EXAMINING 8TH GRADE STUDENTS' PERCEPTION OF LEARNING ENVIRONMENT OF SCIENCE CLASSROOMS IN RELATION TO MOTIVATIONAL BELIEFS AND ATTITUDES

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

BY

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

JANUARY 2007

Approval of the Graduate School of Social Sciences

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ABSTRACT

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January 2007, 136 pages

The classroom has become an important focus of educational research because most learning takes place there. The purpose of this study was to examine 8^{th} grade students perception of science classroom environment from constructivist perspective and investigate the association between students perceptions, motivational beliefs and attitudes toward science. In addition in this study the affects of gender difference on students' constructivist learning environment, motivation and attitude toward science were investigated. The data in the present study were collected through Turkish version of Constructivist Learning Environment Survey (CLES), Test of Science Related Attitudes (TOSRA) and Motivated Strategies for Learning Questionnaire (MSLQ) from 8th grade students who were in randomly selected from 15 elementary schools in

Çankaya, Ankara. A total of 956 students (462 girls, 493 boys and one did not indicate gender) were participated in the study.

The data obtained from participants were analyzed by using Canonical Correlation Analyses and Multivariate Analyses of Variance (MANOVA). Results of canonical correlation analyses indicated that all constructivist learning environment variables and all the motivational beliefs variables were positively related with each other. In addition the result of this analysis also showed that all constructivist learning environment variables and attitude variables were positively related with each other. The findings of MANOVA showed that gender had a significant effect on students' constructivist learning environment (personal relevance and critical voice), their adaptive motivational beliefs (intrinsic goal orientation, task value, and control of learning beliefs), and their attitude toward science (adaptation to science attitudes, enjoyment of science lesson, leisure interest in science, and career interest in science). Results indicated that girls' perceptions of their learning environment, their adaptive motivational beliefs and their attitude toward science were higher than boys.

Keywords: Learning Environments, Constructivist Learning Environment, Science Classroom, Motivational Beliefs, Attitude, Gender.

ÖZ

8. SINIF ÖĞRENCİLERİNİN FEN DERSLERİNDEKİ ÖĞRENME ORTAMLARINA YÖNELİK ALGILARI İLE GÜDÜSEL İNANÇ VE TUTUMLARI ARASINDAKİ İLİŞKİNİN İNCELENMESİ

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Ocak 2007, 136 sayfa

Öğrenmenin önemli bir kısmının gerçekleştiği sınıflar eğitim araştırmalarının önemli bir boyutunu oluşturmaktadır. Bu çalışmanın amacı 8. sınıf öğrencilerinin fen derslerindeki yapılandırıcı öğrenme ortamı algılarını ve bu algılarıyla güdüsel inançları ve fen derslerine yönelik tutumları arasındaki ilişkiyi incelemektir. Bu çalışmada ayrıca cinsiyetin, öğrencilerin yapılandırıcı öğrenme ortamına algılarına, onların güdüsel inançlarına ve fene yönelik tutumlarına etkisi araştırılmıştır. Veriler Ankarada, Çankaya ilçesinde bulunan ve rasgele seçilen 15 ilköğretim okulundaki 8. sınıfta okuyan öğrencilerden, Yapılandırmacı Öğrenme Ortamı Ölçeği (CLES), Fen Tutum Testi (TOSRA) ve Öğrenmede Güdüsel Stratejiler Anketi (MSLQ) ile toplanmıştır. Bu çalışmaya toplam 956 öğrenci (462 kız, 493 erkek ve cinsiyetini belirtmemiş 1 öğrenci) katılmıştır.

Katılımcılardan elde edilen veriler Kanonik Korelasyon analizleri ve Çoklu Varyans Analizi kullanılarak değerlendirilmiştir. Kanonik Korelayon analizi bütün yapılandırıcı öğrenme ortamı değişkenlerinin güdüsel inanç değişkenleri ile pozitif bir ilişkiye sahip olduğunu ortaya koymuştur. Yine bu analiz yapılandırıcı öğrenme ortamı ile öğrencilerin fen dersine yönelik tutumları arasında da pozitif bir ilişkinin olduğunu göstermiştir. Çoklu Varyans Analizi sonuçları ise cinsiyetin öğrencilerin öğrenme ortamlarını algılayışları, güdüsel inançları ve fene yönelik tutumları üzerinde anlamlı bir etkisi olduğunu göstermiştir. Çoklu Varyans Analizi sonuçlarına göre kız öğrencilerin öğrenme ortamlarını algılayışları, güdüsel inançları ve fene yönelik tutumları erkeklerden daha yüksektir.

Anahtar Kelimeler: Öğrenme Ortamları, Yapısallandırıcı Öğrenme Ortamları, Fen Sınıfı, Güdüsel İnançlar, Tutum, Cinsiyet.

To My Parents

ACKNOWLEDGEMENT

I would like to thank my supervisor Assoc. Prof. Dr. Jale Çakıroglu for her valuable guidance and helped in every step throughout the research.

I also want to thank to my co-supervisor Assist. Prof. Dr. Semra Sungur for her valuable contributions, advices and supports throughout the study.

I am grateful to my parents, my sisters Çiğdem and Betül and my uncle Adnan who provided valuable support and encouragements throughout my life and this study. Thank you for your encouragement, and support.

Finally, I want to thank to the members of my committee for their willingness to serve on the committee and their important and valuable feedbacks.

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CLES	:	Constructivist Learning Environment Survey
MSLQ	:	The Motivated Strategies for Learning Questionnaire
TOSRA	:	Test of Science Related Attitude
QTI	:	Questionnaire on Teacher Interaction
WIHIC	:	What Is Happening in This Classroom?
PR	:	Personal Relevance
U	:	Uncertainty
CV	:	Critical Voice
SC	:	Shared Control
SN	:	Social Negotiation
IGO	:	Intrinsic Goal Orientation
CB	:	Control of Learning Beliefs
TV	:	Task Value
SE	:	Self Efficacy for Learning Beliefs and Performance
A	:	Adaptation to Science Attitudes
E	:	Enjoyment of Science Lesson
L	:	Leisure Interest in Science
C	:	Career Interest in Science
MANOVA	:	Multivariate Analysis of Variance

df	:	Degree of Freedom
p	:	Significance Level

CHAPTER I

INTRODUCTION

The classroom has become an important place for educational research because most learning takes place there. The importance of the classroom learning environment has been increasingly recognized internationally over the past 30 years. According to Wilson (1996), classroom learning environment is a place where learners and teachers interact with each other and use a variety of tools and information resources in their pursuit of learning activities. Research in education that focuses on classroom and school-level learning environments has produced promising findings leading to an enhancement of the teaching and learning process. Fraser (1986) argues that perceptions of the students and the teachers are very important when investigating the learning environment (Wubbels & Brekelmans, 1998). The role of teachers' and students' perceptions of the classroom environment in influencing cognitive and affective outcomes has been addressed in many learning environment studies and a strong relations between student outcomes and their perceptions about their learning environment have been shown by many researchers (Fraser & Fisher, 1982; Wubbels, & Brekelmans, 1998; den Brok, Brekelmans, & Wubbels, 2004). Fraser (1998,b) emphasized that relations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcomes, with a variety of instruments, across different countries and grade levels. Learning environment research has studied these associations in different types of classroom environments (Fraser, 2002), for instance science laboratory classroom environments, computer-assisted instruction classrooms, constructivist classroom environments and cross-national studies of science classroom environments. In learning environment research, attitude is one of the factors that has affects on learning environment. Newhouse (1990) emphasizes that attitude is a very important factor in influencing human behavior. Attitude is defined in Newhouse's (1990) study as positive or negative feelings about a person, object, or issue. Having these feelings is affected by personal opinion, and these personal opinions can be gained by personal life experiences and education. In science learning environment studies, the results generally showed that there is a relationship between science learning environment and students' attitude toward science (Riah & Fraser, 1997; Aldigre & Fraser, 2000; den Brok, Fisher & Rickards, 2004; Rakıcı, 2004; Puacharearn & Fisher, 2004; Wahyudi & David, 2004; Telli, Çakıroğlu & den Brok, 2006). Attitude toward science indicate that students' affective behaviors, for example preference, acceptance, appreciate and commitment toward science. The investigation of students' attitudes towards studying science has been a substantive feature of the work of the science education research community for the past 30–40 years. Several studies have indicated that classroom learning environment is a strong factor in determining and predicting students' attitudes toward science (Lawrenz, 1976; Simpson & Oliver, 1990; Riah & Fraser, 1997; Aldolphe, Fraser & Aldridge, 2003). In other words, classroom environment is generally shows a positive correlation with attitude.

In recent years the goals of education have changed in learning environments. Memorization of facts has been accepted to be less important than problem-solving skills and life-long learning. In line with these changes, the studies to understand the nature of learning have also been improved. At present, theoretical and empirical studies in education are favoring construction of knowledge model instead of traditional information transmission model in learning environments (Yarger, Thomas, Boysen & Marlino, 1999). Constructivism as a knowledge construction model has received attention in education especially for the past two decades because it has been perceived as a more natural, relevant, productive and empowering framework for instructing students (Cannella & Reiff, 1994, cited in Abdal-Haqq, 1998). Studies indicate that early elementary students are interested in science activities and enthusiastic about them (Pitburn & Baker, 1993). However, as students progress through school, many of them lose interest in science activities and perceive careers in science more negatively (Stodolsky, Salk & Glaessner, 1991). On the other hand, empirical evidence suggests that the constructivist model of teaching and learning has a positive effect on student attitudes is relatively scant. Curriculum development researches also emphasized the importance of constructivism. Recently, the principles of constructivist approach have been widely applied in education especially in science, mathematics and primary school education (Roth, 1990, cited in Kesal, 2003). As a result, constructivist learning environment became shaped and visible in classrooms.

Current studies in the field of educational psychology, science education, and learning environment have also emphasized the importance of the relations between students' learning environment and their motivation (Ben Ari, 2003; Carnegie Council on Adolescent Development, 1989; Jackson & Davis, 2000; Kaplan & Middleton, 2002; Manning, 2000; McCombs & Whisler, 1997; National Middle School Association, 1995; Payne, Conroy, & Racine, 1998; Stipek, 2002). Motivation is a cognitive process which gives directions to learners' choice, effort and persistence. For example, Pintrich and Schunk (2002) proposed that learning environments providing students with some choice and control enhances intrinsic motivation which is related to higher levels of self-efficacy, intrinsic goal orientation, and other adaptive motivational beliefs. In fact, constructivist learning environments promotes adaptive motivational beliefs by offering opportunities to develop autonomy, responsibility and optimal level of challenge (Ames, 1992). Based on the accumulating research it is concluded that the quality of student learning depends closely on an interaction between the kinds of social and academic goals students bring to the classroom, the motivating properties of these goals and prevailing classroom reward structures. The literature acknowledges that cognitive achievement and metacognitive strategies are not sufficient to promote student achievement, and that students also be motivated to learn intentionally and in self regulated manner (Pintrich, 1989). In student centered learning environment learners are given actual control and self direction of academic tasks through task and assessment design by enhancing motivational effects. There is sufficient evidence of the importance of considering motivational dimensions of learning activities and environments. Learners' capacity to engage in deep and generative learning is closely linked to efficacy beliefs, motivational states and levels of confidence (McLoughlin & Luca, 2004). When a student engage in a task, they have to monitor their behavior, judge its outcomes, and react to those outcomes to regulate what they do (Eccles & Wigfield, 2002). In their study, VanZile-Tamsen and Livingston (1999) found that students have a general pattern of motivational beliefs that is either positive or negative. Students with a positive motivational orientation generally have high self-efficacy and also tend to display an internal locus of control, have mastery or deep approach goals rather than performance or surface goals. Such a positive motivational orientation correlates significantly with self regulated strategies, and this relationship is stronger for low-achieving than for high-achieving students. These findings imply that this positive motivational orientation is important for promoting self regulated strategies for all students, but is even more important for low-achieving students. As a result an individual's self efficacy beliefs, attributional beliefs, and motivational goal orientation will influence the type of strategies that are used, the effectiveness of that strategy use, persistence at academic tasks, positive learning environment and ultimately academic achievement. The motivational goal orientation of the class setting and the individual student (i.e., mastery goals vs. performance goals) tends to influence what types of strategies are used and how effective this use is (Ames & Archer, 1988; Nolen, 1988). Therefore based on the related theory and literature, it is visible that there is a need for empirical research investigating relationship between students' perception of learning environment and their adaptive motivational beliefs in Turkey, because the studies in this field are very limited.

This study aims to examine the relationship between elementary school students' perception of science classroom environment from constructivist perspective, their adaptive motivational beliefs and their attitude toward science.

1.1 Significance of the Study

The classroom is the basic unit of organization of the educational system. By continuing to increase the knowledge of the interactions that occur within the classroom, the quality of science education can be improved with understanding of students' development, their perception about learning environment and their attitude toward science. Fraser (1989) mentioned that the classroom environment is such a potent determinant of students' outcomes that it should not be ignored by those wishing to improve the effectiveness of schools. He emphasizes that students spend a great amount of time (more than 15,000 hours) in the classroom environment. Therefore the quality of the environment of these classrooms has a significant impact on students' learning (Fraser, 1989). Also Talton and Simpson (1987) indicated that classroom learning environment was the strongest predictor of attitude toward science in all grades. It has been assumed that having a positive classroom environment is an educationally desirable end. This study provides science teachers with information about aspects of the constructivist learning environment that could lead to increase in students' motivational beliefs and positive attitude toward science. By collecting information on students' perceptions of constructivist learning environment and motivational beliefs it is hoped to initiate and support activities in science education. The practical implication of this research is that student outcomes might be improved by creating classroom environments with respect to constructivist perspective found empirically to be conducive to students' motivational beliefs and their attitude toward science. This study also provided a degree of support for promoting constructivist oriented teaching in science classrooms to help students more intrinsically goal oriented, self-efficacious, and help them realize the importance and usefulness of what they learned in the classrooms. Understanding students' perceptions of their classroom learning environments and the factors associated with their perceptions may help teachers and educational researchers to find out some alternative ways that enhance the student's learning. In addition considering the fact that during 2004-2005 academic year the national science curriculum for elementary school has changed based on constructivist perspective in Turkey, this study can help science teachers to understand their students' needs and expectations, to adopt the new curriculum easily and to understand the importance of the constructivist approach in science education. Also this study is likely to supply significant data to teachers, researchers and science educators who deal with the development of science teaching and curriculum to suggest concept, idea and directions for making choices or decisions in increasing the degree of using constructivist teaching and action research in the classroom.

Chapter I presented the introduction and significance of the present study. Chapter II comprises a review of literature concerning the development of learning environments, constructivism constructivist learning environment and constructivist learning environment survey. In addition some brief information about attitude and motivation was given in that part. Chapter III presents the problems and hypothesis of the study. Chapter IV describes population, sample, variables, instruments, procedure, analysis of data, assumptions and limitations. Chapter V gives knowledge about the results of statistical analysis. Chapter IV summarizes the study and provides conclusions and recommendations.

CHAPTER II

REVIEW OF RELATED LITERATURE

This review of related literature is designed to provide background information about learning environment, constructivism and constructivist learning environment literature. In addition present study focused on the relationships of constructivist learning environment between attitude and motivation. Each section provides a brief overview of the subject matter, connecting theory and experimental studies to the research problem under consideration in this study. The sections of this chapter are: Learning Environment; Constructivism; Attitude; Motivation; and Summary of the Chapter.

2.1 Learning Environment

Classroom learning environment, referred to the educational environment or the classroom climate, is the social atmosphere in which learning occurs. Fraser (1994) indicated these learning environments as the social-psychological contexts or determinants of learning.

The nature of the classroom learning environment and psycho-social interactions can make a difference in how the students learn and achieve their goals (McRobbie, Roth & Lucus, 1997). The physical environment of the school and the classroom for instance, facilities, spaces, lightening, ventilation, desks and chairs, and air in the classroom affect the safety and comfort of students and so affect learning and personal development of students. The psychological environment refers to the social quality of the school and classroom; especially it relates perceptions and feelings about social relationships among students and teachers. The classroom psychological environment, which refers to classroom social climate, classroom social interactions, and classroom social relationship are often used interchangeably when discussing the classroom learning environment (Cheng, 1994). According to Moos (2002), psychosocial environments tend to preserve the individual characteristics that are compatible with their prevailing aspects. When individuals in an environment are offered information about their learning environment, opportunities for adaptation to the environment can affect the individuals' expectations of the social setting.

The learning environment has a big influence on student outcomes and plays an important role in improving the efficiency of learning in all levels of classrooms. Studies consistently have shown evidence of relations between student perceptions of their classroom learning environment and their cognitive and affective outcomes (Fraser & Fisher, 1982; Fraser, 1986, 1989, 1994; Hunus & Fraser, 1997; Chionh & Fraser, 1998; Roth, 1998; Haertel, Walberg, & Haertel, 1981; Henderson, Fisher & Fraser, 1995; Margianti, Fraser & Aldridge, 2001; Myint & Goh, 2001; Koul & Fisher, 2002). Students learn better when they perceive their classroom environment positively (Chionh & Fraser, 1998). Classroom environments involve the shared perceptions of the students and teachers in a particular environment (Fraser, 1986). There is a positive relation between perceptions of learning environment and attitudinal outcomes so classroom learning environment is the strongest predictor of attitude toward science in all grades (Talton & Simpson, 1987; Hunus & Fraser, 1997, Rawnsley & Fisher, 1998, Myint & Goh, 2001).

2.1.1 Learning Environment Research Instruments

The work on educational environments over the previous 30 years is the basic ideas of Lewin and Murray and their followers. Lewin's (1936) seminal work is basic determinant of human behavior in which behavior is considered to be a function of the person and environment. Murray (1938) was first person to follow Lewin's approach by proposing a need press model which allows the analogues representations of person and environment in common terms.

There are different scales which assess classroom environment. Each scale has been classified according to Moos's (1974) scheme for classifying human environments (see Table 2.1). Over several decades, the quality of these dimensions -

relationships, personal development and system maintenance/change – has been verified in studies on family, work, school, health, military, prison and social community environments (Moos, 1976; 1979; 2002). The model was tested with empirical probes that confirmed validity of the model as well as its dynamic structure (Fraser, Walberg, Welch, & Hattie, 1987). 'While controlling other factors like student ability, age, motivation, the quality of instruction, etc., classroom and social environment were determined as particular important factors for improving student cognitive and effective outcomes' (Telli, 2006, p.27).

Table 2.1 Human social environments classified by Rudolph Moos

Dimension	Definition	Related terms
Relationship	The nature and intensity of personal relationship within the environment and the extent to which people are involved in the environment and support one another.	cohesiveness, expressiveness, support, involvement, affiliation, and involvement.
Personal development	The basic directions along which personal growth and self-enhancement tend to occur.	independence, achievement, task orientation, self-discovery, anger, aggression, competition, autonomy, and personal status.
System maintenance and system change	The extent, to which the environment is orderly, clear in expectations, maintains control and is responsive to change.	organization, control, order, clarity, innovation, physical comfort, and influence

Source: Telli (2006, p.26)

Researchers have developed numerous questionnaires to assess students' perceptions of their classroom learning environments. Table 2.2 (Fraser, 1998, b) gives information about nine of major learning environment instruments namely; the Learning Environment Inventory (LEI), the Individualized Classroom Environment Questionnaire (ICEQ), the Classroom Environment Scale (CES), the College and

University Classroom Environment Inventory (CUCEI), the My Class Inventory (MCI), the Science Laboratory Environment Inventory (SLEI), the Questionnaire on Teacher Interaction (QTI), the Constructivist Learning Environment Survey (CLES) and the What Is Happening In This Class? (WIHIC). The level of instruments, item per scale, and scale classification were listed. Scales are classified according to Moos's Scheme. These questionnaires have been used in different countries and at different grade levels. They have been translated into different languages and these questionnaires have been used by many researchers, teachers and students in all over the world. Besides the learning environment instruments emphasized above, there are other instruments, which have been developed for specific purposes. These instruments were developed by drawing upon a combination of existing instruments.

Table 2.2 Overview of scales contained in nine learning environment instruments

Instrument	Level	Items/ scale	Relationship dimensions	Personal development dimensions	System maintenance and change dimensions
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favoritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Formality Material Environment Goal Direction
Individualized Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalization Participation	Independence Investigation	Differentiation
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher Support	Task Orientation Competition	Organization Rule Clarity Teacher Control
College and University Classroom Environment Inventory (CUCEI)	Higher Education	7	Personalization Involvement Student Cohesiveness Satisfaction	Task Orientation	Innovation Individualization
My Class Inventory (MCI)	Elementary	6--9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
Science Laboratory Environment Inventory (SLEI)	Upper Secondary/ Higher	7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment
Questionnaire on Teacher Interaction (QTI)	Secondary/ Primary	8--10	Understanding Dissatisfied Admonishing		Student Responsibility Uncertain
Constructivist Learning Environment Survey (CLES)	Secondary	7	Personal Relevance Uncertainty Student	Critical Voice Shared Control Investigation	Student Negotiation
What Is Happening In This Classroom (WIHIC)	Secondary	8	Cohesiveness Teacher Support Involvement	Task Orientation Cooperation	Equity

Source: Fraser (1998,b)

Learning environment researches give information about what goes on in school settings beyond the notation of student achievement. Walberg and Moos began considering psychosocial environments and their influences on student outcomes in the late 1960s and early 1970s. Their work can be considered the "starting points for contemporary learning environment research" (Fraser, 1990, p. 201). Learning environment researches, which were firstly started in Western countries, showed strong emphasis on the use of a variety of validated questionnaires that assess students' perceptions of their classroom learning environment. Later, researches on learning environment were started in Asia countries and Asian researchers have conducted studies that have cross-validated the main contemporary classroom environment questionnaires (e.g. Questionnaire on Teacher Interaction, Science Laboratory Environment Inventory, Constructivist Learning Environment Survey, and What Is Happening In This Class?) which were originally developed in English. For example, the Constructivist Learning Environment Survey (CLES) has been translated into other languages and used in Taiwan (Aldridge & Fraser 2000) and Korea (Kim, Fisher & Fraser, 1999), the Science Laboratory Environment Inventory (SLEI) was field-tested and validated in different countries such as the USA, Canada, England, Israel, Australia and Nigeria and was also cross-validated in Australia (Fisher, Henderson & Fraser, 1997; Fraser & McRobbie, 1995), Korea (Lee & Fraser, 2001) and Singapore (Wong & Fraser, 1996), Questionnaire on Teacher Interaction (QTI) has been cross-validated at different grade levels in the USA (Wubbels & Levy, 1993), Australia (Fisher, Henderson & Fraser, 1995), Singapore (Goh & Fraser, 1996), Brunei (Riah & Fraser, 1997) and Indonesia (Soerjaningsih, Fraser & Aldridge, 2002).

