699	1.07956	.852
	11th Grade	.5538	1.01488	.948
	12th Grade	.8334	1.54426	.949
10th Grade	9th Grade	.8699	1.07956	.852
	11th Grade	1.4238	1.17266	.618
	12th Grade	1.7033	1.65224	.731
11th Grade	9th Grade	-.5538	1.01488	.948
	10th Grade	-1.4238	1.17266	.618
	12th Grade	.2796	1.61071	.998
12th Grade	9th Grade	-.8334	1.54426	.949
	10th Grade	-1.7033	1.65224	.731
	11th Grade	-.2796	1.61071	.998

Furthermore, related with the significant effect of interactions, Table 4.4 indicates that the effect of interaction between grade level and school type ($F(9,781) = 7.481$, $p < .05$), and the effect of interaction among three independent variables ($F(9,781) = 2.081$, $p < .05$) were significant. On the other hand, the effect of interaction between gender and grade level ($F(3,781) = 1.009$, $p > .05$), and the effect of interaction between gender and school type ($F(3,781) = 0.470$, $p > .05$) were not significant.

4.2.3 ANOVA for Chemistry Self-Efficacy for Cognitive Skills

Three-way ANOVA results with respect to the dependent variable of chemistry self-efficacy for cognitive skills were showed in Table 4.8.

Table 4.8 Tests of between-subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
gender	203.22	1	203.22	3.457	.063	.004	.459
grade	458.556	3	152.852	2.600	.051	.010	.639
school type	4460.541	3	1486.847	25.290	.000	.089	1.000
gender * grade	172.899	3	57.633	.980	.401	.004	.268
gender * school type	236.505	3	78.835	1.341	.260	.005	.359
grade * school type	1764.422	9	196.047	3.335	.001	.037	.986
gender * grade * school type	747.42	9	83.047	1.413	.178	.016	.687
Error	45916.45	781	58.792				
Total	785777.7	813					
Corrected Total	54684.18	812					

The eighth hypothesis states that there was no significant mean difference between male and female students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills. This hypothesis was not rejected in that gender difference was not significant ($F(1,781) = 3.457$, $p > .05$). Moreover, the ninth hypothesis states that there was no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills. The Table 4.8 showed that grade level difference was not significant ($F(1,781) = 2.600$, $p > .05$).

On the other hand, the seventh hypothesis stated that there was no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from High School Chemistry Self-Efficacy Scale for Cognitive Skills. The results showed that there was significant mean differences among school types ($F(3,781) = 25.29$, $p < .05$). Thus, seventh hypothesis was rejected. In order to see which school types significantly differ from the other ones, post hoc analysis which indicates multiple comparisons was conducted as displayed in Table 4.9. According to this table, there were significant differences between vocational public high school and other types of high schools which are general pubic high school, Anatolian public high school and general private high school.

Table 4.9 Multiple comparisons for school type variable

(I) SCHOOL TYPE	(J) SCHOOL TYPE	Mean Difference (I-J)	Std. Error	Sig.
General	Anatolian	-1.2180	.74569	.360
	Vocational	5.0194	.69137	.000
	Private	.0252	.82187	1.000
Anatolian	General	1.2180	.74569	.360
	Vocational	6.2374	.74439	.000
	Private	1.2432	.86694	.478
Vocational	General	-5.0194	.69137	.000
	Anatolian	-6.2374	.74439	.000
	Private	-4.9941	.82068	.000
Private	General	-.0252	.82187	1.000
	Anatolian	-1.2432	.86694	.478
	Vocational	4.9941	.82068	.000

The Table 4.10 showed that vocational public high school students had lower CSCS scores than the other three types of high schools. Moreover, Figure 4.9 illustrates the changes of students CSCS scores with respect to school type and gender.