2.1.2 Researches Related with Learning Environment

Recent learning environment researches have commonly focused on different aspects of learning environment. Some of these aspects are: students perception about their science learning environment, investigating science laboratory learning environments, perceptional differences between genders, cross-national and cross-cultural studies, teacher interpersonal behavior and differences between students' and teachers' perceptions of the same learning environment.

Generally, in learning environment studies researchers studied on the relations between students' learning environment and their attitude toward science. For example Riah and Fraser (1997) indicated that there is a relationship between students' perception of learning environment and their attitude toward science. Similarly, there is a research that explored the nature of learning environments in Jammu, India was conducted by Koul and Fisher (2002). A sample of 1021 students from 32 science classes in seven co-educational private schools completed the questionnaire on the What is Happening in This Classroom? (WIHIC) and attitude scale. The multiple regressions showed that three scales namely investigation, task orientation and equity were positively and significantly related to student's attitudes. The result of Riah and Fraser (1997) and Koul and Fisher (2002) are replicated in different studies by different researchers (Allen, 2003; Chionh & Fraser, 1998; Hoffnerr-Moss & Fraser, 2002; Rawnsley & Fisher, 1998; Telli, Çakıroğlu & den Brok, 2006; Wahyudi & David, 2004) who also found that most of the learning environment scales were positively and significantly related with students' attitude toward science.

On the other hand, some researchers also focused on more specific variables like gender difference affects on learning environment in their studies. In learning environment research generally researchers emphasized the differences between girls and boys about their perceptions on their learning environments. For example, Huang (2003) conducted a study to investigate factors such as school, subject, and several academic background variables that can be related to classroom learning environments of middle school students and whether the relationships vary by gender. Three learning environment instruments which were the Classroom Environment Scale (CES), the Instructional Learning Environment Questionnaire (ILEQ) (Knight & Waxman, 1989, 1990), and WIHIC questionnaire were used. This study was administrated to 644 seventh grade students from six middle schools in northern Taiwan. They represent four classes of students from each school. Firstly, this study indicated that girls perceived their classroom learning environments more positively than boys did. Girls were more involved, more affiliated and more cooperative with classmates than boys were. Therefore, gender is a key predictor of learning environment in this study. Secondly, it also showed that middle school students had favorable perceptions of their psychosocial environment. Most of them had high self-expectations but did not often investigate problems or do research to find solutions whenever they encountered difficulties or questions. Although students came from the same school, same classroom, and similar academic background, girls' academic background variables demonstrated greater effects on their perceptions of learning environment than their counterparts. Wahyudi and David (2004) also investigated gender difference of students' perceptions toward their science learning environment. WHICH questionnaire was administrated to 1400 students in lower secondary schools in Indonesia. Firstly the study confirmed that Indonesian version of WHICH questionnaire was valid. Secondly this study showed that female students generally held slightly more positive perceptions of both actual and preferred learning environment. In addition it is found that there were significant differences between students' perceptions actual and preferred learning environment, with students tending to prefer a more favorable classroom learning environment than they actually experienced. Similar results found by Mok (2002). According to Mok's study, girls had both higher developmental expectations of their schools and more positive perceptions of their classroom environment. Rakıcı (2004) also found that girls rated their learning environment and teacher interpersonal behavior more favorably than do boys.

The critical component of the classroom is heavily influenced by the interpersonal skills of a teacher (Creton, Wubbels & Hooymayers, 1989). It accepted that a productive and a stable classroom atmosphere are at the heart of the teaching effectiveness, and that the quality of the climate is dependent on the nature of the teacher-student communication (Levy, Wubbels, & Brekelmans, 1992). The personal relationship between student and teacher is important to supply a favorable social classroom atmosphere. Perceptions of teacher behaviors as a motivating or demotivating factor in the classroom have a critical role in the learning environment and students' learning. In addition researches have shown that students' perception of their teachers' interpersonal behavior is an important factor in explaining their cognitive and effective outcomes (Wubbels, Brekelmans &, Hooymayers 1991, Goh & Fraser, 1998, Henderson, Fisher & Fraser, 2000, Den Brok, 2001, Brekelmans, Webber, & Den Brok 2002, Scott, Den Brok, & Fisher 2004; Rakıcı, 2004). Some examples of classroom environment research involving the use of the QTI include: research in secondary science classrooms (Fisher, Goh, Wong & Rickards, 1996); the study of the professional development of teachers (Fisher, Fraser & Cresswell, 1995); the assessment of teacher-student interpersonal relationships in mathematics classrooms (Fisher, Rickards & Fraser, 1996; Rickards & Fisher, 1996); the investigation of sex differences in biology students' perceptions of teacher-student relationships (Henderson, Fisher & Fraser, 1995); the relationship between teacher personality and interpersonal teacher behavior (Kent, Fisher & Fraser, 1995); and the relationship between science students' perceptions of their teacher's interpersonal behavior, students' cultural environment and students' preferred student-teacher interpersonal behavior (Waldrip & Fisher, 1996). The QTI has been used in different countries for example, in Singapore (Goh & Fraser, 1998), Brunei (Riah & Fraser, 1998), Indonesia (Soerjaningsih, Fraser & Aldridge, 2002) and in Turkey (Rakıcı, 2004; Telli, 2006).

A recent study which was conducted by den Brok, Fisher, and Rickards (2004) investigated whether student, teacher and class characteristics affect students' perceptions of their teacher interpersonal behavior. The (QTI) used in the U.S. and The Netherlands has shown that in these countries, several factors affect student's perceptions. These factors were student and teacher gender, student and teacher ethnic background, student age, teacher experience, class size, student achievement and subject. It was found that each of these variables has an effect, and also that they interact with each other in determining students perceptions. The results indicated that the more positive the attitude of the student, the higher his or her perception of the teacher in terms of both influence and proximity. In addition boys perceived their teachers as less dominant and cooperative than girls. Differences in perceptions were also reported with respect to ethnicity-related variables. Students speaking mainly English at home perceived their teachers as more dominant and more cooperative. The findings related with gender and attitude supports earlier findings (den Brok, Fisher, Brekelmans, Rickards, Wubbels, Levy & Waldrip, 2003; den Brok, Wubbels & Brekelmans, 2003).

Although teachers and students share the same learning environment, in literature there are some differences between teachers' and students' perceptions of the same learning environments. Generally the studies emphasize that students and teachers perceive the nature of the same classroom differently and that students find their actual classroom environment less positive than they would prefer. For example, Rickards and Fisher (1998) conducted a study by a sample of 153 teachers and their 3515 students from 164 secondary school science classes in 35 schools using the Questionnaire on Teacher Interaction (QTI). The result of this study showed that teachers perceived their interactions more positively than did their students.

Similarly, the investigation of differences between students and teachers in their perceptions of the same actual classroom environment and differences between the actual environment and that preferred by students or teachers was reported by Fisher and Fraser (1983a). In this study ICEQ was used, with a sample of 116 classes for the comparisons of student actual with student preferred scores and a sub-sample of 56 of the teachers of these classes for contrasting teachers' and students' scores. Students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. Also, teachers perceived a more positive classroom environment than did their students in the same classroom on four of the ICEQ's dimensions. These results have been replicated in other studies by different researchers (Fraser & McRobbie, 1995; Hofstein & Lazarowitz, 1986; Wubbels, Brekelmans & Hooymayers, 1991).

One of the most important learning environments in science education is laboratory. Laboratory environment is a setting in which the students work cooperatively in small groups to investigate scientific phenomena. It is a unique model of instruction, and a unique model of learning environment. In this respect Fraser, Giddings, and McRobbie (1992) investigated the science laboratory classroom environments in a number of schools and universities in six countries (Australia, USA, Canada, England, Israel and Nigeria). The sample consisted of 3,727 students from 198 classes in schools and of 1,720 students from 71 university classes. One of the aims of this study was to develop, validate and use a new instrument, the Science Laboratory Environment Inventory (SLEI), which is specifically suited to science laboratory environments at either the upper secondary school or higher education level. Data from the six-country sample provided strong evidence that science laboratory classes around the world are dominated by closed-ended activities. It was also found that females held more favorable perceptions than males and that there were statistically significant associations between students' attitude toward science and their perception of laboratory environment.

Hofstein, Nahum, and Shore (2001) stated that the science laboratory environment provides a unique learning environment which is different from the learning environment that exists in classrooms in which different instructional techniques are used. In this study Science Laboratory Environment Inventory (SLEI) was used to assess the students' perceptions of their chemistry laboratory learning environment. The sample consisted of two groups of students, the inquiry groups and the control groups. The inquiry group consisted of 130 eleventh grade students and the control group consisted of 185 eleventh grade students. The two groups comprised students who opted to study chemistry beyond the tenth grade (where chemistry is compulsory). Statistical comparison of two groups (control and inquiry) showed significant differences between the groups regarding their actual perceptions. The inquiry group had higher actual perception than control group. Moreover, it was found that the differences between the actual and preferred laboratory learning environment were significantly smaller for the inquiry group than for the control group.

In Singapore, Wong and Fraser (1996) also investigated the associations between students' perceptions of their chemistry laboratory classroom environment and their attitudes towards chemistry, using a sample of 1592 final year secondary school chemistry students in 56 classes in 28 randomly-selected coeducational government schools. Students' perceptions of their Chemistry Laboratory environment were assessed using the Chemistry Laboratory Learning Environment Inventory (CLEI), which is a modified version of the Science Laboratory Environment Inventory (SLEI). The questionnaire on Chemistry-Related Attitudes (QOCRA), a modified form of the Test of Science-Related Attitudes (TOSRA), was used to assess the students' attitudes to chemistry. According to results of the study there were significant associations between the nature of the chemistry laboratory classroom environment and the students' attitude toward science.

Many of the studies in the literature aimed to develop standard instruments like QTI, CLES in order to assess science classroom environments. So there are some validation research examples of learning environment instruments in the followings. One is an investigation of science classroom environments in Korea. For example, Lee and Fraser (2001) focused on two aspects, namely, constructivism and the interaction pattern between students and teachers. Their study made use of two questionnaires (Constructivist Learning Environment Survey, CLES, and Questionnaire on Teacher Interactions, QTI) after a rigorous translation procedure. Analyses of the survey data, collected by using the QTI and CLES, suggested that the Korean versions of the CLES and QTI have satisfactory reliability and validity for all scales when used in Korean high schools. From the survey with the CLES, it was revealed that science lessons 'sometimes' conveyed the notions of constructivism. This suggested that active implementation of constructivism in practice by teachers has been supported by various bodies (i.e., Ministry of Education). A similar study was also conducted by Kim, Fisher and Fraser (1999) and provided further support for the reliability and validity of CLES in Korea.

In another study, in Singapore, Chionh and Fraser (1998) cross-validated a version of the What Is Happening In This Class? (WIHIC) questionnaire with a group of geography and mathematics students. They also investigated the relationships between classroom environment and the learning outcomes of achievement, attitudes and self-esteem among these geography and mathematics students. The researchers also investigated differences in students' perceptions of their geography and mathematics classroom environments. The study involved 2310 tenth students of the Express/Special Course in 75 randomly-selected classes from 38 randomly-selected schools in Singapore. For the investigations of relations between classroom environment and outcomes, a 24-item semantic differential attitude instrument and a 20-item self-esteem inventory were developed. The comparison of geography and mathematics samples revealed that both groups of students had almost similar general perceptions of their learning environments. However, better examination scores were found in classrooms perceived as having more student cohesiveness, whilst attitudes and self-esteem were more favorable in classrooms perceived to have more teacher support, task orientation and equity.

There are also some cross-national studies related with learning environments. One of these researches is the study of Aldridge and Fraser (2000). They have completed a cross-national study of classroom environments in Taiwan and Australia. Their research is distinctive in that it not only provides an example of one of the few cross-national studies in science education, but it also used multiple methodologies exploring the nature of classroom learning environments in Taiwan and Australia. The WIHIC questionnaire was used to measure students' perception of their classroom environment, and an eight-item scale based on a scale from the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981) was used to investigate students' satisfaction in terms of enjoyment, interest and how much they look forward to science classes. The WIHIC questionnaire and the attitude survey were administered to a sample of 1,081 grades 8 and 9 general science students from 50 classes in 25 schools in Western Australia and 1,879 Grades 7-9 students from 50 classes in 25 schools in Taiwan. An analysis of variance (ANOVA) was used to determine the ability of each WIHIC scale to differentiate between the perceptions of students in different classes. The differences in mean environment and attitude scores for Taiwan and Australia were investigated (Aldridge & Fraser, 2000). Results indicated that students in Australia viewed their classroom environment more favorably than did students in Taiwan. There was a statistically significant difference for the scales of: involvement; investigation; task orientation; cooperation; and equity. Students in Taiwan, however, expressed a significantly more positive attitude towards science than did students in Australia. The effect size showed large differences between the two countries. Although Australian students had more favorable perceptions of the learning environment, students in Taiwan had more positive attitudes towards their science class. The researchers also examined the perceptions of the students in each country using classroom observations, interviews with teachers and students, and narrative stories written by the researchers. After gathering the qualitative data, three important points emerged for the researchers. Firstly, whilst the classroom environments are different in the two countries, the questionnaire scores do not necessarily reflect fully the overall quality of education. Secondly, when interpreting the data for scales of the WIHIC questionnaire, consideration needed to be given to whether the scales reflect what is considered to be educationally important in the countries and cultures from which the data were collected. Finally, Aldridge and Fraser (2000) suggested that comparisons of quantitative data from different countries should be considered cautiously because there were some items for which students in one country interpreted slightly different from other country.

Similarly, den Brok, Fisher, Brekelmans, Rickards, Wubbels, Levy, and Waldrip (2003) have conducted a cross national study. Firstly, in their research they investigated the reliability and the validity of the Questionnaire on Teacher Interaction (QTI) in 6 countries: United States, Australia, the Netherlands, Slovakia, Singapore and Brunei. QTI data were obtained from researchers that conducted their studies in each of the six countries, and were then reanalyzed to meet the purposes of the study. To enhance comparison between countries, researchers were asked to provide only data on secondary Science (Physics and Chemistry) teachers. In all countries, convenience sampling was used, except for the Netherlands, where teachers were randomly sampled. In most countries, reliability was lowest for the student responsibility/freedom scale (SC) and strict scale (DO). On average, reliability was highest for Australia and Singapore. Outcomes indicated that the scale inter-correlations corresponded with a circular ordering best for Australia and the Netherlands and least for Slovakia and Singapore. The study shows that results on the QTI cannot be compared between countries on the scale level and that further research is necessary to determine whether the instrument has cross-cultural validity.

The research related to science learning environment and teachers' interpersonal behaviors are very limited number in Turkey. One of them is the study of Rakıcı (2004). Rakıcı has conducted a research about eight grade students' perceptions of their science learning environment and teachers' interpersonal behavior. She used WIHIC questionnaire, QTI scale and the science attitude scale to find out perceptions of students toward their learning environment, the relation of teacher-student interaction on learning environment and students attitude toward science. The results of this study indicated that Turkish students generally perceived a positive science classroom learning environment and perceived that their teachers displayed cooperative behaviors (leadership, helping / friendly and understanding) rather than opposition behaviors (uncertain, dissatisfied, and strict) in terms of interaction with them. In addition analysis showed that there is a relationship between students' perceptions of classroom environment (learning environment and teacher interpersonal behavior) and students' cognitive and effective outcomes. In addition, it was found that girls rated their learning environment and teacher interpersonal behavior more favorably than do boys. Lastly, students viewed science learning environment of their male teachers' classes more cooperative than female teachers' classes and rated their male teachers as display more strict behavior than female teachers. This study was the first learning environment research done on interpersonal teacher behavior in Turkey.

A similar study was conducted by Telli (2006). She conducted the study to investigate Turkish secondary school students' perceptions of their science teachers' interpersonal behavior; teacher profiles and variables affecting Turkish students' perceptions of their science teachers' interpersonal behaviors. Also, differences in perceptions between Turkish students and their Dutch counterparts were examined. Data were collected from 7484 secondary school science students (grades 9-11) in 278 classes taught by 133 teachers from 55 schools in thirteen cities of Turkey using QTI and Test of Science Related Attitudes (TOSRA). Students' perception of teacher interpersonal behavior was positive. Students generally perceived more dominance than submissiveness and more cooperation than opposition in their classes. Teachers' self and ideal perceptions were higher on both dimensions than students' as other studies investigating difference between student and teacher perceptions. Significant differences were found between countries in terms of students' perceptions of their teachers' interpersonal behaviors as well as different distribution of teacher profiles. When comparing profile of the Turkish teacher with Dutch and US/Dutch sample, there are more Directive, Authoritative and Tolerant/Authoritative teachers in Turkish sample. The large Dutch sample contains more Authorities classes and US/Dutch sample contain s more Tolerate. Also, Turkish teachers were perceived higher on Influence and Proximity than Dutch colleagues. This finding can be result of Turkish teachers' high contact culture and also more cooperative behaviors in their classrooms. In both countries students had positive perceptions towards their science teachers. Finally, Telli found that students' perceptions of their teachers' interpersonal behavior were related to their effective learning outcomes, to several student, class and teacher background characteristics and to the subject taught.

Telli, Çakıroğlu and den Brok (2006) also conducted a study to investigate Turkish high school students' perceptions and their attitude toward science. In addition the study examined the differences in students' attitude toward biology by gender, grade level, and parental education. Data were collected from 1,983 ninth and tenth grade students through WHICH instrument and Test of Science Related Attitudes (TOSRA). They found that teacher support, task orientation and equity perceptions are related to students' attitudes. There is low association with inquiry, high associations with enjoyment of science, leisure interest and career interest. In addition the results showed that younger students (grade 9) have more positive attitudes than older students (grade 10). There was also gender difference in that boys have more positive attitudes only in terms of career than girls. For inquiry, enjoyment and leisure subdimensions terms, there was no difference between boys and girls. For parental education variable, the results showed that mother educational level is negatively associated with three out of four attitude (inquiry, leisure and career), educational level of father positively related to enjoyment.

To sum up, the classroom learning environment has a strong influence on students' outcomes and plays an important role in improving the efficiency of learning in all levels of classrooms.

2.2 Constructivism

Learning and instructional theories can be categorized as objectivist and constructivist. The traditional instructional theories can be called as objectivist and this approach states that knowledge depends on an objective reality and is an absolute entity. While designing an instruction based on an objectivist approach, firstly knowledge is divided into pieces and then the learner learns this knowledge into meaningful pieces. Each knowledge pieces given to the students supplies a target behavior that has to be achieved in order to realize the goals of instruction. In other words, learning occurs only if the student receives and saves the knowledge without changing it. Deryakulu (2001) indicates that behaviorist and cognitive learning theories are the reflections of the objectivist approach in instruction. On the other hand unlike the objectivist approach, constructivist approach emphasizes that learning is the learner's construction of his own knowledge in his mind (Deryakulu, 2001).

Constructivism is defined as an epistemology, a learning theory that offers an explanation of the nature of knowledge and how human beings learn (Cannella & Reiff, 1994, cited in Abdal-Haqq, 1998). Constructivism emphasizes that learners construct knowledge as a result of their own activities and interaction with the environment. According to constructivist theory, individuals construct knowledge in interaction with their environment, and in the process both the individual and the environment are changed (Abdal-Haqq, 1998; Airasian & Walsh, 1997; Brooks & Brooks, 1993; Richardson, 1997). If it is believed that learners passively receive information then priority of education will be on knowledge transmission. If it is believed that learners actively construct knowledge, then learning will emphasize the development of meaning and understanding. Von Glasersfeld (1993) explains constructivism as a way of thinking about learning; specifically he saw it as a useful model that should never be offered as 'truth'.

In recent years, education has been blamed for graduates no being sufficiently able to apply their knowledge to solve complex problems in working context. The development and implementation of instructional practices that will foster students' skills to communicate, think and reason effectively, make judgments about the accuracy of information, solve complex problems and work collaboratively in diverse teams, remains an important challenge for today's education (Pellegrino, Chodowsky & Glaser 2001). New learning environments based on constructivist theory claim to develop an educational setting to reach this goal, making students' learn the core issue and defining instruction as enhancing learning (Lea, Stephenson & Troy, 2003).

Constructivism has become an important and leading theory in science education (Tobin, 1993). Constructivism provides a plausible, functional framework for understanding and interpreting experiences of learning and teaching. Therefore constructivism acts as a central theoretical referent to build a classroom that maximizes student learning. It can be said that constructivist teaching has become a significant innovation in science education in order to improve science-learning environments.

Since constructivism emphasizes how the learner constructs knowledge, it is essential to mention what knowledge is according to the constructivist approach. Nature of knowledge and its implications for teachers and students are summarized below (Hendry, 1996):

1. In the classroom learning environment, knowledge exists in the mind of students and the teacher. It does not exist on the blackboard, in books, in teacher or student talk.

2. The students and the teacher give meaning to curriculum or instructional materials according to their existing knowledge and beliefs.

3. The construction of students' knowledge occurs in interrelationship with the world outside the classroom and interrelationship with the curriculum and other students inside the classroom.

4. Students' and teachers' knowledge can never be certain as all knowledge because knowledge can be reexamination and revision.

5. Students with different backgrounds and teachers share a particular knowledge; fundamentally they can share the same perceptual knowledge.

6. Students construct new knowledge through perception and action.

7. The construction of knowledge is time-consuming and difficult. So construction of knowledge requires time and energy.

2.2.1 The History of Constructivism

Although constructivist theory has reached high popularity in recent years, the idea of constructivism is not new. Aspects of constructivist theory can be found among the works of Socrates, Plato, Kant and Aristotle all of which emphasize the formation of knowledge by the individual. Socrates can be considered as the first philosopher who had an important contribution in establishing the foundations of constructivism. According to him, the teacher and the learners should construct and interpret the knowledge deep inside them through talking with and questioning each other (Hilav, 1990, cited in Erdem, 2001). Kant (late 18^{th} to early 19^{th} centuries) explained that "logical analysis of actions and objects lead to the growth of knowledge and the view that one's individual experiences generate new knowledge" (Brooks & Brooks, 1993, p. 23). But it was Piaget's theory of intellectual growth that had the primary influence on the development of current positions.

Constructivist theory focuses on the students rather than the teachers. Teachers are seen as facilitators who guide students to construct their own solutions to problems. There are two approaches for this theory; social constructivism and cognitive constructivism:

1. Lev Vygotsky is a Russian psychologist and philosopher and is most often associated with the social constructivist theory. He emphasizes the influences of cultural and social influence in learning and supports a discovery model of learning. According to this approach the teacher is in an active role while the students develop mental abilities naturally through various ways of discovery.

2. Piaget is associated with the cognitive constructivism. Cognitive constructivism indicates two different constructions. First, on the idea that people learn by actively constructing new knowledge, not by having information poured into their heads. Furthermore, constructivism asserts that people learn with particular effectiveness when they are engaged in "constructing" personally meaningful artifacts.

Among various interpretations of constructivism, Piagetian and Vygotskian constructivist approaches have been more affective in education (Caverly & Peterson, 1996). Piagetian and Vygotskian constructivist approaches can be contrasted with respect to two major issues that shape their explanations: (1) education for individual development versus education for social transformation and (2) the degree of influence that social context has on individual cognitive development (Richardson, 1997).

Piaget is considered as the father of constructivism. In addition he is thought as the foundation of the modern day constructivism (Crowther, 1997). His cognitive developmental theory maintains that as children mature, they progress through a series of stages, each step representing a qualitatively different set of cognitive structures until they reach the stage when they are able to think abstractly (Posner, Strike, Hewson & Gertzog, 1982). According to Piaget, the learning occurs because of the reciprocal effects of assimilation (fitting a new experience into an existing mental structure or schema) and accommodation (revising an existing schema for integrating the new experience into it) constantly forced to reach equilibrium between them (Abdal-Haqq, 1998).

Piagetian constructivists generally think that the purpose of education as educating the individual learners in according to their interests and needs are supported. Piagetian constructivism emphasizes learner-centered approach in which the learner is the subject of study and individual cognitive development is in the center (Airasian & Walsh, 1997). According to this approach students come to classrooms with ideas, beliefs, and opinions that need to be changed or modified by a teacher who facilitates this changing by devising tasks and questions that create dilemmas for students. Knowledge construction occurs as a result of working through these dilemmas (Abdal-Haqq, 1998; Brooks & Brooks, 1993).

Vygotsky is considered to be the founder of social constructivism (Abdal-Haqq, 1998). In contrast, Vygotsky (Caverly & Peterson, 1996) rejects the individualistic orientation of Piagetian theory and emphasizes education for social construction and reflects a theory of human development that situates the individual within a sociocultural context. According to this theory, individuals construct knowledge in interaction with the environment, and in the process both the individual and the environment are changed (Brooks & Brooks, 1993; Caverly & Peterson, 1996; Richardson, 1997; Abdal-Haqq, 1998). In this view, classrooms are the sociocultural settings where teaching and learning take place. The theory of Vygotsky is also student-centered and experiential; however, the teacher is more active in planning and guiding social interactions that enable the students to build and test knowledge within a social context (Akar, 2001).

Although Piaget and Vygotsky suggest that the teacher should encourage the students to search, solve problems, make their own decisions and construct their knowledge (Erdem, 2001), both of them are considered to be incomplete and criticized. Critics of Piagetian theory emphasize that this perspective does not take into consideration the influence of sociocultural context, characteristics of teachers and students and their prior learning histories on learning in the classroom and is isolated universal forms of knowledge. Critics of Vygotskian theory indicate that while the social constructivists' concern with social and or cultural factors enhances the recognition of differences across meanings, it limits the recognition of the universal forms that bring order to an infinite variety of meanings (Airasian & Walsh, 1997).

2.2.2 Kinds of Constructivism

There are different kinds of constructivism. Two of them are radical and critical constructivism. These two kinds of constructivism are important in science education research.

2.2.2.1 Radical Constructivism

Radical constructivism, psychological interpretation of rationalism, was advanced by von Glasersfeld (1990). Radical constructivism says that learning occurs when the individual logically constructs viable knowledge from the range of experiences with the world. This interpretation of constructivism is considered to be radical because it emphasizes subjectivity and impossibility of being objective.

Radical Constructivism has emerged in education in the form of unguided inquiry or discovery learning (Caverly & Peterson, 1996).

In science education, von Glasersfeld's radical constructivism (von Glasersfeld, 1989) is most often employed as reference position of the constructivist view. Radical constructivism is a theory of knowledge, exactly a theory of experiential knowledge. This knowledge is seen as tentative human construction on the basis of the already existing knowledge. The tentative character of experiential knowledge has great importance. It leads to the rejection that there may be ultimate truth for this kind of knowledge. The tentative character includes every kind of experiential knowledge, knowledge constructed by the individual and science knowledge as well. Also the latter is viewed as human construction on the basis of the conceptions and ideas the individual scientist or the respective scientific community holds (Duit, 2001). There are three key principles of radical constructivism (von Glasersfeld, 1989). The first states that knowledge is not passively received but is built up by the cognizing subject. According to this principle it is impossible to transfer ideas into students' mind, rather students construct their own meanings from the words or visual images they hear or see. What the learners already know occurs with knowledge construction process. The second principle emphasize that the function of cognition is adaptive and enables the learners to construct viable explanations of experiences. Knowledge of the world outside, hence, is viewed as human tentative construction. The reality outside is not denied but it is only possible to know about that reality in a personal and subjective way. Third principle of radical constructivism as intended by von Glasersfeld highlights that although individuals have to construct their own meaning of a new phenomenon or idea, the process of constructing meaning always is embedded within a social setting of which the individual is part.

2.2.2.2 Critical Constructivism

Critical Constructivism is a development of the radical constructivism by Ernst von Glasersfeld. Critical constructivism interested with constructivism within a social and cultural environment adding a critical dimension. According to critical constructivism there is a world out there of which people have no certain knowledge, and of which certain knowledge is unattainable. Taylor (1996) describes critical constructivism as a social epistemology that addresses the socio-cultural context of knowledge construction and serves as a referent for cultural reform. It confirms the relativism of radical constructivism. Thus, critical constructivism adds a greater emphasis on the actions for change. It is a framework using to make potentially disempowering cultural myths more visible, and hence more open to question through conversation and critical self-reflection. An important part of that framework is the promotion of communicative ethics, that is, conditions for establishing dialogue oriented towards achieving mutual understanding (Taylor, 1998). The conditions include: a primary concern for maintaining empathetic, caring and trusting relationships; a commitment to dialogue that aims to achieve reciprocal understanding of goals, interests and standards; and concern for and critical awareness of the often-invisible rules of the classroom, including social and cultural myths. That is, to achieve critical constructivist ideals it is needed to accept the unique differences of the individuals in the classes. Critical constructivism can be characterized as emphasizing reflection, imagination, social consciousness and democratic citizenship, and as giving rise to a pedagogy that enables students to continually shape and reshape their own conceptual biographies (Taylor, 1998).

2.2.3 Constructivist Learning Environment

Wilson (1996, p.5) defines constructivists learning environment 'as a place where learners work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem solving activities'. He also emphasized that students have more control in this environment and the teacher takes the role of 'coach and facilitator'.

Learning activities in constructivist classrooms are characterized by active engagement, inquiry, reflective thinking, problem solving and collaboration with others. The teacher is mainly a guide, a facilitator and an initiator of activities who encourages and supports learners to question and to formulate their own ideas, opinions and conclusions with leadership qualities (Airasian & Walsh, 1997; Richardson, 1997).

Brooks and Brooks (1993) also note that the constructivist classroom requires innovative assessment procedures by its very nature. As they note, it is very conflicting for teachers to teach in a student-centered way that focuses on knowledge and meaning construction, while then assessing the student's learning through traditional tests. As a consequence, teachers and schools need to think carefully about designing assessment processes that are authentic to the constructivist model and which are contextually based. This should be founded on the assessment through teaching model which provides an ongoing evaluation of the child's understanding and present skills. However, essay exams, open ended questions and term-papers rather than standardized tests can be used to assess students' learning in constructivist learning environment (Gergen, 1994, cited in Akar, 2001).

As a result, constructivist learning environments are student centered and learner controlled, emphasizing student responsibility and initiative in determining learning goals and regulating their performance toward those goals. Constructivist learning environment operate on a different set of assumptions about learning than traditional classroom pedagogies, thus creating implications both for teaching beliefs and actions of educators adopting constructivist learning environments.

2.2.3.1 Constructivist Learning Environment Design

Moving from theory to practice always includes challenges, in education or in any other field. When there are multiple brands of the theory, the task becomes more difficult. Although there are those who will argue that constructivism does not provide a model for implementation, numerous researchers, educators and authors are actively engaged in using constructivist principles to design and implement new learning environments.

Jonassen (1998) emphasize that learners should be dealt with interesting, relevant, and meaningful problems to solve in their learning environment. These real world problems should not be overly defined, but rather ill-structured, in order to allow students to seek out a solution to the problem. There is no single right answer or single solution for a problem according to this theory. Constructivist learning environments must be designed to engage the learner in complex thinking problems that require reasoning and investigation to solve. Student must construct their own ideas to solve the problems.

Teachers develop the situation for students to explain, select a process for groupings of materials and students, build a bridge between what students already know and what they want them to learn, anticipate questions to ask and answer without giving away an explanation, encourage students to exhibit a record of their thinking by sharing it with others, and solicit students' reflections about their learning.

Scott, Dyson and Gater (1987) suggested that a constructivist teaching sequence should include three phases as follows:

Phase1: Elicitation of ideas from students. The critical question in this phase is ‘What situation is the teacher going to arrange for students to explain?’. The teaching commences with orientation or a question (which involves exploring student ideas, discussing the difference among ideas, carrying out experiments, and trying to explain observed phenomena). Students usually become aware of their own views and the other students’ view about the subject. This phase can set clearly the scene of work.

Phase2: Reconstructing and application of ideas. This is an initial activity intended to determine students' prior knowledge and to build a "bridge" between what they already know and what they might learn by explaining the situation. During the reconstruction phase, students’ ideas can be clarified, challenged, and exchanged through discussion with others, or the teacher can promote conceptual conflict through the use of a disconfirming experiment and demonstration. So in this phase students can have an opportunity to consolidate and reinforce new conceptions by using them in both familiar and novel situations.

Phase3: Review of change in ideas. Students are invited to reflect on how their ideas have changed by drawing comparisons between their new thinking and their initial thinking at the beginning of the unit. There are some important questions for this phase: What attitudes, skills, and concepts will students take out the door? What did students learn today that they won't forget tomorrow? What did they know before; what did they want to know; and what did they learn? At the end of this phase the questions indicated above can be answered easily.

Teachers should plan and use these phase with their students. It should be taken into consideration how the students would be forced to be active and in which environments they would interact. Learning subject should be formed in accordance with the qualities and situation of the students for per class. The important thing is to provide the students to form the information authentically based on their own background information.

Jonassen (1991 p.11-12) emphasizes that many educators and cognitive psychologists have applied constructivism to develop learning environments. From these applications, he has isolated a number of design principles:

1. Create real-world environments that employ the context in which learning is relevant;
2. Focus on realistic approaches to solving real-world problems;
3. The teacher is a coach and analyzer of the strategies used to solve these problems;
4. Stress conceptual interrelatedness, providing multiple representations or perspectives on the content;
5. Instructional goals and objectives should be negotiated and not imposed;
6. Evaluation should serve as a self-analysis tool;
7. Provide tools and environments that help learners interpret the multiple perspectives of the world;
8. Learning should be internally controlled and mediated by the learner.

Teacher consideration of student perceptions about the learning environment is a significant element of improving the teaching and learning environment. Teachers should give importance to student’s perceptions of the classroom learning environment when designing viable conceptual constructs for students. Constructivism is a learning theory that recognizes the importance of considering student perceptions of the classroom learning environment and has been a major influence on science education in the past two decades. Many of the other principles can help to enhance the construction of knowledge and the facilitation of cognitive transformation.

2.2.4 Constructivism in Science Education

The constructivist view comes in many variants in science education literature on students' learning (Good, Wandersee, & Julien, 1993). It is based on a number of quite different philosophical perspectives that share a common "constructivist principle". The common constructivist principle is a "view of human knowledge as a process of personal cognitive construction, or invention, undertaken by the individual who is trying, for whatever purpose, to make sense of her social or natural environment." (Taylor, 1993, 268). In other words; knowledge is not viewed as some sort of a true copy of features of the world outside but as construction of the individual.

The aims of constructivist science education are fundamentally different from traditional approaches. According to constructivist approach understanding science goes far beyond the repetition of definitions and formulas. It includes applications of science knowledge for the mentioned purposes, and also incorporates views about science and meta-cognitive issue. The purpose of constructivist science education is to create reflective learner who is aware of the strength and limitations of her or his knowledge. In order to address these aims constructivist approaches usually emphasizes the changes at several levels and aspects of science education. Assessment has manifold functions in school. In more traditionally oriented approaches the pedagogical function, i.e., assessment as a means of helping students to learn, is given only scant attention. Constructivist approaches usually differ fundamentally from more traditional ones in this respect. The role of assessment among other supporting conditions of conceptual change is given key importance.

The constructivist view, for instance, does not only provide a new means of thinking about learning but also of viewing science content: "....we knew that our views of learning affect our teaching, but now we see that they also affect our perceptions of content...." (Fensham, Gunstone, & White, 1994, p.1). Constructivism in science education includes students' conceptions of various kinds in the process of reconstruction of science content.

Constructivist science education goes far beyond epistemological and knowledge acquisition issues. It concerns the arrangement of conditions that support students' constructions on the basis of their already existing knowledge. There are four main facets of the view of knowledge (Duit, 2001):

1. Active construction on the basis of the already existing conceptions. Students must construct the new knowledge actively by themselves on the basics of the already existing knowledge. Simple transfer of pieces of knowledge from a certain source to the learner is not possible. Many students' prior science conceptions are in stark contrast to the science conceptions to be learned. Changing from these conceptions to science conceptions is not easy.

2. Tentative construction. All knowledge or ideas constructed by the individual about traits of the world outside or about ideas another may have is tentative in nature. It is hypothetical and may need minor or major changes when other evidences become available. Also science knowledge as accepted today in scientific communities in principle is tentative in nature and open for revision.

3. Viability. Knowledge and ideas that have been constructed need to be viable, i.e., useful for the individuals. Students may, for instance, construct what they like but then they run the risk of not being understood by others. Only constructs that stand the test of being viable survive to speak.

4. Social construction. Although every individual has to construct knowledge by her or himself the construction process always also has a social component. Knowledge is always constructed within a certain social setting.

In constructivist learning the focus is on the students, their interests, their learning skills, and their needs in a broad sense. Science instruction from that perspective aims at providing students with science knowledge in such a way that they understand not only the science concepts and principles rather than learning definitions and formulas by heart but also understand in which way science knowledge is of significance for their lives and for the lives of all other human beings.

2. 2.5 Constructivist Learning Environment Survey

The traditional teacher-centered, didactic approach to teaching has been extensively criticized and there is a better understanding of the nature of knowledge development. Fraser (1994) writes: 'Although classroom environment research has focused on the assessment and improvement of teaching and learning, it has done so largely within the context of the traditional, dominant epistemology underpinning the established classroom environment. Consequently, a new learning environment instrument is needed to help researchers assess the degree to which a particular classroom's environment is consistent with constructivist epistemology and to help teachers reflect on their epistemological assumptions and reshape their teaching practice. The Constructivist Learning Environment Survey (CLES) was developed to meet this need' (p. 527). As evidenced by its widespread implementation and established validity in various countries, the Constructivist Learning Environment Survey (CLES) is a valuable tool for assisting researchers and teachers in assessing the degree to which a classroom's environment is consistent with a constructivist epistemology, as well as for assisting teachers in reflecting on their epistemological assumptions and reshaping their practice. Variations of the relatively short and highly appropriate instrument were made to make it suitable for assessing both teachers' and students' viewpoints (Nix, Fraser & Ledbetter, 2005).

Therefore, the Constructivist Learning Environment Survey (CLES) was developed with a psychological view of learning that focused on students as co-constructers of their own knowledge (Taylor & Fraser, 1991). Originally, the CLES was found to be valid (Taylor & Fraser, 1991) and to contribute insightful understanding of classroom learning environment. But Taylor (1994) found major sociocultural constraints to the development of the constructivist learning environment and developed a new version of the CLES based on critical constructivism, which combines the radical constructivist theory and critical social theory.

The Constructivist Learning Environment Survey (CLES) is enabled educators and researchers to measure students' perceptions of the extent to which constructivist approaches are present in classrooms. The original version of the CLES (Taylor & Fraser 1991) was based largely on a psychosocial view of constructivist reform that focused on students as co-constructers of knowledge. The new version of the CLES was designed to obtain measures of five key elements of a critical constructivist learning environment from the students' perception: The degree of personal relevance to evaluate whether students have shared control over their learning; the degree to which students feel free to express concerns about their learning; the degree to which students are able to interact with each other to improve their understanding; and the extent to which science is viewed as ever changing (Taylor, Fraser & Fisher, 1997). The CLES contains 30 items altogether, with six items in each of the five scales. The response alternatives for each item are Almost Always, Often, Sometimes, Seldom, and Almost Never.

2.2.6 Studies Related with Constructivist Learning Environment

Although constructivism is not a new educational approach, the studies on constructivist learning environment are conducted in the last two decades more frequently. Especially in the 90s, studies on constructivist learning environment increased while the studies conducted before 90s focused on the traditional approach. Therefore, the present literature will focus on the studies conducted in the last decade because they are built upon the earlier research related to constructivism. The research focused on different aspects of constructivist learning environment. For example, some research focused on validation of Constructivist Learning Environment Scale (CLES), some focused on perceptions of students about their science classrooms, some were related with the practical application of constructivism in the learning environments and some examined the curricula which emphasizes constructivism.

There have been many researches about the validation of Constructivist Learning Environment Scale (CLES). One of them is the study which was conducted by Puacharearn and Fisher (2004) which describes the first study conducted in Thailand that resulted in changes in science teachers' classroom environments. In the first phase of the study, CLES was validated for use in Thailand. Second, the effectiveness of cooperative learning integrated with constructivist teaching in promoting improvement in classroom environments was evaluated through an action research process, involving the use of feedback on actual and preferred classroom environments. The sample consisted of seven secondary science teachers and their 17 classes of 606 students in Thailand. Student Actual and Preferred Forms of the CLES, assessing personal relevance, uncertainty, critical voice, shared control and student negotiation, were administered. The result of this study showed that firstly the Constructivist Learning Environment Survey (CLES) was validated for use in Thailand. Secondly, changes in classrooms did occur, thus supporting the effectiveness of cooperative learning integrated with constructivist teaching in improving learning environments and students' attitudes towards science in Thailand. The average classroom in this study had relatively high levels of student perceived actual uncertainty, student negotiation and personal relevance, but the levels of shared control and critical voice were consistently lower. For all five scales, students preferred a more favorable classroom environment than what they perceived actually.