Table 4.10 Means and standard deviations of CSCS scores for school types

School Type	Mean	SD
General	31,2380	6,86805
Anatolian	32,4560	6,59372
Vocational	26,2187	9,47529
Private	31,2128	7,63809

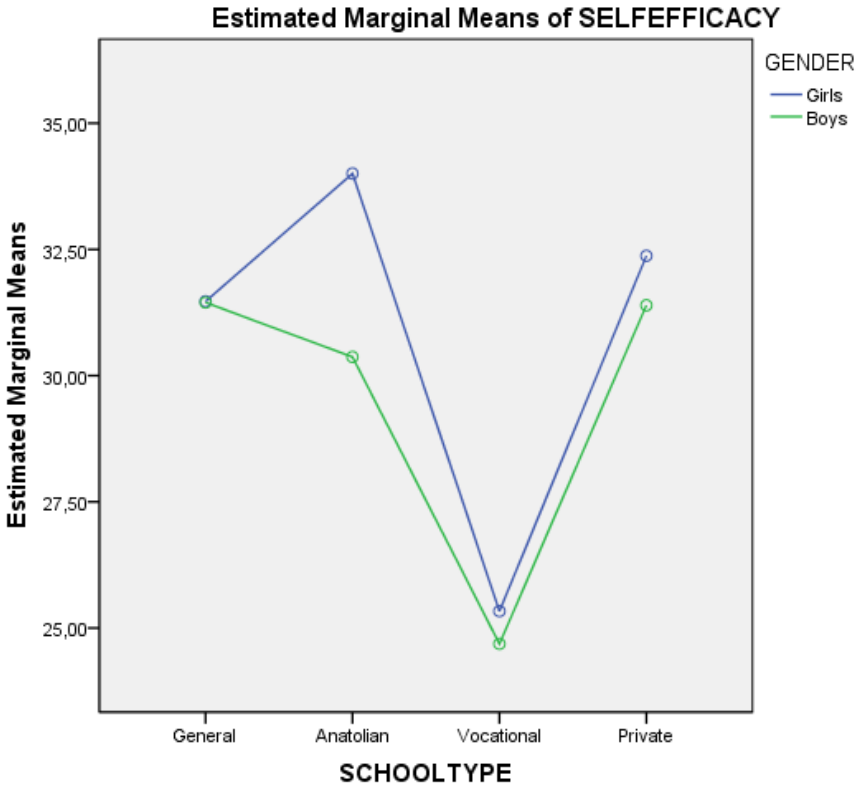

Figure 4.9 Profile plot for gain scores of CSCS

Furthermore, as for the effects of interactions, the Table 4.8 presents that the effect of interaction between grade level and school type were significant ($F(9,781) = 3.335$, $p < .05$). On the other hand, the effect of interaction between gender and grade level ($F(3,781) = 0.980$, $p > .05$), the effect of interaction between gender and school type ($F(3,781) = 1.341$, $p > .05$), and the effect of interaction among three independent variables ($F(9,781) = 1.413$, $p > .05$) were not significant.

4.2.4 ANOVA for Motivational Beliefs toward Chemistry

Three-way ANOVA results with respect to the dependent variable of motivational beliefs toward chemistry were showed in Table 4.11.

Table 4.11 Tests of between-subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
gender	990.695	1	990.695	5.798	.016	.007	.672
grade	556.797	3	185.599	1.086	.354	.004	.295
school type	22957.890	3	7652.630	44.790	.000	.147	1.000
gender * grade	771.501	3	257.167	1.505	.212	.006	.399
gender * school type	36.790	3	12.263	0.072	.975	.000	.063
grade * school type	6699.600	9	744.400	4.357	.000	.048	.998
gender * grade * school type	3683.945	9	409.327	2.396	.011	.027	.924
Error	133437.404	781	170.855				
Total	4212131.220	813					
Corrected Total	174605.470	812					

The twelfth hypothesis states that there was no significant mean difference between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version. Table 4.11 presents that grade level difference was not significant ($F(3,781) = 1.086$, $p > .05$). So, this hypothesis was not rejected.