Another study which focused on validation of CLES was conducted by Aldridge and Fraser (2000). They focused on the validation and use of English and Chinese versions of the Constructivist Learning Environment Survey (CLES) in a cross national study of high school science classrooms in Australia and Taiwan. The CLES was administered to 1082 students from 50 classes in Australia and 1879 students from 50 classes in Taiwan. Data analysis supported each scale's internal consistency reliability, factor structure and ability to differentiate between classrooms and revealed interesting differences between average scale scores in Taiwan and Australia. This cross national study of science classroom environment in Taiwan and Australia combined quantitative and qualitative methods. The questionnaire data were used to guide the collection of qualitative data in each country to explain patterns and differences in mean scale scores in Australia and Taiwan. Interviews with students also provided precautionary information regarding students' understanding of some items and the use of a Western survey to measure constructivist learning environment in an Eastern country. The quantitative data, collected during the CLES supported the reliability and validity of both an English and Mandarin version. A comparison of CLES scale mean scores in two countries revealed that Australian students perceived more critical voice and students negotiation and less personal relevance, uncertainty and shared control than students in Taiwan. Also the attitudes of Taiwanese students towards their science classes were more positive than for students in Australia. By combining qualitative and quantitative data it was possible to determine not only that the learning environments in each country were different, but also some explanations of why they were different. This study suggested that the CLES is a useful tool for examining the transformation of teaching and learning practices in accordance with a constructivist perspective.

Constructivist learning environment researches have made an influence on curriculum development research. In some countries, curricula development research focused on constructivist approach and new curriculums emphasized the constructivism has been developed. So some researchers conducted study to examine the effect of curriculum which emphasizes constructivism. For example, Fisher and Kim (1999) investigated the constructivist learning environments in science classes in Korea. The main purpose of this research was to investigate whether the science curriculum reform efforts, reflecting a constructivist view, in Korea had positive effect on the classroom-learning environment in grade 10 science. The CLES and attitude scale was administrated to 1083 students and 24 science teachers in 12 different schools, four of which were located in the metropolitan area, four in a small sized city, and four in the rural area of Korea. One class of grade 10 students and one class of grade 11 students were sampled at each school. Grade 10 students did perceive a more constructivist-learning environment than grade 11 students who had not been exposed to the new curriculum. Students who were in 10 grade perceived more positively their learning environment of General Science, which is designed according to constructivist learning environment so that students would learn about and understand science basic concepts through involvement in an inquiry process and negotiation, than grade 11 students who studied an academic-centered science curriculum. This result suggested that efforts of curriculum reform produced some positive effect on improving the science learning environment. This study reported associations between the five actual CLES skills and student attitudes towards the science class. Multiple regression analysis involving the whole set of CLES skills was conducted, in addition to a simple correlation analysis, to provide a more conservative test of associations between each CLES scale and attitude when all other CLES scales were mutually controlled. An examination of the simple correlation coefficients indicated that there were statistically significant relationships ($p<0,05$) between students' perceptions of learning environment and their attitudes towards the science class for most scales of CLES. Students' perceptions showed a statistically significant correlation with their attitudes for the skills of personal relevance, shared control, and student negotiation for grade 10 and for the scales of personal relevance, uncertainty, and shared control for grade 11. Multiple correlations were also statistically significant ($p<0,01$) for both grade 10 and grade 11 students. Results revealed that personal relevance was the strongest independent predictor of students' attitude towards their science class. This study suggested that favorable student attitudes could be promoted in classes where students perceive more personal relevance, shared control with their teachers and negotiate their learning. In addition there were differences between student perceptions of actual and preferred environment in that student tended to prefer a more positive environment than what was perceived to be present.

A similar study conducted by Lee and Fraser (2001) to investigate Korean high school students' perceptions about their science classrooms, focusing especially on the notions of constructivism. Data were collected through the use of the CLES. The study involved 439 high school students from three different streams, 145 from the humanity stream, 195 from the science-oriented stream, and 99 from the science-independent stream. The validity and reliability of the CLES were confirmed when used with Korean students. Associations between classroom environment and student attitudes were found. When the perceptions of the students from the three streams were compared, it was found that students from the science-independent stream perceived their classroom environments more favorably than did students in the other two streams.

Peiro (2004) also conducted a study to provide validation data for modified English and Spanish versions of the Constructivist Learning Environment Survey (CLES) and the Test of Science-Related Attitudes (TOSRA) and to explore the influence of the science learning environment on student outcomes in the early childhood grades. Particularly, he investigated the relationship between Grade K-3 students' perceptions of the science classroom environment and their attitudes toward science. Additionally, the use of teacher action research, aimed at creating a more constructivist learning environment, was evaluated in terms of its association with pretest-posttest changes in Spanish-speaking kindergarten LEP (Limited English Proficient) students' classroom environment, scientific understanding of a specified topic, and attitudes toward science. The results of the combined analyses showed that the modified English and Spanish versions of the CLES and TOSRA were valid and reliable when used with early childhood students. The data were analyzed using simple correlation and multiple regression analyses calculated for two units of analysis (individual and class mean). The results of the combined analyses showed that positive and significant relationships exist between the learning environment created in an early childhood science class and students' attitudes toward science. The modified Spanish versions of the CLES and TOSRA and three teacher-made science topic tests were administered to 30 Spanish-speaking LEP (Limited English Proficient) students at the beginning and at the end of the teacher action research project. During the three-month period of the teacher action research project, interventions aimed at creating a more constructivist learning environment were implemented during science lessons. Results showed that pre-post tests differences were significantly different for the Personal Relevance and Student Negotiation scales of the CLES, both scales of the TOSRA, and the three teacher-made science topic tests. The effect sizes also indicated a large and educationally important difference between students' perceptions of the learning environment, scientific understanding of a specified topic and attitudes toward science at the beginning and at the end of the teacher action research project. Qualitative data in the form of student work samples were also collected during the three-month intervention period of the action research project. The student work samples consistently showed that students gained a deeper understanding of the science topics after the teacher action research interventions had been implemented. The most significant aspect of this study was that it is one of few learning environment studies to involve very young children.

Kim (2005) conducted a study to investigate the effects of a constructivist approach on academic achievement, self-concept and learning strategies, and student preference. The 76 six graders were divided into two groups. The experimental group was taught using the constructivist approach while the control group was taught using the traditional approach. A total of 40 hours over nine weeks was used to implement the experiment. The instruments used were as follows; mathematics tests administered by the teacher, self-concept inventory, learning strategies inventory, and a classroom environment survey. The results are 1) constructivist teaching is more effective than traditional teaching in terms of academic achievement; 2) constructivist teaching is not effective in relation to self-concept and learning strategy, but had some effect upon motivation, anxiety towards learning and self-monitoring; 3) a constructivist environment was preferred to a traditional classroom.

There has been limited number of studies about constructivist learning environment in Turkey. One of them is the study of Güzel and Alkan (2005). They examined the propriety of change and the problems confronted in the application of the new elementary science curriculum being piloted which was claimed to be prepared according to constructivist learning approach. For this purpose, the Constructivist Learning Environment Survey developed by Aldridge and Fraser (2000) was translated and adapted into Turkish and administered to 600 students (253 male and 347 female students), whose ages ranged between 10 and 12 and who attend the Pilot Elementary Schools in İzmir during 2004-2005 academic years. In addition 10 elementary teachers who were teaching in these schools were also involved in the study. Results showed that the teachers were faced some problems in choosing activity in the stage of classroom management and the construction of concept. Also the study indicated that the teachers could not require the sharing of responsibility. The students had positive opinions about the application of the constructivist learning approach as indicated by high subscale scores of CLES.

As a result constructivist learning environment studies takes an important part in educational research. Studies related with constructivist learning environment showed that there is a positive relationship between constructivist learning environment and attitude toward science.

2.3 Attitude

Attitude is defined an individual's viewpoint or disposition toward a person, thing or idea (Gall, Borg, & Gall, 2003). It contains three domains: affect, cognition and connation. Affect refers to the person's feelings about the object. Cognition is the person's beliefs and knowledge about the object and connation is the behavior which an individual shows towards the object (Gall, Borg, & Gall, 2003). These three components of attitude have been taken into consideration in instruments which evaluate attitude. Although there are wide ranges of definition of attitude, there is a consensus that attitude is a learned disposition to feel, think or behave favorably or unfavorably towards something, for example science (Ousbourne, Simon, & Collins, 2003; Gall et al., 2003). Science educators define attitude in science as the better understand and predict the science related behaviors of students and teachers. Attitude toward science is the feelings, beliefs and values held about the enterprise of school science, science and the impact of the science on society (Osbourne et al., 2003). Klopfer (1976) developed six categories of conceptually different attitudinal aims for the term of 'attitude toward science': manifestation of favorable attitudes to science and scientists; acceptance of scientific inquiry as a way of thought; adaptation of scientific attitudes; enjoyment of science learning experiences; development of interest in science and science related activities; and development of interest in pursuing a career in science. In the present study, it is focused on four categories of Klopfer's attitude toward science term: adaptation of science attitudes; enjoyment of science lesson; leisure interest in science; and career interest in science.

In thirty years the research related to attitude toward science has been increasing importance in literature. There are some reasons why students' attitude toward science is essential part in educational researches. Firstly, attitudes toward science are believed to influence behaviors, such as selecting courses, visiting museums, and supporting scientific inquiry (Koballa & Crowley, 1985). Secondly, in many research a relationship between attitudes and achievement has been shown to exist. Schibeci and Riley (1986) indicated that attitudes influence achievement, rather than achievement influencing attitudes. Students with positive attitudes toward science tend to have higher scores on achievement measures (Oliver & Simpson, 1988; Weinburgh, 1994). Thirdly, research related to attitude indicates that an important and increasing percent of students are not interested in science. Many students, especially females, associate science with negative feelings and attitudes which discourage them from continuing with scientific inquiry. Lastly, there is a decrease in positive attitude toward science with increasing grade level for both boys and girls. The declining in positive attitudes toward science was found in the findings of Hofstein, Maoz, & Rishpon (1990), Catsambis (1995), and Weinburgh (1994). Weinburgh (1994) reported that grade level was a significant predictor of student attitudes toward science. These four reasons show that attempts to discover which variables most influence attitudes toward science is necessary.

For a long time the development of positive attitude toward science has been the concern of science educators. Such attitudes have been recognized as important goals of science education. If science education aims to involvement, success and understanding of science for all students, the development of positive attitudes should not be less important than cognitive ones. Miller, Lietz, & Kotte (2002), for example, showed that attitudes to science have the strongest influence on students' desire for a job in science. Therefore science educators have agreed about the attitudes are as affective as cognitive variables in learning outcomes.

Some factors have effects on attitude toward science. Some of these factors can be the science achievement, gender difference, student-student and student-teacher interaction and classroom learning environment. Some research has indicated some relationship between attitude toward science and science achievement (Cannon & Simpson, 1985; Freedman 1997). Oliver and Simpson (1988) for example found that students' self concept of their ability in science was positively correlated with science achievement.

One of the most significant factors that influence attitude toward science is gender. There are some researches related with gender differences in attitude toward science (Catsambis, 1995, Greenfield, 1996; Jones, Howe, & Rua, 2000; Oakes, 1990; Simpson & Oliver, 1985, 1990). Many of the studies have focused on middle and high school students. Schibeci (1984) reported that of all the variables that may influence attitude toward science, gender has generally been shown to have a consistent influence. There are different results related with gender differences in literature. The results of the studies have developed data confirming gender differences in some cases and rejecting the idea of gender differences in other cases. For example, some literature on science education indicates that middle school male students hold more positive attitude toward science than females (Catsambis, 1995; Jones, Howe, & Rua 2000; Piburn & Baker, 1993; Greenfield, 1996). On the other hand, some studies reported that there is no difference between boys and girls with respect to attitude toward science (Catsambis, 1995; Dhindsa & Chung, 2003; Miller, Lietz & Kotte, 2002; Smist, Archambault, & Owen, 1994). For example, Catsambis (1995) in a study of gender differences in science achievements and attitudes among middle school students found that females tend to have less positive attitudes toward science, participate in fewer relevant extracurricular activities and tend to aspire less often to science careers than male students. This study got data from a large sample of about 24,500 eight grade students in 1052 schools. Although females tend to have less positive attitudes toward science, participate in fewer relevant extracurricular activities and tend to aspire less often to science careers than male students, it was surprising that they did not lag behind their male classmates in science achievement test, grades and course enrollments. This study indicated that the decline of gender differences in achievement might not be enough to ensure the increased participation of females in scientific and technical fields.

Some research indicate that males have a more positive attitude toward science, are more highly motivated to achieve in science, and more likely to select science courses as electives in high school (Hykle, 1993). Simpson and Oliver (1985), in an ongoing multidimensional study among 4,000 students in grades 6 through 10, found that males show significantly more positive attitudes towards science than females. Kahle and Lakes (1983) suggest that the lack of positive attitudes toward science by females begins in the elementary grades. However, in a study of 1,200 students enrolled in grades four through six, Pogge (1986) found that students have a positive attitude toward science. Sadker and Sadker (1986) report that gender differences are more pronounced in middle school.

Studies on gender showed that females avoid additional science courses and less confident about their academic skills (Archer & McDonald,1991). Kahle and Damnjanovich (1997) report that, while boys and girls interest in a science as a career are the same in the seventh grade, most girls lost interest with the transition of higher classes. One study involving fourth and fifth grade students' attitudes following a week long hands on electricity unit, showed that the girls displayed significantly improved attitudes towards doing electric activities. This finding suggested that some negative attitude might be based on lack of experience (Kahle & Damnjanovich 1997). Similarly Zimmerman and Bennett (1987) found that both eight grade males and females enjoyed doing science experiments but that males were more enthusiastic than females. This view is supported by Schibeci's (1984) extensive review of the literature. Interestingly, Weinburgh's work shows that this effect is highest for 'general science', and her finding raises the question of whether the introduction of 'balanced science' or integrated science courses during the past decade has had a similar effect in increasing the separation between boys' and girls' attitudes to science (Weinburgh, 1994).

On the other hand, some researchers found different results related with gender difference from studies discussed above. For example, Schibeci and Riley (1986) did a narrative review of literature that indicated females showed a more positive attitude toward Biology, whereas boys showed a more positive attitude toward Pysics and Chemistry. This research result showed that students' attitude toward science is dependent on whether the life science or physical science is interested. For example the findings of Jones, Howe and Ria (2000) supported this thought and showed that while boys wanted to learn about planes, cars, lights, electricity and new sources of energy, girls wanted to learn about rainbows, healthy eating and animal communication. These finding supports that boys show more positive attitude toward physical sciences, but girls have more positive attitude toward biological sciences. In addition Baker (1985) found that middle school females had a statistically significantly higher attitude than the males. Dihindsa and Chung (2003) also found a significant difference in attitudes toward science in favor of females in single sex schools compared to males and females in coeducational schools and males in single sex schools.

The nature and classroom instruction, the relationships among student-student and student teacher, and the classroom learning environment have also been shown to influence attitudes toward science (Myers & Fouts, 1992; Piburn & Baker, 1993). In addition, the literature suggests that students' perceptions of their classroom environment affect their attitude toward science (Talton & Simpson; 1987).

Several studies have pointed towards the influence of classroom environment as a significant determinant of attitude (Piburn & Baker, 1993; Talton and Simpson 1987). In a detailed study by Myers and Fouts (1992), using 699 students from 27 high schools in America, it was found that the most positive attitudes toward science were related with a high level of involvement, very high level of personal support, strong positive relationships with other students and teachers, and the use of a variety of teaching strategies and unusual learning activities with high teacher support and low levels of teacher control. In addition, Piburn and Baker (1993) conducted an exclusively qualitative study of 149 students (83 elementary school students, 35 junior high school students and 31 high school students). The results indicated that a major factor in declining attitudes toward science was the increasing isolation that students experience as they move through the grades. Also the decrease in student-student and student-teacher interactions with increasing grade level causes negative attitude toward science.

Simpson and Oliver (1990) found that schools, particularly classroom variables, are the strongest influence on attitude toward science from their extensive and major longitudinal study conducted in North Carolina. This study has showed that there is a relationship between the learning environment and students' attitude. According to result of the research, learning environment was positively and significantly related to student's attitudes. A significant determinant of attitude towards school science was also found by Woolnough (1991), whose research showed that it was a major factor in continuing with science education. Woolnough conducted a more extensive study of subject choice with 1180 students who had, and had not, chosen to study science using a mix of attitudes questionnaires and interviews. In addition, 132 Heads of science completed a separate questionnaire, and 108 sixth formers and 84 staff from 12 schools were interviewed. His study identified six factors that were responsible for student choice/non-choice of the sciences. Of these the two strongest factors were the influence of student's positive experience of extracurricular activities and the nature of in-class activities; that is, the quality of the science teaching. Taken together, this body of findings strongly suggests that the quality of teaching is an important determinant of attitude and subject choice.

Student attitudes toward science have been studied for decades, but little progress has been made in moving generations of students toward a more positive attitude. If the two attitudes are correlated then, possibly, the problem of students' attitudes toward science may be but a piece of a more global attitude problem. For example, Morrell (1998) conducted a study to examine 5th, 7th, and 10th graders' attitudes toward school and classroom science. This study was designed to determine what students' attitudes are, whether a relationship exists between these school and classroom science attitudes, and what relationships exist between attitudes toward school and science and students' grade level, gender, ethnicity, school/community type, expected grade point average (GPA) and science grade, and personally satisfying GPA and science grade. Approximately 1,000 students actually participated in the study. The initial sample for this study included all 5th-, 7th-, and lOth-grade students from districts representative of rural, urban, and small city Northwest communities. In general, students' attitudes toward school were positive at all levels. Students' attitudes toward science were rather neutral. The results indicated that, although a statistically significant relationship did exist between students ' attitudes toward school and toward classroom science, the relationship had no practical meaning. Females were slightly more positive about school than males. No gender differences were found with respect to classroom attitudes. Fifth graders held significantly more positive attitudes toward science than upper-grade students. None of the grade levels sampled had clearly positive attitudes toward classroom science. Similar results were found by different researchers about the students in upper grades have less positive attitudes toward school and science when compared with students in lower grades (Darom & Rich, 1988; Finson & Enochs, 1987; Levin & Fowler, 1984; Simpson & Oliver, 1985; Yager & Bonnstetter, 1984; Yager & Penick, 1986). Thus, attitude change efforts need to be implemented by all subject area teachers and not in isolation by science teachers. As more information about factors affecting students' attitudes toward science is obtained, curriculum and instruction can be better designed to affect those attitudes.

2.4 Motivation

Intelligence can not be thought only determinant of academic achievement. Student success is also dependent on high motivation and engagement in learning which have consistently been linked to reduced dropout rates and increased levels of success (Kushman, Sieber, & Harold, 2000 cited in Yumuşak, 2006). Motivation involves processes whereby goal-directed activity is instigated and sustained (Pintrich & Schunk, 2002). According to cognitive perspective, motivation can be characterized as a product or as a process (Winne & Marx, 1989). The product refers to learner's willingness to engage in a task. The process refers to goal directed behavior (Pintrich & Schunk, 2002). From this aspect, motivation refers not just to an end state but also to the means through which that state is determined, and more generally to the cognitive process that govern learners' choice, effort, and persistence (Winne & Marx, 1989). There are different motivational variables in literature for instance, goal orientations, expectancy value theory, self efficacy and task value, and control beliefs.

In the last 20 years, achievement goal theory has emerged as an important framework in motivation research (Ames, 1992). Achievement goal theory emphasizes students' reasons for choosing, performing, and persisting at various learning activities and also focuses on the quality of students' effort, engagement, and learning. There are two types of goal orientations, mastery goal orientation and performance goal orientation which are used to understand students' academic behavior in classrooms. Some researchers used intrinsic goal orientation instead of mastery goal orientation and extrinsic goal orientation instead of performance goal orientation. Mastery or intrinsic goal orientation is defined as a desire to improve one's ability, master a skill, and understand learning material. Self-improvement or skill development is the goal, and students derive satisfaction from the qualities of the task, such as its challenge, interest, or enjoyment. In contrast, performance goals which students are focused on are concerned with demonstrating high ability relative to others, competing for grades, or gaining recognition for their abilities. For these students, a sense of accomplishment is derived from demonstrating high ability and avoiding negative judgments of ability, regardless of the learning involved. However, in general, evidence suggests that students demonstrate the most positive pattern of learning when they are focused on mastery goals (Ames & Archer, 1988; Meece, Blumenfeld, & Hoyle, 1988; Meece & Miller, 2001; Stipek & Gralinski, 1996).

Individuals are concerned with increasing their competence, prefer moderately challenging tasks, persist in the face of difficulties, have positive affect toward learning, value ability and normatively high outcomes, attach importance to developing new skills and see outcomes as dependent on effort invested, when they are focused mastery goal oriented activities (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Garner, 1990). On the other hand, the adoption of performance goals results in a maladaptive motivational and response pattern, whereby individuals are concerned with gaining favorable judgments of their competence, prefer easy tasks, try to outperform others and to achieve success with little effort, withdraw in the face of difficulties, have negative affect toward learning, and need public recognition for their achievements (Dweck, 1986; Dweck & Leggett, 1988; Jagacinski & Nicholls, 1987). Of importance for instructors interested in facilitating student goal setting is that mastery-oriented goals were positively related to persistence (Ames, 1992; Dweck, 1989; Meece & Holt, 1993) and achievement outcomes (McNeil & Alibali, 2000; Morgan, 1987; Schunk, 1996).

Some theorists try to explain students' choice of achievement tasks, persistence on those tasks, power in carrying them out, and performance on those tasks (Eccles, Wigfield, & Schiefele, 1998). In literature there are many theories which focuses on individuals belief about their competence and efficacy, expectancies for success and failure, and sense of control over outcomes (Yumuşak, 2006). These beliefs all are directly related with this question, 'Can I success this task?' If students give positive answer to this question, than they easily perform better and be motivated to select challenging tasks. Expectancy value theory suggests that people orient themselves to the word according to their expectations (beliefs) and evaluations. Utilizing this approach, behavior, behavior intentions, or attitudes are seen as a function of expectancy – the perceived probability that an object possesses a particular attribute or that a behavior will have a particular consequence-;and evaluation – the degree of effect, positive or negative, toward an attribute or behavioral outcome- (Palmgreen, 1984). Expectancy beliefs can be measured in a way analogous to measures of Bandura’s (1997) personal efficacy expectations. Self-efficacy refers to one's beliefs about his or her ability to perform a specific behavior (Bandura, 1986, 1998). Bandura (1986) believed that self-efficacy was not a theory itself, but a portion of social cognitive theory. It is a construct based on cognitive and behavioral concepts that Bandura (1977a) describes as an individual's perception of his or her skills and abilities and whether the skills/abilities produce effective and competent actions. Self-efficacy influences perceptions of actions and coping behaviors and the choice of environments and situations in which the individual will attempt to access. Schunk and Hadson (1985) found that students who expected that they would have less difficulty in learning to solve the problems tended to learn more than students who anticipated having difficulty. In addition many studies have reported that students’ self efficacy beliefs influence their motivation and learning (Bandura, 1986; Brophy, 1983; Pintrich & De Groot, 1990).

Bandura (1998) states that there is a reciprocal relationship between cognitive process and behavior change in self-efficacy theory. Bandura's conceptualization of self-efficacy encompasses two components, efficacy expectations and outcome expectations. Efficacy expectations refer to one's belief that he or she can successfully produce the behaviors that will lead to a desired outcome, while outcome expectations refer to one's belief that a particular course of action will produce a certain outcome (Bandura, 1977a). Efficacy expectations have an effect on one's choice of settings, behaviors, and persistence. People with low efficacy expectations will likely avoid situations in which they feel unable to cope. Instead, they will seek out situations in which they feel that they will be able to handle. Persistence in producing behaviors is also affected by efficacy expectations. Individuals who have high levels of efficacy expectations will be more likely to persist with behaviors when they become difficult and will therefore be more likely to execute the behavior successfully which in turn increases their efficacy expectations even more (Bandura, 1998). For example students with high self-efficacy engage in more effective self-regulatory strategies. Confident students monitor their academic work time effectively, persist when confronted with academic challenges, incorrectly reject correct hypotheses, and solve conceptual problems. And as students' self-efficacy increases, so does the accuracy of the self-evaluations they make about the outcomes of their self-monitoring (Bouffard-Bouchard, Parent, & Larivee, 1991). On the other hand, individuals with low levels of efficacy expectations will be more likely to stop production of behaviors once the behaviors become difficult and they will in turn reinforce their already low efficacy expectations (Strauser, Waldrop, Hamsley & Jenkins, 1998; Strauser, Waldrop & Jenkins, 1998). The concept of self-efficacy is situation-specific meaning that one will have a range of both high and low self-efficacy expectations at one time depending on specific situation, task, or behavior (Sadri & Robertson, 1993).

Pintrich and De Groot (1990) found that academic self-efficacy was related both to cognitive strategy use and to self-regulation through the use of metacognitive strategies. Academic self-efficacy also correlated with semester and final year grades, in-class seatwork and homework, exams and quizzes, and essays and reports. The researchers concluded that self-efficacy played a "facilitative" role in the process of cognitive engagement, that raising self-efficacy might lead to increased use of cognitive strategies and, thereby, higher performance, and that "students need to have both the `will' and the `skill' to be successful in classrooms" (p. 38). Students who believe they are capable of performing academic tasks use more cognitive and metacognitive strategies, and, regardless of previous achievement or ability, work harder, persist longer, and persevere in the face of adversity. In one study, children of low, middle, and high mathematics ability but who had, within each ability level, either high or low mathematics self-efficacy were tested on a set of mathematics problems. After receiving the same mathematics instruction, the students were given new problems to solve and an opportunity to rework those they had missed. Level of mathematics ability was related to performance but, regardless of ability level, children with high self-efficacy completed more problems correctly and reworked more of the ones they missed (Collins, 1982).

Value of the material to be learned is other important factor that is thought to relate to motivation in learning situations (Eccles, 1983; Pintrich, 1989). Brophy (1999) has suggested that a great deal is known about expectancy aspects of motivation, whereas very little is known about the role of task value. He has asserted that expectancy of success may be very important for sustaining motivation in situations where goals and standards for performance are clear. However, when the goals and standards are not enough clear, the factors that empower motivation are also unclear. Task value may be more important in these situations because personal beliefs of relevance and interest may strengthen engagement rather than periodic success feedback. Pintrich, Marx, and Boyle (1993) described one major factor affecting students' motivational beliefs in learning, which could influence their cognitive processes. It is students' beliefs about the reasons for choosing to do a task, including their goal orientation, and their value and interest in the task. Eccles (1983) and Pintrich (1989) have emphasized that task value is what draws an individual to a learning situation in the first place, and Brophy (1999) has suggested that value may be the only factor to sustain motivation when goals and standards for performance are unclear.

Another important factor that is related to motivation in learning situation is control of learning beliefs. Weiner (1986) explains control beliefs of learning as beliefs about the causes of success and failure and how much perceived control one has to bring about outcomes or to control one's behavior. Rotter's (1966) locus of control theory is fundamental of control belief theory and its roots are in social learning theory. Expectancies are generalized from specific situations to situations that are perceived as similar or related. Generalized attitudes, beliefs, and expectancies can affect a variety of behavioral choices in many different life situations (Rotter, 1966). Locus of control (Rotter, 1966) refers to one's belief in his or her abilities to control life events. The term locus of control is often used interchangeably with self-efficacy. However, the terms are not equivalent. While self-efficacy focuses on the perception of ability to act competently and effectively, locus of control focuses on the perception of control (Bandura, 1977a). An individual with an internal locus of control believes that outcomes are related to his or her behavior or personal investment, but an individual with an external locus of control believes that outcomes are not related to his or her behavior and thinks that external forces beyond his or her control. Individuals with an external locus of control may perceive life events to be controlled by luck, chance, fate, or powerful others. Stated in different way, individuals with an internal locus of control are more likely to change their behavior following reinforcement than are individuals with an external locus of control (Marks, 1998).

As it is indicated until now, students who set effective goals, utilize appropriate learning strategies, and evaluate the requirements of learning tasks adequately tend to achieve at higher levels than other students (Locke & Latham, 1990; Zimmerman, 1989; Zimmerman & Schunk, 1989). Research into the variables that facilitate achievement has increasingly focused on students' regulation of their learning activities. Much of this research has addressed self-regulated learning from a social-cognitive perspective (Bandura, 1986). The basic assumption of this focus is that students can activate and sustain the cognitions, behaviors, and affects oriented toward learning and thereby attain their goals (Hofer, Yu, Pintrich, 1998; Zimmerman, 1989). Stated another way, self-regulated learners "seek to accomplish academic goals strategically and manage to overcome obstacles using a battery of resources" (Randi & Corno, 2000, p. 651).

Student's motivation for learning is generally regarded as one of the most critical and important determinants of the success and quality of any learning outcome (Mitchell, 1992). Examining the construct of intrinsic motivation in elementary school students is significant and important, because academic intrinsic motivation in the elementary years may have profound implications for initial and future school success. Students who are more intrinsically than extrinsically motivated fare better and students who are not motivated to engage in learning are unlikely to succeed (Gottfried, 1990). Conti (2001) found that intrinsically motivated people are less concerned with the difficulties of a certain task and how long it takes, than someone who is more extrinsically motivated. Similarly, when people are intrinsically motivated for partaking in certain tasks, they experience many positive traits such as, a rise in creativity levels, the ability to perform better, the preference of a challenging task and remaining interested for a longer period of time (Conti, 2001). McCombs (1995) emphasize that knowing how to meet individual learner needs for control, competence, and belonging in the classroom is one key to student motivation. Another key to motivation, then, is being aware of the degree to which learning tasks stimulate are related to student interests, the level of student control and choice that is encouraged, the necessary skill development that is fostered, and the resource and social support that is provided.

Development of academic intrinsic motivation in students is an important goal for educators because of its importance for future motivation as well as for student's effective school functioning (Gottfried, 1990). The few studies that have examined motivation in young children have found that it is a weak predictor of achievement (Stipek & Ryan, 1997). While the particular goal a student adopts may be influenced by individual factors such as prior experience, or the influence of his/her family, several investigators have argued that the classroom environment can exert a major influence on the salience of a particular goal and hence on its adoption (Blumenfeld, 1992; Ryan & Grolnick, 1986; Urdan, 1997). Several middle school documents (Carnegie Council on Adolescent Development, 1989; Jackson & Davis, 2000; Manning, 2000; National Middle School Association, 1995; Payne, Conroy, & Racine, 1998) emphasize the benefits of a positive classroom environment on students' academic achievement and positive socialization. In other words, positive classroom environment motivate students to achieve and have positive social environment.

However, there has been little systematic analysis of the influence of classroom structure on students' motivational structure. Based on a survey of the relevant research literature, Ames (1992) derived three classroom structures which were found to affect a range of motivational variables and in particular the adoption of mastery versus performance achievement goal orientation, namely, the design of the learning tasks, evaluation practices, and distribution of authority. According to Ames' analysis, a mastery goal will be salient when: (1) the task is characterized by a focus on the meaningful aspects of the learning activities, novelty, variety and diversity, is challenging, helps students to establish short-term self-referenced goals, and promotes the development and employment of effective learning strategies; (2)

evaluation is characterized by focusing on individual improvement, progress and mastery, recognition of effort, providing opportunity for improvement, and viewing mistakes as a legitimate part of the learning process; (3) authority implementation is characterized by allowing students' participation in decision making, providing opportunities to develop responsibility and independence, and supporting the development of self-management and monitoring skills. Ames (1992) emphasizes that the three classroom structures should not be viewed as autonomous or contributing independently to student motivation but rather as working in concert; consequently, in order to modify the classroom learning environment in a manner which would promote the adoption of a mastery goal, there is a need for a comprehensive approach whereby the three structures are coordinated and directed toward the same goal.

A study conducted by Ben-Ari (2003) examined differential effects of the learning environment on student achievement motivation. According to this study there was a significant correlations between the students' perceived classroom goal structures and their personal goal orientations and motivational patterns, indicating that the more the student perceived his/her classroom as having a mastery goal structure, the higher was his/her personal mastery goal orientation, the lower was his/her performance-avoid goal orientation, and the higher were his/her adaptive motivational patterns. In comparison, the more the student perceived his/her classroom as having a performance goal structure, the higher was his/her personal performance-approach and performance-avoid goal orientations. Thus, the more the students adopted a personal mastery goal orientation, the more willing they were to exhibit adaptive motivational patterns, whereas the more the students adopted performance-avoid goal orientation, the less they were willing to exhibit adaptive motivational patterns. It appears from the above that mastery orientation, whether at the classroom or at the personal level, might be a better predictor of adaptive motivational patterns compared to performance orientations. Indeed, the hierarchical regressions conducted for the motivational patterns revealed a higher unique contribution for the classroom mastery goal structure compared with classroom performance goal structure, and for the students' mastery goal orientation compared with the students' performance goal orientations. The regressions also raised the possibility of mediation effects of the students' personal goal orientations on their motivational patterns.

Considerable evidence indicates a shift in the motivational orientation and climate of classrooms from mastery to performance goal orientation during the middle school transition. For example, Midgley, Anderman, and Hicks (1995) compared elementary and middle school teachers' use of teaching practices emphasizing mastery goals (e.g., emphasizing understanding rather than memorization, recognizing students for trying hard, accepting mistakes as part of the learning process). When compared with elementary teachers, middle school teachers reported using fewer of these teaching strategies. Similarly, longitudinal studies have shown that students perceive their classroom environments as less focused on mastery goals and more focused on performance goals, as they make the transition into middle school (Anderman & Midgley, 1997). As school or classroom goals change, students also adopt performance goals for their own academic work (Anderman & Anderman, 1999; Roeser, Midgley, & Urdan, 1996).

The goal structures of classrooms also have important implications for students' self-concepts of ability and educational values during the transition from seventh to eighth grade. Increases in the perceived emphasis placed on performance goals (competition and ability comparisons) had a negative effect on ability and value beliefs over time (Roeser, Eccles, & Strobel, 1998). Thus, declines in mastery goals that emerge at the transition into middle school may continue to the next grade levels. As just described, declines in students' orientation toward mastery have important implications for the quality of their academic engagement and learning.

Thus, goal theories of motivation provide a useful framework for describing the learning environment of middle school classrooms. This framework assumes that children are motivated to engage in school activities for multiple reasons, and the goals students adopt have important implications for how they approach and engage in learning. Significant changes occur in students' goal orientations during the late elementary and early adolescent years, with a shift toward greater concern with competition and outperforming others. While the long-term impact of performance goals is not yet clear (Kaplan & Middleton, 2002), considerable evidence suggests that children and young adolescents benefit the most from classroom environments with a mastery focus (Ames, 1992; Stipek, 2002).

As discussed previously, young adolescents need classroom environments that afford opportunities to develop their cognitive abilities and self efficacy, to gain independence and autonomy, and to connect positively with adults and peers (McCombs & Whisler, 1997). It includes strategies for promoting high academic achievement as well as without problems not related with their life, disengagement, and emotional distress. Students in these classrooms are less focused on ability concerns and avoiding work. Additionally, students who were more focused on mastery goals reported higher levels of academic efficacy and greater use of active learning strategies, such as checking answers and relating information to their earlier learning. Students' perceptions of learner-centered practices were also positively related to teachers' ratings of their classroom performance. Taken together, these results identified many important benefits of learner-centered practices for young adolescents (Meece, 2003).

Gender has also an important affect on the motivation of students. While some researches indicate no gender difference on motivation (e.g Meece & Jones, 1996), others emphasize the importance of gender difference on motivation (Mori & Gobel, 2006; Wigfield, Eccles, & Pintrich, 1996; Simpson & Oliver, 1985, 1990; Dai, 2001; Yavuz, 2006). Gender differences in students' academic self-efficacy and in their self-efficacy to employ self-regulatory strategies are often reported. For example, boys and girls report equal confidence in their mathematics ability during the elementary years, but, by middle school, boys begin to rate themselves more efficacious than do girls (Wigfield, Eccles, & Pintrich, 1996). Conversely, in areas related to language arts, male and female students exhibit similar confidence despite the fact that the achievement of female students is typically greater. On the other hand, a study conducted by Simpson and Oliver (1985, 1990) have shown females to be significantly more motivated to achieve in science than males. This was found to be true at each grade level studied from sixth through tenth grade.

Similar study conducted by Yavuz (2006). The aim of her study was to investigate the motivational traits (achiever, curious, conscientious and social) in science. A total number of 3685 students (1927 females and 1748 males) who were in 6th, 7th and 8th science classes included in this study. According to result of her study there was a significant effect of gender on motivational traits and girls are more achiever, curious, conscientious and sociable than boys. In this study also it is found that motivational trait scores decreases as the grade level increases.

A recent study which was again conducted in Turkey by Özkan (2003) examined the gender difference on motivation. Özkan used Motivational Strategies for Learning Questionnaire (MSLQ) and biology achievement test in the study and administered them to 980 10th grade biology students. The results showed that while self efficacy mean scores of male students were higher than girl students, however, scores related to intrinsic goal orientation and test anxiety were higher for female students than male students.

Conversely to the result of Özkan (2003), some studies have reported that girls express greater self-efficacy for self-regulation during elementary school (Pajares, Miller & Johnson 1999) and middle school (Pajares, Britner & Valiante, 2000; Pajares & Valiante, 2001). Girls express greater confidence in their capability to use strategies such as finishing homework assignments on time, studying when there are other things to do, remembering information presented in class and textbooks, and participating in class discussions.

In summary, these results provide further evidence for contextual effects on achievement motivation (e.g., Ames & Archer, 1988; Solmon, 1996) by showing that classrooms are settings with qualities that can transcend the personal qualities of the students, and that the teaching strategy implemented in the classroom - and to which the students are exposed - defines the characteristics of the classroom setting. The results also support that in classroom setting gender difference is an important factor that influence learning environment and motivation of students.

To create good educational interventions and assess their effectiveness, it is important for developmental educators to understand the complex nature of students' motivation. For this reason Pintrich, Smith, Garcia and McKeachie developed a version of Motivated Strategies for Learning Questionnaire" (MSLQ) for assessing students' motivational orientations and their use of different learning strategies in the early 1990’s. In the present research Motivated Strategies for Learning Questionnaire" (MSLQ) was used to assess the students’ motivation. The MSLQ was used by many researchers to measure components of self regulation and to determine its relation to students’ academic achievement (Pintrich & DeGroot, 1990, Neber & Schommer-Aikins, 2002).

2.5 Summary of the Chapter

This literature review chapter provided a definition of ‘learning environment’, a historical development of the theoretical perspectives that have underpinned classroom environment researchers, detailed information about constructivism and constructivist learning environment. In addition two important variables, attitude and motivation, which have important effects on learning environment of students, were detailed in this part. According to literature some items can be summarized like:

1. Classroom learning environment is a place where learners and teachers interact each other and use variety of tools and information resources in this pyshico-social environment.
2. Researches showed that there is a significant relationship between students’ learning environment and their affective and cognitive outcomes.
3. Researches also indicate that there are some differences about student perceptions of their learning environment with respect to their gender, teacher gender, age, grade level, etc. For example, Huang (2003) found that females rated their learning environment more positive than boys.
4. Attitude is to feel, think or behave favorably or unfavorably toward something. In science education students’ attitude toward science effects students’ perceptions about classroom learning environment. If students’ attitude toward science is positive, it means that students’ perceptions about their learning environment are positive.
5. Motivation is the learners’ willingness to engage in and persist at a task. Motivation of students also is an important factor that affect learning environment. Gender difference and learning environment are factors that have affect on motivation.

CHAPTER 3

PROBLEMS AND HYPOTHESES

This chapter includes main problem, related sub-problems, and the null hypotheses of the study.

3.1 The Main Problem

1. What is the relationship between elementary school students' perception of science classroom environment from constructivist perspective (personal relevance, student negotiation, shared control, critical voice, uncertainty) and their adaptive motivational beliefs (intrinsic goal orientation, task value, control of learning beliefs and self efficacy for learning and performance)?

2. What is the relationship between elementary school students' perception of science classroom environment from constructivist perspective and their attitude toward science?

3. Are there any significant difference between the 8^{th} grade boys and girls with respect to their perceptions of science learning environment from constructivist perspective, adaptive motivational beliefs and attitude toward science?

3.2 Sub-Problems

The following sub-problems were investigated based on the main problem;

Based on the third research question, the following sub-problems to be addressed in this study are as:

3.2.1 Is there a significant difference between the 8^{th} grade boys and girls with respect to their perceptions of constructivist science learning environment?

3.2.2 Is there a significant difference between the 8^{th} grade boys and girls with respect to their perceptions of adaptive motivational beliefs?

3.2.3 Is there a significant difference between the 8^{th} grade boys and girls with respect to their perceptions of attitude toward science?

3.3 Hypotheses

The problems stated above are tested with the following hypotheses that are written in null form.

The null hypothesis of the main problem 1:

Ho 1: There is no significant relationship between elementary school students' perception of science classroom environment from constructivist perspective and their adaptive motivational beliefs.

The null hypothesis of the main problem 2:

Ho 2: There is no significant relationship between elementary school students' perception of science classroom environment from constructivist perspective and their attitude toward science.

Ho 3: There is no significant difference between the 8^{th} grade boys and girls with respect to their perceptions of constructivist science learning environment, motivational beliefs and attitude toward science.

The null hypothesis of the main problem 3:

Ho 3.1: There is no significant difference between the 8^{th} grade boys and girls with respect to their perceptions of constructivist science learning environment.

Ho 3.2: There is no significant difference between the 8th grade boys and girls with respect to their perceptions of adaptive motivational beliefs.

Ho 3.3: There is no significant difference between the 8th grade boys and girls with respect to their perceptions of attitude toward science.

CHAPTER IV

METHOD

In the following chapter, population and sampling, description of the variables, instruments of the study, procedure and methods used to analyze data and assumptions and limitations will be explained briefly.

4.1 Population and Sample:

All eighth grade state schools' students in Turkey were identified as the target population of this study. However, it is appropriate to define an accessible population since it is not easy to come into contact with this target population. The accessible population was determined as eighth grade students in Çankaya districts of Ankara. This is the population which the results of the study will be generalized.

The population being sampled in this study was 12890 eighth grade students according to the Provincial Directorate of National Education in Ankara. Accordingly the desired sample size was determined as 1289 students, which is 10% of the whole population. But the study was able to be applied to only 956 students from 36 elementary 8^{th} grade science classes in 15 schools, which is 7.4 % of the whole population. Schools were selected randomly. Class size in these schools varied from 20 to 40 students. Of the students, 462 were girls and 493 were boys (1 student made no indication of gender).

4.2 Variables:

In this study there were four variables. The three variables were elementary school students' perception of science classroom environment from constructivist learning environment perspective (personal relevance, uncertainty, critical voice, shared control, and social negotiation), students' attitude towards science (adaptation of science attitudes, enjoyment of science lesson, leisure interest in science and career interest in science), and their adaptive motivational beliefs (intrinsic goal orientation, task value, control of learning beliefs and self-efficacy). These variables were continuous. Last variable was students' gender and it was discrete and nominal scale of measurement.

4.3 Data Collection Instruments:

In this study, three instruments were used in order to obtain data from students. These are the Turkish versions of the Constructivist Learning Environment Survey (CLES; Johnson and McClure, 2003), Test of Science Related Attitudes Scale (TOSRA; Fraser, 1981) and Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991).