On the other hand, the eleventh hypothesis stated that there was no significant mean difference between male and female students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version. The

results showed that there was significant mean differences between genders ($F(1,781) = 5.789$, $p < .05$). Thus, eleventh hypothesis was rejected. Besides, the tenth hypothesis stated that there was no significant mean difference between general public high school, Anatolian public high school, vocational public high school, and general private high school students with respect to their scores obtained from Motivated Strategies for Learning Questionnaire-Turkish Version. The results showed that there was significant mean differences among school types ($F(3,781) = 44.790$, $p < .05$). Thus, tenth hypothesis was rejected. In order to see which school types significantly differ from the other ones, post hoc analysis which indicates multiple comparisons was conducted as showed in Table 4.12. According to this table, there were significant differences between vocational public high school and other types of high schools which are general pubic high school, Anatolian public high school and general private high school. From mean differences values in the Table 4.12, it was seen that vocational public high school students had lower MSLQ-TV scores than the other three types of high schools. Moreover, Figure 4.10 illustrates the changes of students MSLQ-TV scores with respect to school type and gender. It was seen that MSLQ-TV scores of girls were greater than the scores of boys.

Table 4.12 Multiple comparisons for school type variable

(I) SCHOOL TYPE	(J) SCHOOL TYPE	Mean Difference (I-J)	Std. Error	Sig.
General	Anatolian	-.4006	1.27120	.989
	Vocational	11.9779*	1.17859	.000
	Private	-1.7402	1.40105	.600
Anatolian	General	.4006	1.27120	.989
	Vocational	12.3785*	1.26897	.000
	Private	-1.3397	1.47789	.801
Vocational	General	-11.9779*	1.17859	.000
	Anatolian	-12.3785*	1.26897	.000
	Private	-13.7182*	1.39904	.000
Private	General	1.7402	1.40105	.600
	Anatolian	1.3397	1.47789	.801
	Vocational	13.7182*	1.39904	.000

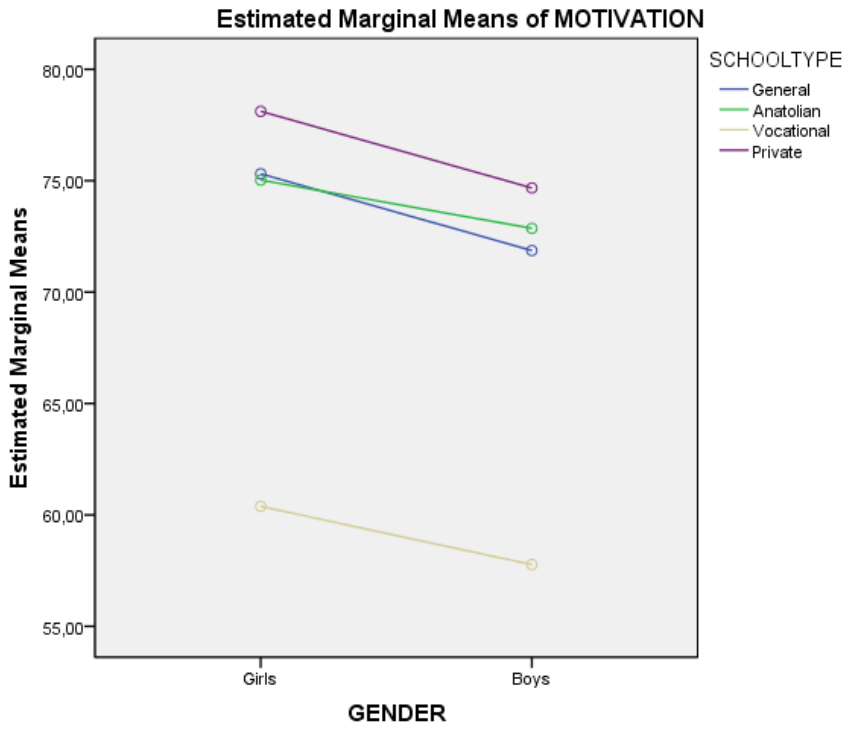

Figure 4.10 Profile plot for gain scores of MSLQ-TV

Furthermore, related with the interactions effects, the Table 4.11 presents that the effect of interaction between grade level and school type were significant ($F(9,781) = 4.357$, $p < .05$), and the effect of interaction among three independent variables were also significant ($F(9,781) = 2.396$, $p > .05$). On the other hand, the effect of interaction between gender and grade level ($F(3,781) = 1.505$, $p > .05$), and the effect of interaction between gender and school type ($F(3,781) = 0.072$, $p > .05$) were not significant.

4.3 Conclusions

The conclusions derived from the results are as follows:

- A high correlation between students' motivational beliefs and self-efficacy beliefs was obtained in correlational analysis. It can be concluded that there was significant relationship between high school students' motivational beliefs and self-efficacy beliefs toward chemistry lessons.

- A high correlation between students' motivational beliefs and attitudes was obtained in correlational analysis. It can be concluded that there was significant relationship between high school students' motivational beliefs and attitudes toward chemistry lessons.

- A high correlation between students' self-efficacy beliefs and attitudes was obtained in correlational analysis. It can be concluded that there was significant relationship between high school students' self-efficacy beliefs and attitudes toward chemistry lessons.

- ANOVA results showed that there were significant mean differences between boys and girls with respect to their attitude and motivational beliefs scores. The means of girls were higher than boys in terms of ASTC and MSLQ-TV scores. Besides, there was no significant mean difference between boys and girls with respect to their self-efficacy beliefs scores.

- ANOVA results showed that there were significant mean differences between students from vocational high school and students from other three types of high schools with respect to their self-efficacy beliefs and motivational beliefs scores. The means of vocational high school students were lower than other three types of high school students in terms of CSCS, and MSLQ-TV scores.

- ANOVA results showed that there were significant mean differences between students from different types of schools with respect to their attitude scores. The means of private public high school students were the highest and the means of vocational public high school were the lowest in terms of ASTC scores. Besides, there were no significant mean difference between students from general public high school and Anatolian public high school with respect to their attitude scores.

- ANOVA results showed that there were no significant mean differences between 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade students with respect to their attitude, self-efficacy beliefs and motivational beliefs scores.

CHAPTER 5

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter consists of five sections. First section presents discussion of the results. The second and the third sections include internal and external validity of the study, respectively. The fourth section announces implications, and the final section presents recommendations for further research.

5.1 Discussion

In the beginning of the study, several relationships were hypothesized among dependent variables. It was expected that there would be correlations among those variables which are secondary school students' attitudes, self-efficacy beliefs, and motivational beliefs toward chemistry lessons. Due to the fact that those affective variables have an immense influence on students' academic achievements, they are thought to be reciprocally related with each other. Based on the statistical analyses results given in previous chapter, several conclusions were reached showing high correlations between these three variables. Besides, the results of the current study are consistent with the results of the study of Kurbanoglu and Akin (2010).

Attitude Scale Toward Chemistry (ASTC) scores change between 15 and 75, and the mean was calculated as 45.165; Motivated Strategies for Learning Questionnaire-Turkish Version (MSLQ-TV) scores change between 22 and 110, and the mean was calculated as 70.471; and High School Chemistry Self-Efficacy Scale for Cognitive Skills (CSCS) scores change between 10 and 50, and the mean was calculated as 29.988. These mean scores showed that students' attitudes, self-efficacy beliefs, and motivational beliefs toward chemistry lessons

were at medium level. Thus, it can be concluded that something should be done by authorities to improve students' attitudes, motivation, and self-efficacy beliefs toward chemistry lessons by means of designing appropriate chemistry curriculum and by designing effective chemistry courses.

As far as gender is concerned, it was expected that male students show higher attitudes and motivational beliefs toward chemistry lessons than female students as most of the previous studies stated. However, in this study, female students' attitudes and motivation toward chemistry were higher than male ones. This finding does not support the existence of the notorious gender gap in science. We can infer from this finding that the gender gap is disappearing.