4.3.1 Constructivist Learning Environment Survey (CLES)

The CLES was used to obtain measures of students' perceptions of the frequency of occurrence of five key dimensions of a critical constructivist learning environment. CLES was originally developed by Taylor and Fraser (1991). The version used in this study has five scales; personal relevance (PR), uncertainty (U), shared control (SC), critical voice (CV), and student negotiation (SN). Table 4.1 gives information about the subdimentions of CLES. In the present study CLES consists of 20 items with a five-point Likert-type response scale with the following alternatives: (1) Almost Always, (2) Often, (3) Sometimes, (4) Seldom, (5) Almost Never. Originally developed CLES contains 30 items. Johnson and McClure (2003) developed shortened and revised version of CLES which includes 20 items, each dimension has four items. This shortened and revised version of CLES was translated and adapted into Turkish by Yılmaz, Çakıroğlu and Boone (2006). Analysis of individual and class alpha coefficients of the five dimensions of the scale revealed that all the coefficients were accepted as high enough for the reliability of the items for the study. The individual reliabilities for personal relevance, uncertainty, shared control, critical voice, and student negotiation were .72, .73, .83, .73, and .77 respectively. The class reliabilities for personal relevance, uncertainty, shared control, critical voice, and student negotiation were .83, .85, .89, .85, and .88 respectively. Overall scale reliability was found as .88. In the present study reliability for personal relevance, uncertainty, shared control, critical voice, and student negotiation were respectively .75, .58, .72, .69 and .68.

Table 4.1 Scales, scale descriptions and sample items for the CLES

Scales	Scale description	Item Sample
Personal Relevance	Extent to which teachers relate science to students out of school experiences	In this science class, I learn about the world outside the school.
Student Negotiation	Extent to which opportunities exist for students to explain and justify to other students their newly developing ideas and to listen and reflect on the viability of other students' ideas.	In this science class, I ask other students to explain their ideas.
Shared Control	Extent to which students are invited to share with the teacher control of the learning environment, including the articulation of their own learning goals, design and management of their learning activities and determining and applying assessment criteria	In this science class, I help the teacher to plan what I'm going to learn.
Critical Voice	Extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher's pedagogical plans and methods to express concerns about any impediments to their learning.	In this science class, it's OK to ask the teacher, 'Why do we have to do this?'
Uncertainty	Extent to which opportunities are provided for students to experience scientific knowledge as arising from theory dependent inquiry, involving human experience and values, evolving and non-foundational, and culturally and socially determined.	In this science class I learn the views of science have changed over time.

Source: Taylor and Fraser (1991)

4.3.2 Motivated Strategies for Learning Questionnaire (MSLQ)

The Motivation Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia, and McKeachie (1991) was used to measure students' motivational beliefs. The MSLQ is a self-report instrument with two main sections: a motivation section and a learning strategies section. Motivation section consists of 31 items in six subscales while learning strategies section consists of 50 items in nine subscales. In this study, four subscales in the motivation section (intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance) were used to measure students' adaptive motivational beliefs. Intrinsic goal orientation focuses on learning and mastery; task value focuses on judgments of how interesting, useful, and important the course content is to the student; control of learning beliefs focuses on students' beliefs that outcomes are contingent on one's own effort; and self-efficacy for learning and performance focuses on judgments of one's ability to accomplish a task and confidence in one's skills to perform a task. Table 4.2 gives information about MSLQ.

The Turkish version of the MSLQ translated and adapted into Turkish by Sungur (2004). During validation of the instrument, two confirmatory factor analysis were conducted, one for the set of motivation items and the other for the set of learning strategies items. The reliability coefficients for intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance were .74, .90, .68 and .93 respectively. For the present study the reliability coefficients for intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance were .71, .80, .65 and .83 respectively.

Table 4.2 Scales, scale descriptions and sample items for the MSLQ

Scales	Scale description	Item Sample
Intrinsic Goal Orientation	A desire to improve one's ability, master a skill, and understand learning material	The most satisfying thing for me in the science lesson is trying to understand the contents as thoroughly as possible
Task Value	Judgments of how interesting, useful, and important the course content is to the student	It is important for me to understand subjects in science lesson
Control of Learning Beliefs	Beliefs about the causes of success and failure and how much perceived control one has to bring about outcomes or to control one's behavior	If I can not learn subjects in science lesson, this is my fault
Self-Efficacy for Learning and Performance	One's beliefs about his or her ability to perform a specific behavior	I expect that I will be very successful in science lesson

Source: Pintrich, Smith, Garcia, and McKeachie (1991)

4.3.3 Test of Science Related Attitude (TOSRA)

TOSRA was used to measure student's attitudes toward science as a school subject. TOSRA developed by Fraser (1981). TOSRA makes use of Klopher's (1971) classification of students' attitudinal aims. The six categories in Klopfer's classification are; attitude to science and scientists; attitude the inquiry; adaptation of scientific attitudes; enjoyment of science learning experiences; interest in science; and interest in a career in science. This instrument has been widely used to measure attitudes related to the study of science (McRobbie & Fraser, 1993). TOSRA developed by Fraser (1981) originally consisted of 7 scales and 70 items. The seven original scales were: social implications of science, normality of scientists, attitude to scientific inquiry, adaptation of scientific attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science. Each of the seven scales included 10 items. The TOSRA items are scored on a 5-point scale, ranging from strongly agree (5) to strongly disagree (1). In the present study only four scales from the original form of TOSRA were selected. They are adaptation to science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science (see Table 4.2). As a result in this study, TOSRA scale consists of 40 items in 5-point Likert scale (Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree).

The questionnaire was first translated into Turkish and a pilot study was conducted with 399 eleventh grade high school students in the first term of 2003 academic year (Telli, Çakıroğlu, & Rakıcı, 2003). After the pilot study, a factor analysis was conducted and necessary modifications were made. After this first pilot, within the same academic year the instrument was distributed among classes and students in a study conducted with 1983 ninth and tenth grade students from nine high schools. Reliability of scales ranged from .62 to .85 in that study (Telli, 2006, p.112). Table 4.3 gives information about scales, scale descriptions and sample items about TOSRA. In the present study reliability for adaptation of scientific attitudes, enjoyment of science lessons, leisure interest in science and career interest in science were .64, .85, .82, and .78 respectively.

Table 4.3 Scales, scale descriptions and sample items for the TOSRA

Scales	Scale description	Item Sample
Adaptation to science attitude	Adoption of 'scientific attitudes'	I am curious about the world in which we live. (+)
Enjoyment of science lessons	Enjoyment of science learning experiences	I dislike science lessons. (-)
Leisure interest in science	Development of interest in science and science related activities	I would like to belong to a science club. (+)
Career interest in science	Development of interest in pursing a career in science	I would dislike being a scientist after I leave school. (-)

*Source: Fraser (1981)

4.4 Procedure

This study started with defining the research problem. Next, the related literature was reviewed in detail. Educational Resources Information Center (ERIC), International Dissertation Abstracts, Social Science Citation Index (SSCI), Ebscohost, Science Direct, and Internet were searched systematically. In addition MS and PhD theses made in Turkey and other countries were also searched. All of the relevant documents were carefully organized and read.

After completing the literature review, the participant schools and subjects of the study were determined and permission was granted for the study from the Ministry of Education. The measuring instruments (CLES, TOSRA and MSLQ) were administered to the 956 eight grade students from 36 elementary schools durring the last eight weeks of the spring semester of 2005-2006. One class hour was given to the participants to complete all instruments. Directions were made clear and questions of students answered clearly by the researcher. Students were also informed about that the results of questionnaires were not effect their science grades and any information related with their thoughts about their science class would not be given to their science teachers. Due to the time restriction and impossibility of being present in each class during administration, the researcher occasionally requested teacher support. The teachers were informed about the study and about the directions that should be done during the administration. No specific problems were encountered during the administration of the measuring instruments.

4.5 Analysis of Data

The statistical analyses were done by using statistical package for the social science programs (SPSS). The data obtained in the study were analyzed by using descriptive statistics and inferential statistics.

4.5.1 Descriptive Statistics

Descriptive statistics such as mean, standard deviation, range, minimum and maximum of the variables were presented.

4.5.2 Inferential Statistics

In order to test the null hypotheses, statistical technique named Canonical Correlation Analysis and MANOVA were used.

4.6 Assumptions and Limitations of the Study

In any research study there can be several considerations that affect the overall findings, or effective usefulness of the results. The assumptions and limitations of this study considered by the researcher are given below.

4.6.1 Assumptions of the Study

1. The administration of the instruments was under standard conditions.

2. All the students in the study responded the items of the CLES, TOSRA and MSLQ sincerely and correctly.

4.6.2 Limitations of the Study

1. The items of instruments are so many, so they might to be too long for 8^{th} grade students.

2. This study consists of only the Çankaya District to investigate.

3. This study was limited to 8th grade students.

CHAPTER 5

RESULTS

This chapter is divided into three sections. In the first section descriptive statistics are presented. Inferential statistics by which main problems and the null hypothesis were tested are presented in second section. Finally, in the last section there are summaries of findings of the study.

5.1 Descriptive Statistics

In descriptive statistics parts, mean, standard deviation, range, minimum and maximum values for constructivist learning environment variables, motivational beliefs variables and attitude variables were presented.

Descriptive statistics related to adaptive motivational beliefs variables (intrinsic goal orientation, control of learning beliefs, task value, and self efficacy for learning and performance) showed that the related scores ranged from '4' to '28' for intrinsic goal orientation and control of learning beliefs and means were '19.43' and '20.33' respectively. For task value and self efficacy variables the scores ranged from '6' to '42' and '8' to '56' and means were '29.66' and '38.45' respectively. In general means ranged from 19.43 and '38.45' (see Table 5.1).

Table 5.1 Descriptive statistics related to motivational beliefs variables

Variable	Mean	Std. Deviation	Range	Minimum	Maximum
IGO	19.43	5.62	24.00	4.00	28.00
CB	20.33	5.34	24.00	4.00	28.00
TV	29.66	8.31	36.00	6.00	42.00
SE	38.45	9.91	48.00	8.00	56.00

Descriptive statistics related to attitude variables (adaptation to science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science) showed that scores ranged from ‘10’ to ‘50’ except for adaptation to science attitude variable which ranges from ‘15’ to ‘50’. Means ranged from ‘31.85’ and ’35.56’ (see Table 5.2).

Table 5.2 Descriptive statistics related to attitude variables

Variable	Mean	Std. Deviation	Range	Minimum	Maximum
A	35.56	6.04	35.00	15.00	50.00
E	33.91	8.86	40.00	10.00	50.00
L	31.85	8.23	40.00	10.00	50.00
C	32.23	7.57	40.00	10.00	50.00

Descriptive statistics concerning the constructivist learning environment variables (personal relevance, uncertainty, critical voice, social control and social negotiation) showed that all related scores ranged from ‘4’ to ‘20’ with means ranged ’10.41’ to ’13.88’ (see Table 5.3).

Table 5.3 Descriptive statistics related to constructivist learning environment variables

Variable	Mean	Std. Deviation	Range	Minimum	Maximum
PR	13.88	3.69	16.00	4.00	20.00
U	12.57	3.19	16.00	4.00	20.00
CV	13.48	3.65	16.00	4.00	20.00
SC	10.41	3.72	16.00	4.00	20.00
SN	12.07	3.64	16.00	4.00	20.00

5.2 Inferential Statistic

In order to analyze first and second hypotheses of the study, canonical correlation analyses were conducted and third hypothesis was tested by conducting one-way between groups multivariate analysis of variance (MANOVA).

5.2.1 Main Problem 1

What is the relationship between elementary school students' perception of science classroom environment from constructivist perspective (personal relevance, student negotiation, shared control, critical voice, uncertainty) and their adaptive motivational beliefs (intrinsic goal orientation, task value, control of learning beliefs and self efficacy for learning and performance)?

Ho 1: There is no significant relationship between elementary school students' perception of science classroom environment from constructivist perspective and their adaptive motivational beliefs.

In order to address first main problem, a canonical correlation analysis was performed between the set of science constructivist learning environment and set of adaptive motivational beliefs. The first canonical correlation was 0.65 (42 % overlapping variance), accounting for the significant relationships between the two sets of variables. The remaining canonical correlations were effectively zero.

Data on the first canonical variate were presented in Table 5.4. As shown in the table, with a cutoff correlation of 0.30 (Tabachnick & Fidell, 1996), all the variables in the constructivist learning environment variables set were correlated with the first canonical variate. The first canonical variate was positively associated with all these variables. Similarly, all motivational beliefs variables were positively correlated with the first canonical variate. In addition, the first pair of canonical variates indicated that all constructivist learning environment variables and all the motivational beliefs variables were positively related with each other. In other words, perception of higher levels of personal relevance, uncertainty, critical voice, shared control and social negotiation in a classroom environment were associated with higher levels of intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance.

Moreover, the percent of variance values indicated that the first canonical variate pair extracts 59 % of variance from constructivist learning environment variables and 74 % of variance from the motivational beliefs variables. Also, redundancy values revealed that the first constructivist learning environment variate accounts for 25 % of the variance in motivational beliefs variables. Similarly, the first motivational beliefs variate accounts for 32 % of the variance in the constructivist learning environment variables.

Table 5.4 Correlations, Standardized Canonical Coefficients, Canonical Correlations, Percents of Variance, and Redundancies between Constructivist Learning Environment Variables and Motivational Beliefs Variables.

	First Canonical Variate	
	Correlation	Coefficient
Constructivist Learning Environment Variables		
Personal Relevance	0.91	0.52
Uncertainty	0.75	0.12
Critical Voice	0.89	0.42
Shared Control	0.61	0.05
Social Negotiation	0.66	0.05
Percent of Variance	0.59	
Redundancy	0.25	
Motivational Beliefs Variables		
Intrinsic Goal Orientation	0.89	0.28
Task Value	0.95	0.55
Control of Learning Beliefs	0.77	0.11
Self-Efficacy for Learning and Performance	0.80	0.18
Percent of Variance	0.74	
Redundancy	0.32	
Canonical Correlation	0.65	

5.2.2 Main Problem 2

What is the relationship between elementary school students' perception of science classroom environment from constructivist perspective and their attitude toward science?

Ho 2: There is no significant relationship between elementary school students' perception of science classroom environment from constructivist perspective and their attitude toward science.

In order to investigate the relationship between the set of constructivist learning environment variables and the set of attitude toward science variables canonical correlation analysis was performed. The first canonical correlation was 0.65 (42 % overlapping variance), accounting for the significant relationships between the two sets of variables.

Data on the first canonical variate were presented in Table 5.5. As shown in the table, with a cutoff correlation of 0.30 (Tabachnick & Fidell, 1996), all the variables in the constructivist learning environment variables set were correlated with the first canonical variate. The first canonical variate was positively associated with all these variables. In addition all attitude variables were also positively correlated with the first canonical variate. In addition, the first pair of canonical variates indicated that all constructivist learning environment variables and attitude variables were positively related with each other. In other words, perception of higher levels of personal relevance, uncertainty, critical voice, shared control, and social negotiation in a classroom environment were associated with higher levels of adaptation to science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science.

The percent of variance values indicated that the first canonical variate pair extracts 58 % of variance from constructivist learning environment variables and 75 % of variance from attitude variables. Also, redundancy values revealed that the first constructivist learning environment variate accounts for 24 % of the variance in attitude variables. Similarly, the first attitude variate accounts for 31 % of the variance in the constructivist learning environment variables.

Table 5.5 Correlations, Standardized Canonical Coefficients, Canonical Correlations, Percents of Variance, and Redundancies between Constructivist Learning Environment Variables and Attitude Variables.

	First Canonical Variate	
	Correlation	Coefficient
Constructivist Learning Environment Variables		
Personal Relevance	0.92	0.58
Uncertainty	0.68	-0.06
Critical Voice	0.90	0.43
Shared Control	0.62	0.13
Social Negotiation	0.65	0.06
Percent of Variance	0.58	
Redundancy	0.24	
Attitude variables		
Adaptation to Science Attitudes	0.79	0.21
Enjoyment of Science Lessons	0.96	0.50
Leisure Interest in Science	0.90	0.33
Career Interest in Science	0.81	0.08
Percent of Variance	0.75	
Redundancy	0.31	
Canonical Correlation	0.65	

5.2.3 Main Problem 3

Are there any significant difference between the 8^{th} grade boys and girls with respect to their perceptions of science learning environment from constructivist perspective, adaptive motivational beliefs and attitude toward science?

Ho: There is no significant difference between the 8^{th} grade boys and girls with respect to their perceptions of constructivist science learning environment, motivational beliefs and attitude toward science.

5.2.3.1 Assumptions of Multivariate Analysis of Variance

MANOVA has the assumptions of multivariate normality, equity of covariance matrices, equity of variances and independences of observations assumptions. Three separate MANOVAs were conducted with three groups of dependent variables (constructivist learning environment scales, adaptive motivational belief scales and attitude scale) across one group of independent variable (students' gender), so the assumptions were tested for three different groups of data.

5.2.3.1.1 Sample Size

The cases in the cells are greater than the number of the dependent variables, so the sample size is enough to apply MANOVA analysis for the study.

5.2.3.1.2 Normality and Outliers:

For normality assumption, univariate and multivariate normalities were checked. Univariate normality was checked for each of the dependent variables by using skewness and kurtosis values in Tables 5.9, 5.11 and 5.13. The skewness and kurtosis values of dependent variables were all in acceptable range being between -1 and +1 for a normal distribution. In addition histograms for all variables appear to be normally distributed.

To check multivariate normalities mahalanobis distance is calculated and compared with the critical value given in the chi-square table for dependent variables (Pallant, 2001). Concerning students' attitude, there were four dependent variables and the critical chi-square value was found to be 18.47. The maximum mahalanobis distance of the sample was 43.02. This showed that there were outlying cases for attitude pattern and they were (id 225, 324, 439, 499, 600, 627,698, 728) removed from the data. Regarding students' perceptions of constructivist learning environment there were five dependent variables and the critical chi-square value was found to be 20.52. The maximum mahalanobis distance of the sample was 21.33. This showed that there were outlying cases for constructivist learning environment pattern and they were (id 498, 698) removed from the data. For motivational beliefs there were four dependent variables and the critical chi-square value was found to be 18.47. The maximum mahalanobis distance of the sample was 25.15. This showed that there were outlying cases for motivational beliefs pattern and they were (id 20, 23, 193, 376, 606, 637) removed from the data.

5.2.3.1.3 Linearity

To test linearity of the scores the scatter plots are generated for each pairs of the dependent variables (Appendix B, Appendix C, and Appendix D). The scatter plots indicate that in general there is no serious violation of linearity assumption for many pairs of dependent variables across independent variable groups.

5.2.3.1.4 Multicollinarity and Singularity

When the dependent variables are highly correlated this is referred to as Multicollinarity. This can occur when one of the dependent variables is combination of other variables (e.g. attitude scale that is made up of subscales that are also included as dependent variables). As shown in the Tables 5.6, 5.7, 5.8 correlation coefficients between constructivist learning environment variables, motivational belief variables and attitude variables indicate that there is a linear and positive correlation between the dependent variables. As a result, correlations between the variables are significant and the values show that the relation is not weak.

Table 5.6 Correlation coefficients between constructivist learning environment variables

	PR	U	CV	SC	SN
PR	-	.615**	.689**	.415**	.477**
U		-	.682**	.498**	.469**
CV			-	.546**	.606**
SC				-	.579**
SN					-

Table 5.7 Correlation coefficients between attitude variables

	A	E	L	C
A	-	.685**	.643**	.596**
E		-	.813**	.738**
L			-	.774**
C				-

Table 5.8 Correlation coefficients between motivational beliefs variables

	IGO	CB	TV	SE
IGO	-	.703**	.732**	.675**
CB		-	.693**	.590**
TV			-	.671**
SE				-

5.2.3.1.5 Homogeneity of variance-covariance matrices

For the equity of covariance matrices assumption Box's test of equality of variance matrices were conducted. For constructivist learning environment variables significance value is .451 and this value is bigger than .05 ($p>.05$). So equality of covariance matrices assumption is not violated. For adaptive motivational belief variables significance value is .019 and this value smaller than .05. There is a violation of homogeneity of variance-covariance matrices for motivational belief variables. Fortunately, a violation of this assumption has minimal impact if the groups are of approximately of equal size i.e., if the largest group size divided by the smallest group size is less than 1.5 (Hair, Anderson, Tatham, & Black, 1998). In the present study, the ratio was smaller than 1.5. Finally for attitude variables significance value is .118 and also this value is bigger than .05. Thus equality of covariance matrices assumption is not violated.

For equity of error variances, Levene's test was used. If there is a significance value smaller than .05 in Levene's Test, it means that there is a violation of equity of error variance. The significance values of constructivist learning environment variables (for PR, U, CV, SC and SN .77, .28, .47, .51 and .14 respectively), adaptive motivational belief variables (for IGO, CB, TV and SE .09, .08, .53 and .76 respectively) and attitude variables (for A, E, L, and C .67, .92, .07 and .49 respectively) were all bigger than .05. So this assumption is not violated.

The last assumption states that observations should be independent of one another. The administration of the inventory did not involve interactions among subjects. So they did not influence each other. It was observed that all participants did their test by themselves.

5.2.3.2 Sub Problem 3.1

Is there a significant difference between the 8th grade boys and girls with respect to their perceptions of constructivist science learning environment?

Ho: 3.1 There is no significant difference between the 8th grade boys and girls with respect to their perceptions of constructivist science learning environment.

The differences between boys' and girls' perceptions on constructivist learning environment were tested by using MANOVA. Table 5.9 and Table 5.10 give information about the results of MANOVA. Five dependent variables (PR, U, CV, SC and SN) which were subscales of constructivist learning environment and one independent variable which is gender were used in this study. There was a significant difference between boys and girls on the combined dependent variables of constructivist learning environment subscales: $F(5, 828)=3.98$, $p=.001$; Wilk's Lamda=.98; partial eta squared=.02. When the results for the dependent variables were considered separately, the only two differences to reach statistical significance using a Bonferroni adjusted alpha level of .01, were PR and CV. For PR: $F(1, 832)=15.53$, $p=.000$, partial eta squared =.018. An inspection of the mean scores indicated that females reported slightly higher levels of PR (M=14.40, SD=3,6) than males (M=13.40, SD=3.7). For CV dependent variable: $F(1, 832)=9.27$, $p=.001$, partial eta squared=.013. An inspection mean scores indicate that females have higher levels of CV (M=13.94, SD=3.49) than males (M=13.10, SD=3.68). Therefore results showed that girls have more personal relevance and critical voice then boys.

Table 5.9 Means and standard deviations of the students by gender and constructivist learning environment pattern

Constructivist learning environment pattern	Gender							
	Females				Males			
	Mean	S.D.	Skewness	Kurtosis	Mean	S.D.	Skewness	Kurtosis
PR	14.40	3.60	-.389	-.553	13.40	3.72	-.131	-.658
U	12.74	3.21	-.153	-.461	12.38	3.14	-.302	-.140
CV	13.94	3.49	-.301	-.429	13.10	3.68	-.155	-.485
SC	10.59	3.85	.137	-.693	10.35	3.69	.107	-.817
SN	12.40	3.47	-.014	-.501	11.85	3.69	-.105	-.646

Table 5.10 Test of between subject factors of constructivist learning environment pattern

Constructivist learning environment pattern	df	Error df	F	p	Partial eta squared	Observed power
PR	1	832	15.53	.000	.018	.976
U	1	832	2.63	.105	.003	.367
CV	1	832	11.36	.001	.013	.920
SC	1	832	.898	.344	.001	.157
SN	1	832	4.93	.027	.006	.602

Overall mean ratings of mean scores of the students are given in figure 5.1. Mean scores of males and females showed that females have higher means on PR, U, CV, SC, SN dimensions of constructivist learning environment variable. However there is only significant difference on PR and CV variables.

Mean Ratings of the Students on Learning

Environment Variables by Gender

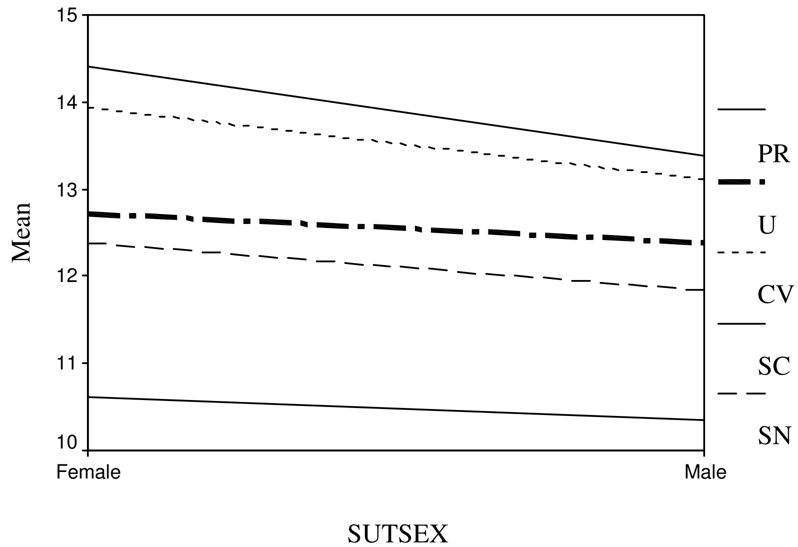

Figure.5.1 Overall mean ratings of the students on five constructivist learning environment variables by gender

5.2.3.3 Sub Problem 3.2

Is there a significant difference between the 8th grade boys and girls with respect to their adaptive motivational beliefs?

Ho: 3.2 There is no significant difference between the 8th grade boys and girls with respect to their adaptive motivational beliefs.

MANOVA was performed to investigate gender differences in adaptive motivational beliefs. Table 5.11 and Table 5.12 show the result of statistic. Four dependent variables (IGO, TV, CB and SE) which were subscales of motivational belief variable and one independent categorical variable which is gender were used. The independent variable was gender. There was a statistically difference between girls and boys on the combined of subscales of adaptive motivational beliefs: F(4, 838)=6.3, p=.000; Wilk's Lamda=.97; partial eta squared= .03 When the results for dependent variables considered separately, the differences to reach statistical significance using a Bonferroni adjusted alpha level of .0125 were all dependent variables except SE. For IGO variable: F(1, 841)=16.94, p=.000, partial eta squared=.02. Mean scores indicated that girls had higher levels of IGO (M=20.31, SD=5.37) than boys (M=18.73, SD=5.76). For CB variable: F(1, 841)=21.44, p=.000, partial eta squared=.025. The mean scores indicated that girls reported higher levels of CB (M=21.24, SD=5.03) than boys (M=19.58, SD=5.40). For TV variable: F(1, 841)=14.84, p=.000, partial eta squared=.017. The mean scores indicated that girls reported higher (M=30.84, SD=8.11) than boys (M=28.66, SD=8.39) for TV variable. As a result, the findings showed that girls have higher levels of intrinsic goal orientation, control of learning belief and task value than boys.

Table 5.11 Means and standard deviations of the students by gender and motivation pattern

Motivation pattern	Gender							
	Females				Males			
	Mean	S.D.	Skewness	Kurtosis	Mean	S.D.	Skewness	Kurtosis
IGO	20.31	5.,37	-.567	-.207	18.73	5.76	-.458	-.402
CB	21.24	5.03	-.736	-.017	19.58	5.40	-.532	-.157
TV	30.84	8.11	-.679	-.178	28.65	8.39	-.445	-.405
SE	39.25	9.86	-.502	-.108	37.79	9.85	-.360	-.079

Table 5.12 Test of between subject factors of motivation pattern

Motivation Pattern	df	Error df	F	p	Partial eta squared	Observed power
IGO	1	841	16.94	.000	.020	.984
CB	1	841	21.44	.000	.025	.996
TV	1	841	14.84	.000	.017	.970
SE	1	841	4.61	.032	.005	.574

Overall mean ratings of mean scores of the students are given in figure 5.2. Mean scores of males and females showed that females have higher means on IGO, CB, TV and SE dimensions of motivational variable.

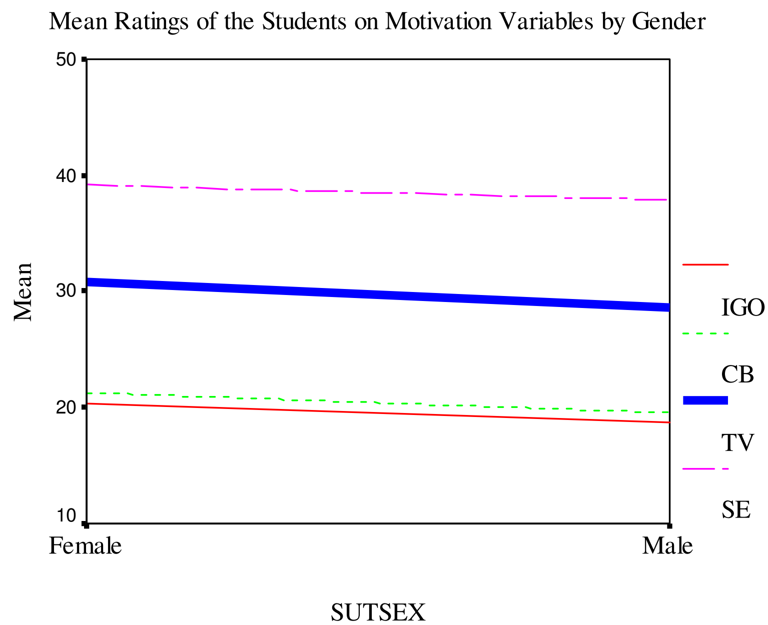

Figure.5.2 Overall mean ratings of the students on four motivational belief variables by gender

5.2.3.4 Sub Problem 3.3

Is there a significant difference between the 8th grade boys and girls with respect to their attitude toward science?

Ho: 3.2 There is no significant difference between the 8th grade boys and girls with respect to their attitude toward science.

Again MANOVA used to investigate gender differences for science attitude of students. Table 5.13 and Table 5.14 give knowledge about MANOVA results. There were four dependent variables (A, E, L and C) which were subscales of attitude variable and one independent variable, gender. It was found that there was a significant difference between boys and girls on the combined dependent variables: F(4, 748)=7.9, p=.000; Wilk's Lamda=.96; partial eta squared=.041. When the results for dependent variables considered separately, all variables reached statistical difference using a Bonferroni adjusted alpha level of .0125. For A variable: F(1, 751)=28.93, p=.000, partier eta squared=.037. The mean scores indicated that girls reported higher levels of A (M=36.79, SD=5.74) than boys (M=34.50, SD=5.96). For E variable: F(1,751)=13.89, p=.000, partier eta squared=.018. The mean scores indicated that girls reported higher levels of A (M=35.32, SD=8.60) than boys (M=32.94, SD=8.94). For L variable: F(1, 751)=19.25, p=.000, partier eta squared=.025. The mean scores indicated that girls reported higher levels of A (M=33.34, SD=8.31) than boys (M=30.74, SD=7.95). For C variable: F(1, 751)=14.79, p=.000, partier eta squared=.0.19. The mean scores indicated that girls reported higher levels of A (M=33.39, SD=7.38) than boys (M=31.28, SD=7.60). To sum up, girls had higher levels of adaptation on science attitudes, enjoyment of science lesson, leisure interest in science and career interest in science than boys.

Table 5.13 Means and standard deviations of the students by gender and attitude pattern

Attitude pattern	Gender							
	Females				Males			
	Mean	S.D.	Skewness	Kurtosis	Mean	S.D.	Skewness	Kurtosis
A	36.79	5.74	-.111	-.421	34.50	5.96	.066	-.116
E	35.,32	8.60	-.436	-.263	32.94	8.94	-.163	-.228
L	33.34	8.31	-.186	-.384	30.74	7.95	.193	.002
C	33.39	7.38	-.083	-.402	31.28	7.60	.116	.119

Table 5.14 Test of between subject factors of attitude pattern

Attitude Pattern	df	Error df	F	p	Partial eta squared	Observed power
A	1	751	28.93	.000	.037	1.000
E	1	751	13.89	.000	.018	.961
L	1	751	19.25	.000	.025	.992
C	1	751	14.79	.000	.019	.970

Overall mean ratings of mean scores of the students are given in figure 5.3. Mean scores of males and females showed that females have higher means on A, E, L and C dimensions of attitude variable.

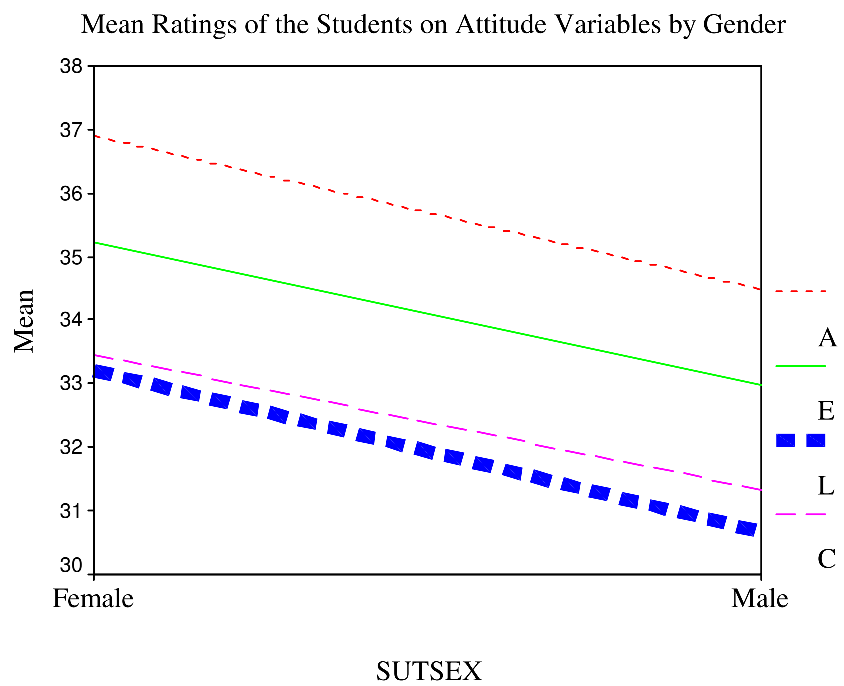

Figure.5.3 Overall mean rating of the students on four attitude variable by gender

5.3 Summary of the Results

The results of the present study can be summarized as follows:

1. First canonical variate showed that all constructivist learning environment variables (PR, U, CV, SC and SN) and all the motivational beliefs variables (IGO, TV, CB, and SE) positively related with each other. In other words perception of higher levels of personal relevance, uncertainty, critical voice, shared control and social negotiation in a classroom environment were associated with higher levels of intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance.

2. First pair of canonical variates indicated that all constructivist learning environment variables (PR, U, CV, SC and SN) and attitude variables (A, E, L, and C) were positively related with each other. In other words, perception of higher levels of personal relevance, uncertainty, critical voice, shared control, and social negotiation in a classroom environment were associated with higher levels of adaptation to science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science.
3. There was a significant difference between boys and girls on the combined dependent variables of constructivist learning environment subscales of personal relevance and critical voice. The result showed that girl students have more personal relevance and critical voice then boy students.
4. There was a statistically difference between girls and boys on the combined subscales of adaptive motivational beliefs of IGO, TV and CB. The findings showed that girl students have higher levels of intrinsic goal orientation, control of learning belief and task value than boy students.
5. There was a significant difference between boys and girls on the combined all subscales of attitude variable which was A, E, L and C. The findings showed that girls have higher levels of adaptation on science attitudes, enjoyment of science lesson, leisure interest in science and career interest in science than boys.

CHAPTER 6

CONCLUSIONS, DISCUSSIONS, AND LIMITATIONS

This chapter includes the summary of the research study, conclusions and discussions of the results, internal and external validity of the study and lastly, implications of the study and recommendations for further studies.

6.1 Summary of the Research Study

In order to investigate eight grade students' science learning environment, their attitude toward science and their adaptive motivational beliefs, 956 eighth grade students were chosen from an acceptable population and Constructivist Learning Environment Survey (CLES), Test of Science Related Attitude (TOSRA), and Motivated Strategies for Learning Questionnaire (MSLQ) were administrated to these students during second semester of 2005-2006 academic year. Random sampling was used to get sample.

6.2 Conclusions and Discussions of the Results

This study aimed to examine the relationship between elementary school students' perception of science classroom environment from constructivist perspective, their adaptive motivational beliefs and their attitude toward science. Moreover, it was examined the affects of gender difference on classroom learning environment, motivation and attitude toward science.

The results of the current study revealed that there is relationship between classroom learning environment and motivation. In addition there is also an association between classroom learning environment and attitude toward science. Moreover gender difference was found on students' learning environment perception, their motivational belief and attitude toward science.

According to the results of canonical analysis which was performed between constructivist learning environment and motivational beliefs, all constructivist learning environment variables and all adaptive motivational belief variables were positively related with each other. In other words, perception of higher levels of personal relevance, uncertainty, critical voice, shared control, social and social negotiation in a classroom environment were associated with higher levels of intrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance. The study which was conducted by Kim (2005) showed that constructivist learning environment has positive effects on motivation of the students; it increases the self efficacy of students. Ben Ari (2003) found the relationships between classroom learning environment and motivation. According to Ben Ari when the student perceived his/her classroom as having more mastery goal structure, he/she had higher adaptive motivational beliefs. Midgley (1993) emphasized that the nature of students' classroom perceptions on motivation depends on characteristics of learning environment in which students finds themselves. To be motivated to learn, students need both opportunities to learn and constant encouragement and support of their learning effort. It is important that classroom organization and management skills to establish effective classroom structure be utilized appropriately. Students' reactions to their own performance depend not just on their level of success and motivation but also on their perceptions of their learning environment. Fosnot (1996) emphasizes that classroom using constructivism and group work techniques result in students that are more autonomy oriented and intrinsically motivated with higher self esteem who perceive themselves as more competent in the cognitive domain. In addition in this classroom there is a decrease in absences, an increased commitment to learning, a willingness to take on difficult tasks, increased persistence, feeling of satisfaction, increased moral, and a willingness to endure pain and frustration to succeed (Johnson & Johnson, 1991).

Another canonical analysis which was conducted between constructivist learning environment and students' attitude toward science indicated that all constructivist learning environment variables and attitude variables were positively related with each other. In other words, perception of higher levels of personal relevance, uncertainty, critical voice, shared control and social negotiation in a classroom environment were associated with higher levels of adaptation to science attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science. The result of the current study is similar to the study of Puacharean and Fisher (2004) and Fisher and Kim (1999). Fisher and Kim (1999) examined the effect of science curriculum reform. Grade 10 and grade 11 students were participated in the research and CLES and TOSRA were administrated to them. The result of the study showed that there was a statistically significant correlation with their attitudes and scales of personal relevance, shared control, and student negotiation for grade 10 and for the scales of personal relevance, uncertainty, and shared control for grade 11. They also found that subscales of constructivist learning environment are positively related with the subscales of attitude toward science. In addition other learning environment researchers emphasize the association between learning environment and students' attitude toward science too (Wong & Fraser, 1996; Riah & Fraser, 1997; Rawnsey & Fisher, 1998; Telli, Çakıroğlu & den Brok, 2006). For example, Koul and Fisher (2002) showed that investigation, task orientation and equity of WIHIC questionnaire were positively and significantly related with students' attitude. Similar studies conducted by Telli, Çakıroğlu and den Brok (2006) and Chion and Fraser (1998) showed that teacher support, task orientation and equity dimensions of WIHIC questionnaire were positively related with students' attitudes. Therefore present research results have consensus with previous researches. As a result when students' perception on their science learning environment is positive, then their attitude toward science is also positive.

When the effect of gender is considered, there are some differences between the results of current study and of previous studies especially on attitude variable. In literature generally boy students' attitude toward science is higher than girl students (Catsambis, 1995; Jones, Howe, & Rua 2000; Piburn & Baker, 1993; Greenfield, 1996), but in the current study girl students' attitude toward science was higher than boys. On the other hand, gender affect on constructivist learning environment results supported with previous research. For gender effect on motivation, there are different findings in previous studies while some support the results (Schibeci & Riley, 1986; Jones et al. 2000) of present study, others does not support the result .

According the result of MANOVA there is a significant difference between boys' and girls' perceptions on personal relevance and critical voice sub dimensions of constructivist learning environment. The mean scores of girls (M=14.40) related to personal relevance dimension were greater than the mean scores of boys (M=13.40). Also the mean scores of girls (M=13.94) related to critical voice dimension were greater than boys (M=13.10). For other dimensions although there are no statistically significant mean difference, the mean scores of girls reflecting uncertainty, shared control and social negotiation dimensions were higher than that of boys. The studies related with constructivist learning environment have not focused on gender difference effect on classroom learning environment. However, some studies related with learning environment such the studies of Huang (2003) and Rakıcı (2004) showed that girls perceived their learning environment more positively than boys did. The results of current study are similar to these results which showed that girls' mean scores are higher than the boys in dimensions of What is Happening in This Classroom? (WHICH) questionnaire.

Although the results of learning environment researches show that girls' perception of their classroom learning environment is more positive than boys, in general literature indicate that there is an opposition when students' attitude toward science is considered. In literature many research support that boy students' attitude toward science is more positive than girls. On the other hand Telli, Çakıroğlu and den Brok (2006) found that there is only significant gender difference on career interest in science but for enjoyment in science and leisure interest dimensions there was no significant difference between boys and girls. In the present study girls' attitude toward science was more positive than boys for all dimensions of attitude scale. The findings of the study support the results of Schibeci and Riley (1986) and Jones et al. (2000). They emphasized that girl students' attitude toward biology is higher than boys, while boys attitude toward physical science is higher than girls.

The present study was applied in April month and although Turkish elementary science curriculum is not separated the components like physics, chemistry and biology, 8th grade science curriculum includes biological science subjects like genetics more than other science components. In addition in most of the classes which the study was administered, genetics subject was teaching. So the result of the current study related with gender difference on attitude toward science can be supported with the literature for 8th grade students who have a loaded biological science subjects in their science curriculum.

Gender effect on motivational beliefs was also studied in the present research. According to results of current study, girls were rated higher in intrinsic goal orientation, control of learning beliefs and task value dimensions of adaptive motivational belief variable than boys. Self efficacy dimension was not statistically significant for this research, whereas the mean scores of girls was again higher than boys. Although some researches in literature emphasize that while girls are more motivated on the art and language subjects, boys are more motivated on science and mathematics subjects, the study of Yavuz (2006) showed that girls have higher motivational traits than boys in all grades of elementary science classes. The study which was conducted by Özkan (2003) showed that girl students' mean scores related to intrinsic goal orientation are higher than boys and the studies of Pajares, Miller and Johnson (1999) and Pajares, Britner and Valiante (2000) indicated that girl students' self efficacy mean scores are higher than boys.