School type was determined as another factor affecting students' attitudes, self-efficacy beliefs, and motivational beliefs toward chemistry lessons in the current study. General private high school students had the highest attitudes toward chemistry lessons. This might be due to the following facts. First of all, those students are generally belong to high socioeconomic status families having a lot of opportunities for developing their aspects toward science related issues and activities. Secondly, in Turkey, private schools have more facilities for improving their students' positive attitudes toward chemistry such as chemistry laboratory than public schools. On the other hand, vocational public high school students had the lowest attitudes, self-efficacy beliefs and motivation toward chemistry lessons according to the findings of this study. Vocational high school students entered to their high schools with minimum scores in the high school entrance examinations. In other words, at the beginning, they might have had less attitudes toward chemistry lessons.

Finally, this study showed that grade level did not have any significant effect on students' attitudes, self-efficacy beliefs, and motivational beliefs toward chemistry lessons. In other words, as years passed, students' affective variables do not change. This means that our education system can do nothing in order to improve students' attitudes, motivational beliefs and self-efficacy beliefs toward chemistry

lessons and necessary importance does not given by the authorities. This may also mean that the existing chemistry curriculum and chemistry courses' current designs were insufficient for improving those affective variables.

5.2 Internal Validity

Internal validity means that observed differences on the dependent variables are directly related to the independent variable, not to extraneous variables that might affect the results of the research study (Fraenkel and Wallen, 1996). In this section possible threats, which may affect the results of the study, to internal validity and the methods used to deal with those threats were discussed.

Location and instrumentation could not be threat to the study because the instruments were administered to all groups in similar physical conditions and generally by the researcher. Data collector characteristics data collector bias could not be threat to the study as they were assumed to be controlled by informing the teachers, data collectors, to ensure standard procedures under which data were collected.

Mortality which is one of the most difficult of all the threats to internal validity to control was not a problem for this study because the responses rate was about % 98 in this study. Finally, confidentiality was not a possible threat for this study since the students did not write their names on the questionnaires.

5.3 External Validity

External validity refers to the extent that the results of a study can be generalized from a sample to a population. Population generalizability refers to the degree to which a sample of a study represents the population of the study (Fraenkel and Wallen, 1996). In the current study the accessible population was secondary school students who take chemistry course in Etimesgut district in Ankara. By using cluster random sampling method, 804 high school students were involved in

the study. Generalization according to the results of the study is not limited because of random sampling. Thus, this study's findings can easily be applied to accessible population.

Furthermore, ecological generalizability refers to the degree to which the results of the study can be extended to other settings or conditions other than those prevailed in a particular study (Fraenkel and Wallen, 1996). All the administration procedure took place in ordinary classrooms during regular class hours in the study. There were not any remarkable differences among the environmental conditions. Therefore, it was thought that external effects were adequately controlled by the settings used in the study.

5.4 Implications

Attitude has long been considered as an important predictor of student learning and achievement by the researchers and educators. Despite the fact that generating students positive attitudes toward chemistry lessons should be one of the major goals of chemistry education, teachers often disregard the importance of attitudinal constructs. In the view of this study, if educators would like to improve achievement levels of students in chemistry lessons, they need to pursue ways to improve students' positive attitudes. Moreover, students' level of motivation and their self-efficacy beliefs have crucial roles in learning and gaining achievement in chemistry. These constructs have an impact on educational and instructional processes.

In the current study gender differences were determined in students' attitudes and motivation toward chemistry lessons. Girls were significantly had higher level of attitude and motivation for chemistry lessons than boys. Besides, students from vocational public high school had less self-efficacy beliefs and motivation than other types of schools. Researchers should be aware of these findings, and try to seek ways for enhancing boys' attitudes and motivation, and vocational public

high school students' self-efficacy beliefs and motivation toward chemistry lessons.

Curriculum design is one of the most important concerns in educational settings and issues. Thus, designing a chemistry curriculum has an immense significance for educators in reaching educational goals. From the point of view of findings of this study, we can infer that developing students' attitudinal and motivational traits toward chemistry are key factors in designing curriculum and in designing effective chemistry courses.

In chemistry teacher education, the importance of affective and cognitive constructs such as attitude, self-efficacy, and motivation should be a focus of concern of teacher training programs in education faculties in universities. By this way, a more vigilant and attentive chemistry teachers about these constructs would be trained and they will give more importance on improving students' self-efficacy beliefs, attitudinal and motivational constructs.

One of the findings of this study was that there was correlation between students' attitudes, self-efficacy beliefs and motivation toward chemistry lessons. In the view of this finding if chemistry educators succeed to improve one of these variables of their students directly, they will also succeed to improve the other variables indirectly.

To sum up, this study has several important implications for chemistry teachers, educators, and researchers from the points of chemistry achievement, and learning, teacher training programs, chemistry curriculum and course design.

5.5 Recommendations for Further Research

This study has suggested several useful topics for further studies. These are briefly as follows:

1. This study can be conducted with a larger sample size from different schools and districts in order to obtain more accurate results and to provide a generalization for larger population.
2. As this study was limited to chemistry domain, a similar study can be conducted related to other domains such as biology, physics, and mathematics.
3. A qualitative research may be conducted to gather data in order to understand the relationships between secondary school students' motivation, self-efficacy beliefs, and attitudes toward chemistry lessons and the effect of gender, school type, and grade level of the students on each of these variables.
4. A study can be conducted to determine the effect of self-efficacy beliefs, motivation, and attitudes toward chemistry lessons to chemistry achievement.
5. A qualitative research may be conducted to understand the reasons of why girls have higher motivation and attitudes toward chemistry than boys.
6. A qualitative research may be conducted to understand the reasons of why students from general private high school have highest, and students from vocational public high school have lowest attitudes toward chemistry lessons among schools.
7. A qualitative research may be conducted to understand the reasons of why students from vocational public high school have less motivation and self-efficacy beliefs toward chemistry lessons than students from general private high school, Anatolian public high school, and general private high school.
8. Future research can examine gender differences in students' motivational and attitudinal constructs toward chemistry lessons.

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APPENDIX – A

ATTITUDE SCALE TOWARD CHEMISTRY (ASTC)

		Tamamen katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Hiç katılmıyorum
1.	Kimya çok sevdiğim bir alandır.	1	2	3	4	5
2.	Kimya ile ilgili kitapları okumaktan hoşlanırım.	1	2	3	4	5
3.	Kimyanın günlük yaşantıda çok önemli yeri yoktur.	1	2	3	4	5
4.	Kimya ile ilgili ders problemlerini çözmekten hoşlanırım.	1	2	3	4	5
5.	Kimya konularıyla ilgili daha çok şey öğrenmek isterim.	1	2	3	4	5
6.	Kimya dersine girerken sıkıntı duyarım.	1	2	3	4	5
7.	Kimya dersine zevkle girerim.	1	2	3	4	5
8.	Kimya derslerine ayrılan ders saatinin daha fazla olmasını isterim.	1	2	3	4	5
9.	Kimya dersine çalışırken canım sıkılır.	1	2	3	4	5
10.	Kimya konularını ilgilendiren günlük olaylar hakkında daha fazla bilgi edinmek isterim.	1	2	3	4	5
11.	Düşünce sistemimizi geliştirmede kimya öğrenimi önemlidir.	1	2	3	4	5
12.	Kimya, çevremizdeki doğal olayların daha iyi anlaşılmasında önemlidir.	1	2	3	4	5
13.	Dersler içinde kimya dersi sevimsiz gelir.	1	2	3	4	5
14.	Kimya konularıyla ilgili tartışmaya katılmak bana cazip gelmez.	1	2	3	4	5
15.	Çalışma zamanımın önemli bir kısmını kimya dersine ayırmak isterim.	1	2	3	4	5

APPENDIX – B

MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE-TURKISH VERSION (MSLQ-TV)

		Kesinlikle katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle katılmıyorum
1.	Kimya dersinde yeni bilgiler öğrenebilmek için, zorlayan ama zevkli sınıf çalışmalarını tercih ederim.	1	2	3	4	5
2.	Sınıftaki diğer öğrenciler ile karşılaştırıldığında, kimya dersine başarılı olmayı beklerim.	1	2	3	4	5
3.	Kimya sınavlarında o kadar heyecanlı olurum ki, öğrendiklerimi hatırlayamam.	1	2	3	4	5
4.	Kimya dersinde anlatılanları öğrenmek benim için önemlidir.	1	2	3	4	5
5.	Kimya dersinde öğrendiklerimden hoşlanırım.	1	2	3	4	5
6.	Kimya dersinde öğretilen konuları anlayabildiğimden eminim.	1	2	3	4	5
7.	Kimya dersinde öğrendiklerimi başka derslerde kullanabileceğime inanıyorum.	1	2	3	4	5
8.	Kimya dersinde çok başarılı olacağımı düşünüyorum.	1	2	3	4	5
9.	Sınıftaki diğer öğrenciler ile karşılaştırıldığında, iyi bir öğrenci olduğumu düşünüyorum.	1	2	3	4	5
10.	Daha fazla çalışma gerektirse bile, bir şeyler öğrenebileceğim ödev konularını seçmeyi tercih ederim.	1	2	3	4	5

11.	Kimya dersi için belirlenen görevleri en iyi şekilde yapabileceğimden eminim.	1	2	3	4	5
12.	Kimya sınavlarında kendimi huzursuz ve mutsuz hissederim.	1	2	3	4	5
13.	Kimya dersinden iyi bir not alacağımı düşünüyorum.	1	2	3	4	5
14.	Kimya sınavından zayıf alsam bile, sınavda yaptığım hatalardan öğrenmeye çalışırım.	1	2	3	4	5
15.	Kimya dersinde öğrendiklerimin benim için faydalı olduğunu düşünürüm.	1	2	3	4	5
16.	Sınıftaki diğer öğrenciler ile karşılaştırıldığında, çalışma becerilerim mükemmeldir.	1	2	3	4	5
17.	Kimya dersinde öğrendiklerimi ilginç buluyorum.	1	2	3	4	5
18.	Sınıftaki diğer öğrenciler ile karşılaştırıldığında, kimya kon uları hakkında daha fazla bilgiye sahip olduğumu düşünürüm.	1	2	3	4	5
19.	Kimya dersinde verilen bilgileri öğrenebileceğime inanıyorum.	1	2	3	4	5
20.	Kimya sınavları ile ilgili çok fazla endişe duyarım.	1	2	3	4	5
21.	Kimya konularını anlamak benim için önemlidir.	1	2	3	4	5
22.	Kimya sınavları sırasında soruları yeterince iyi yanıtlayamadığımı düşünüyorum.	1	2	3	4	5

APPENDIX – C

HIGH SCHOOL CHEMISTRY SELF-EFFICACY SCALE FOR COGNITIVE SKILLS (CSCS)

		yetersiz	çok az yeterli	biraz yeterli	oldukça yeterli	çok yeterli
1.	Kimya kanun ve teorilerini ne derecede açıklayabilirsiniz?	1	2	3	4	5
2.	Kimya problemlerini çözerken uygun formül kullanmada ne kadar iyisiniz?	1	2	3	4	5
3.	Kimya ve diğer bilimler arasında ilişki kurmada ne kadar iyisiniz?	1	2	3	4	5
4.	Atomun yapısını tasvir etmede ne kadar iyisiniz?	1	2	3	4	5
5.	Periyodik tabloyu kullanarak elementlerin özelliklerini tanımlamada ne kadar iyisiniz?	1	2	3	4	5
6.	Element ve bileşiklerin formüllerini okumada ne kadar iyisiniz?	1	2	3	4	5
7.	Kimyasal denklemleri yorumlamada ne kadar iyisiniz?	1	2	3	4	5
8.	Maddenin tanecikli yapısını açıklamada ne kadar iyisiniz?	1	2	3	4	5
9.	Kimyadaki temel kavramları tanımlamada ne kadar iyisiniz?	1	2	3	4	5
10.	Kimya ile ilgili grafik ve çizelgeleri yorumlamada ne kadar iyisiniz?	1	2	3	4	5