To sum up, constructivist learning environment is one of the factors that related with the students' motivation and their attitude toward science. Furthermore, constructivist learning environment, students' motivation and students' attitude toward science are highly affected by the gender of the students. This study suggests that gender has a significant effect on students' learning environment, their motivation and their attitude toward science in favor of females. In addition, according to the present study there is a positive relationship between constructivist learning environment and motivation; and constructivist learning environment and attitude toward science.

Although there are some differences for the results of present study and previous study, in general the results of present study is similar with the findings in the literature. This study should be repeated for different grade levels and in different regions in Turkey to ensure generalizability of the findings.

The present study will be a guide for teachers and educators by showing the students' positive attitude toward constructivist learning environment and emphasizing the importance of relations between motivation and constructivist learning environment. In addition teachers generally think that boy students' attitude toward science and their motivational beliefs toward science subjects are higher than girls. However the present study has showed the opposite of this belief. Therefore this study can help teachers to change their prejudice about girl students' attitude toward science, their place in science education and science career.

6.3 Internal Validity of the Study

Internal validity of a study refers to the degree to which the observed differences on the depended variable occur only the affect of independent variable, not any extraneous variables that can have an affect on dependent variable (Fraenkel & Wallen, 2003). Some internal validity threats can be location and instrumentation, data collector characteristics and confidentially.

Location and instrumentation is minimized by administering the questionnaire to all participants in similar conditions and mostly by the researcher.

Data collector characteristics threat is minimized by the administration of the questionnaire generally doing by researcher.

Confidentially can not be threat for the present study because names of the students were not needed.

6.4 External Validity of the Study

External validity is the degree to which results are generalizable, or applicable to accessible population. The generalizability refers to the degree to which a sample represents the population (Fraenkel & Wallen, 2003).

As selections of schools were done randomly there is no limitation to generalize the results of the study to the accessible population.

In addition all administration procedure occurred in class hour. These two factors can minimize the external validity. Therefore it can be said that external validity for this study is provided.

6.5 Implications of the Study

According to findings of the study and previous research following suggestions can be offered;

1. Classroom learning environment is an important predictor to understand students' attitude toward science and their motivational beliefs. For this reason classroom environments should be developed according to students' need and their interest.

2. Instead of memorizing the facts, students should be encouraged to construct their knowledge by teachers and teachers should design their learning environment according to the principles of constructivism to provide permanent learning.

3. In classroom learning environments teachers should emphasize mastery goal oriented activities rather than performance goal activities to motivate learning continuous.

4. Teachers should be aware of that girl students' attitude toward science as high as boys, even according to the present study girls' attitude is higher than boys'. Science teachers should give equal chance to girl students in their science lessons by

encouraging them to perform experiments, to do projects related with physical and chemical science subjects, etc.

5. Teachers should try to find and form classroom learning environments which students will prefer.

6.6 Recommendations for Further Study

Further study can be conducted to different grade levels and so the grade level differences can be researched.

Further study can be conducted in different cities especially in rural areas to make a generalization for Turkey. In addition the similar study can be conducted in different regions of the same city.

Further studies can be conducted about affects of new science curriculum on the variables of the present study in Turkey.

Further studies can be conducted to investigate elementary school students' perceptions about their actual and preferred classroom learning environment.

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APPENDICES

APPENDIX A

TURKISH VERSION OF CONSTRUCTIVIST LEARNING ENVIRONMENT SURVEY, TEST OF SCIENCE RELATED ATTITUDE, AND THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAİRE

Sevgili Öğrenciler,
Bu çalışma üç bölümden oluşmaktadır. İlk bölümde fen bilgisi dersi ortamı hakkında 20 soru, ikinci bölümde fen bilgisi dersine yönelik tutum ile ilgili 40 soru, üçüncü bölümde ise fen bilgisi dersine yönelik motivasyonlarınız hakkında 31 soru bulunmaktadır. Cevaplarınızı lütfen her bölüm için ayrılan bölüme işaretleyiniz. Bu bir test değildir. Size sorulan durumlar hakkında düşüncelerinizi öğrenmek istiyoruz. Çalışmaya katıldığınız için teşekkür ederiz.

Yüksek Lisans Öğrencisi
Nazmiye ARISOY

Kişisel Bilgiler

1. Okulunuzun adı: …………………………………………………
2. Fen Bilgisi öğretmenizin adı: ....
3. Cinsiyetiniz: ❑ Kız ❑Erkek
4. Kardeş sayısı: …………
5. Sınıfınız: 8 ❑ A ❑ B ❑ C ❑ D ❑ Diğer…..
6. Doğum tarihiniz (yıl): …………….
7. Geçen dönemki Fen Bilgisi karne notunuz: …………

	Hayır	Çok Az	Fikrim ok	Oldukça	Çok Fazla
8. Fen Bilgisi dersini genel olarak faydalı buluyor musunuz?	0❑	1❑	2❑	3❑	4❑
9. Fen Bilgisi dersinde kendinizi yeterli ve becerili hissediyor musunuz?	0❑	1❑	2❑	3❑	4❑
10. Fen Bilgisi dersini ilgi çekici buluyor musunuz?	0❑	1❑	2❑	3❑	4❑
11. Fen Bilgisi dersi için haftalık olarak ne kadar zaman ayırıyorsunuz?(okulda ve evde, toplam olarak)	0❑	1❑	2❑	3❑	4❑

12. Anneniz çalışıyor mu?

❑ Çalışıyor ❑Çalışmıyor ❑Düzenli bir işi yok ❑ Emekli

13. Babanız çalışıyor mu?

❑ Çalışıyor ❑Çalışmıyor ❑Düzenli bir işi yok ❑ Emekli

14. Annenizin Eğitim Durumu	15. Babanızın Eğitim Durumu
❑ Hiç okula gitmemiş	❑ Hiç okula gitmemiş
❑ İlkokul	❑ İlkokul
❑ Ortaokul	❑ Ortaokul
❑ Lise	❑ Lise
❑ Üniversite	❑ Üniversite
❑ Yüksek lisans / Doktora	❑ Yüksek lisans / Doktora

16. Evinizde kaç tane kitap bulunuyor? (Magazin dergileri, gazete ve okul kitapları **dışında**)
❑ Hiç yok ya da çok az (0 – 10)
❑ 11 – 25 tane
❑ 26 – 100 tane
❑ 101- 200 tane
❑ 200 taneden fazla

17. Evinizde bir çalışma odanız var mı?
❑ Evet ❑Hayır

18.Ne kadar sıklıkla eve gazete alıyorsunuz?
❑ Hiçbir zaman ❑ Bazen ❑ Her zaman

<u>BÖLÜM 1.</u> Aşağıda Fen Bilgisi dersi ortamına dair ifadeler göreceksiniz. Fen bilgisi dersinizi düşünerek bu ifadelere ne derecede katılıp ne derecede katılmadığınızı ilgili seçeneği işaretleyerek belirtiniz.

	Hiçbir Zaman	**Nadiren**	**Bazen**	**Sıklıkla**	**Her Zaman**
Fen Bilgisi dersimizde okul içindeki ve dışındaki dünya hakkında bilgi ediniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde bilimin problemlere her zaman bir çözüm getiremediğini öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde neyin, nasıl öğretildiğini rahatlıkla sorguluyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde ne öğreneceğimin planlamasında öğretmene yardımcı oluyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde problemleri nasıl çözeceğimi diğer öğrenciler ile tartışıyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde ne kadar iyi öğrendiğimin değerlendirilmesinde/ölçülmesinde öğretmene yardımcı oluyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde öğrendiğim yeni bilgilerin okul içinde ve dışında edindiğim deneyimler ile ilişkili olduğunun farkındayım.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde neyin, nasıl öğretildiğini rahatlıkla sorgulamama izin verildiğinde daha iyi öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde bilimsel açıklamaların zaman içinde değiştiğini öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde diğer öğrenciler benim fikrimi açıklamamı istiyorlar.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde bilimin okul içindeki ve dışındaki hayatın bir parçası olduğunu öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde hangi etkinliklerin benim için daha yararlı olacağına karar vermede öğretmene yardımcı oluyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde bilimin, insanların kültürel değerlerinden ve fikirlerinden etkilendiğini öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde fikirlerimi diğer öğrencilere açıklıyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde karmaşık olan etkinlikler için açıklayıcı bilgi isteyebiliyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde okul içindeki ve dışındaki dünya hakkında ilginç şeyler öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde diğer öğrencilerin fikirlerini açıklamalarını istiyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde öğrenmeme engel olabilecek durumlar için düşüncelerimi dile getirebiliyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde bilimin, soruların ortaya konması ve çözüm yollarının oluşturulmasında bir yol olduğunu öğreniyorum.	❑	❑	❑	❑	❑
Fen Bilgisi dersimizde herhangi bir etkinlik/aktivite için ne kadar zamana ihtiyacım olduğunu öğretmene bildiriyorum.	❑	❑	❑	❑	❑

BÖLÜM 2. **Aşağıda Fen Bilgisine yönelik tutumlarla ilgili ifadeler göreceksiniz. Bu ifadelere katıldığınızı ya da katılmadığınızı ilgili seçeneği işaretleyerek belirtiniz.**

		Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1.	Önceki düşüncelerimle uyuşmayan konular hakkında okumaktan hoşlanırım.	❑	❑	❑	❑	❑
2.	Fen dersleri eğlencelidir.	❑	❑	❑	❑	❑
3.	Fen ile ilgili kulübe veya topluluğa katılmak isterim.	❑	❑	❑	❑	❑
4.	Okulu bitirdikten sonra fen bilimleri alanında bilim adamı olarak çalışmak istemem.	❑	❑	❑	❑	❑
5.	Her defasında aynı sonuçlara ulaşıp ulaşmadığımı kontrol etmek için yaptığım deneyleri tekrarlamaktan hoşlanmıyorum.	❑	❑	❑	❑	❑
6.	Fen derslerinden hoşlanmıyorum.	❑	❑	❑	❑	❑
7.	Evde televizyondaki fen ile ilgili programları izlerken sıkılıyorum.	❑	❑	❑	❑	❑
8.	Okuldan mezun olduğumda fen alanında keşifler yapan insanlarla çalışmak isterim.	❑	❑	❑	❑	❑
9.	Yaşadığımız dünya hakkında meraklıyım.	❑	❑	❑	❑	❑
10.	Okulda haftalık ders programında daha fazla fen dersi olmalıdır	❑	❑	❑	❑	❑
11.	Fen ile ilgili bilimsel bir kitabın veya bir fen araç gerecinin hediye olarak bana verilmesinden hoşlanırım	❑	❑	❑	❑	❑
12.	Okuldan mezun olduktan sonra fen laboratuarlarında çalışmak istemem	❑	❑	❑	❑	❑
13.	Yeni şeyler keşfetmek önemsizdir.	❑	❑	❑	❑	❑
14.	Fen dersleri beni sıkar.	❑	❑	❑	❑	❑
15.	Tatil süresince fen ile ilgi kitaplar okumaktan hoşlanmam.	❑	❑	❑	❑	❑
16.	Fen laboratuarında çalışmak geçim sağlamak için ilginç bir yol olabilir.	❑	❑	❑	❑	❑
17.	Benden farklı görüşleri olan insanları dinlemeyi severim.	❑	❑	❑	❑	❑
18.	Fen okuldaki en ilginç derslerden biridir.	❑	❑	❑	❑	❑
19.	Evde fen ile ilgili deneyler yapmaktan hoşlanırım.	❑	❑	❑	❑	❑
20.	Fen alanında kariyer sahibi olmak sıkıcı ve monotondur.	❑	❑	❑	❑	❑
21.	Yeni fikirler hakkında bilgi edinmeyi sıkıcı bulurum.	❑	❑	❑	❑	❑
22.	Fen dersleri zaman kaybıdır.	❑	❑	❑	❑	❑
23.	Okuldan sonra arkadaşlarla fen dersi ile ilgili konular hakkında konuşmak sıkıcıdır.	❑	❑	❑	❑	❑
24.	Mezun olduktan sonra fen ile ilgili konuları öğretmek isterim.	❑	❑	❑	❑	❑
25.	Fen deneylerinde daha önce kullanmadığım yeni yöntemleri kullanmayı severim.	❑	❑	❑	❑	❑
26.	Fen derslerinden çok hoşlanırım.	❑	❑	❑	❑	❑
27.	Tatillerde fen laboratuarında bir iş imkanı bulmaktan hoşlanırım.	❑	❑	❑	❑	❑
28.	Meslek olarak fen bilimleri alanında bilim adamı olmak sıkıcıdır.	❑	❑	❑	❑	❑
29.	Eğer kanıtlar fikirlerimin yetersizliğini (zayıflığını) gösterirse fikrimi istemiyerek değiştiririm.	❑	❑	❑	❑	❑
30.	Fen derslerinde işlenen konular ilginç değildir.	❑	❑	❑	❑	❑
31.	Radyodan fen ile ilgili programları dinlemek sıkıcıdır.	❑	❑	❑	❑	❑

32.	Fen alanında bilim adamı olmak bir iş olarak ilginç olabilir.	❑	❑	❑	❑	❑
33.	Fen deneylerinde beklenen sonuçların yanında beklenmeyen sonuçlarıda raporuma yazarım.	❑	❑	❑	❑	❑
34.	Fen derslerini sabırsızlıkla beklerim.	❑	❑	❑	❑	❑
35.	Hafta sonları bilim müzesine gitmek bana zevk verir.	❑	❑	❑	❑	❑
36.	Fen alanında bilimadamı olmak istemem çünkü uzun süreli eğitim gerektirir.	❑	❑	❑	❑	❑
37.	Başkalarının fikirlerini dinlemekten hoşlanmam	❑	❑	❑	❑	❑
38.	Eğer fen dersleri olmasaydı, okul daha eğlenceli olurdu.	❑	❑	❑	❑	❑
39.	Fen ile ilgili gazete makalesi okumaktan hoşlanmam.	❑	❑	❑	❑	❑
40.	Okuldan mezun olduğumda fen alanında bilim adamı olmak isterim.	❑	❑	❑	❑	❑

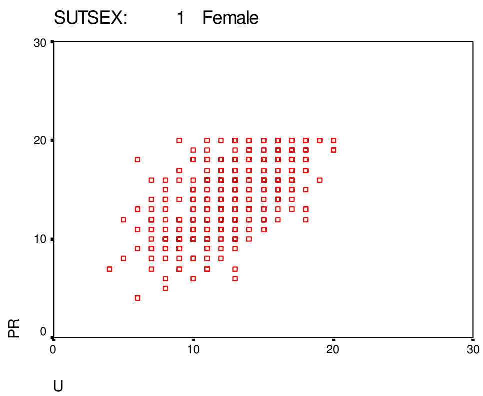
<u>BÖLÜM 3.</u> **Aşağıda Fen Bilgisi dersine yönelik motivasyonunuzla ilgili ifadeler göreceksiniz. Bu ifadelerin ne kadar sizi yansıtıp yansıtmadığını ilgili seçeneği işaretleyerek belirtiniz. Eğer ifadenin sizi tam olarak yansıttığını düşünüyorsanız, 7' yi yuvarlak içine alınız. Eğer ifadenin sizi hiç yansıtmadığını düşünüyorsanız, 1' yi yuvarlak içine alınız. Bu iki durum dışında ise 1 ve 7 arasında sizi en iyi tanımladığını düşündüğünüz numarayı yuvarlak içine alınız.**

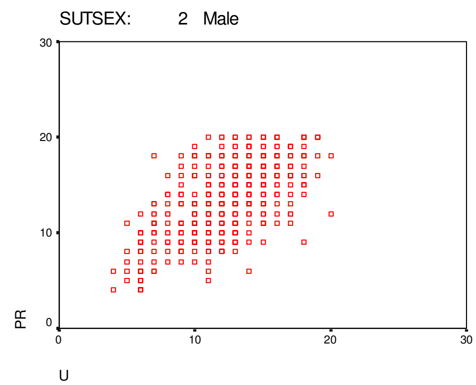
	Beni hiç yansıtmıyor					**beni tam olarak yansıtıyor**	
1. Fen Bilgisi dersinde yeni bilgiler öğrenebilmek için, büyük bir çaba gerektiren sınıf çalışmalarını tercih ederim.	1	2	3	4	5	6	7
2. Eğer uygun şekilde çalışırsam, Fen Bilgisi dersindeki konuları öğrenebilirim.	1	2	3	4	5	6	7
3. Fen Bilgisi sınavları sırasında, diğer arkadaşlarıma göre soruları ne kadar iyi yanıtlayıp yanıtlayamadığımı düşünürüm	1	2	3	4	5	6	7
4. Fen Bilgisi dersinde öğrendiklerimi başka derslerde de kullanabileceğimi düşünüyorum.	1	2	3	4	5	6	7
5. Fen Bilgisi dersinden çok iyi bir not alacağımı düşünüyorum.	1	2	3	4	5	6	7
6. Fen Bilgisi dersi ile ilgili okumalarda yer alan en zor konuyu bile anlayabileceğimden eminim.	1	2	3	4	5	6	7
7. Benim için şu an Fen Bilgisi dersi ile ilgili en tatmin edici şey iyi bir not getirmektir	1	2	3	4	5	6	7
8. Fen Bilgisi sınavları sırasında bir soru üzerinde uğraşırken, aklım sınavın diğer kısımlarında yer alan cevaplayamadığım sorularda olur	1	2	3	4	5	6	7
9. Fen Bilgisi dersindeki konuları **öğrenemezsem** bu benim hatamdır.	1	2	3	4	5	6	7
10.Fen Bilgisi dersindeki konuları öğrenmek benim için önemlidir	1	2	3	4	5	6	7
11. Genel not ortalamamı yükseltmek şu an benim için en önemli şeydir, bu nedenle Fen bilgisi dersindeki temel amacım iyi bir not getirmektir.	1	2	3	4	5	6	7
12. Fen Bilgisi dersinde öğretilen temel kavramları öğrenebileceğimden eminim.	1	2	3	4	5	6	7
13. Eğer başarabilirsem, Fen Bilgisi dersinde sınıftaki pek çok öğrenciden daha iyi bir not getirmek isterim	1	2	3	4	5	6	7
14. Fen Bilgisi sınavları sırasında bu dersten başarısız olmanın sonuçlarını aklımdan geçiririm	1	2	3	4	5	6	7
15. Fen Bilgisi dersinde, öğretmenin anlattığı en karmaşık konuyu anlayabileceğimden eminim.	1	2	3	4	5	6	7
16. Fen Bilgisi derslerinde öğrenmesi zor olsa bile, bende merak uyandıran sınıf çalışmalarını tercih ederim.	1	2	3	4	5	6	7
17. Fen Bilgisi dersinin kapsamında yer alan konular çok ilgimi çekiyor.	1	2	3	4	5	6	7
18. Yeterince sıkı çalışırsam Fen Bilgisi dersinde başarılı olurum.	1	2	3	4	5	6	7
19. Fen Bilgisi sınavlarında kendimi mutsuz ve huzursuz hissederim.	1	2	3	4	5	6	7
20. Fen Bilgisi dersinde verilen sınav ve ödevleri en iyi şekilde yapabileceğimden eminim.	1	2	3	4	5	6	7

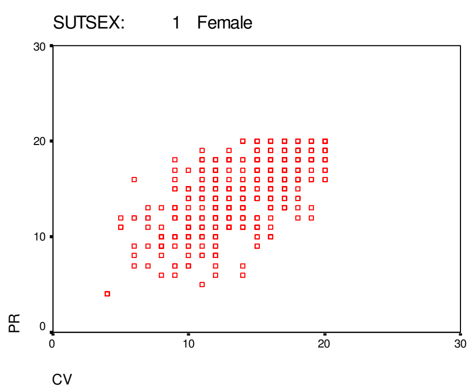
21. Fen Bilgisi dersinde çok başarılı olacağımı umuyorum	1	2	3	4	5	6	7
22. Fen Bilgisi dersinde beni en çok tatmin eden şey, konuları mümkün olduğunca iyi öğrenmeye çalışmaktır.	1	2	3	4	5	6	7
23. Fen Bilgisi dersinde öğrendiklerimin benim için faydalı olduğunu düşünüyorum.	1	2	3	4	5	6	7
24. Fen Bilgisi dersinde, iyi bir not getireceğimden emin **olmasam** bile öğrenmeme olanak sağlayacak ödevleri seçerim.	1	2	3	4	5	6	7
25. Fen Bilgisi dersinde bir konuyu **anlayamazsam** bu yeterince sıkı çalışmadığım içindir.	1	2	3	4	5	6	7
26. Fen Bilgisi dersindeki konulardan hoşlanıyorum.	1	2	3	4	5	6	7
27. Fen Bilgisi dersindeki konuları anlamak benim için önemlidir.	1	2	3	4	5	6	7
28. Fen Bilgisi sınavlarında kalbimin hızla attığını hissederim.	1	2	3	4	5	6	7
29. Fen Bilgisi dersinde öğretilen becerileri iyice öğrenebileceğimden eminim.	1	2	3	4	5	6	7
30. Fen Bilgisi dersinde başarılı olmak istiyorum çünkü yeteneğimi aileme, arkadaşlarıma göstermek benim için önemlidir.	1	2	3	4	5	6	7
31. Dersin zorluğu, öğretmen ve benim becerilerim gözönüne alındığında, Fen Bilgisi dersinde başarılı olacağımı düşünüyorum	1	2	3	4	5	6	7

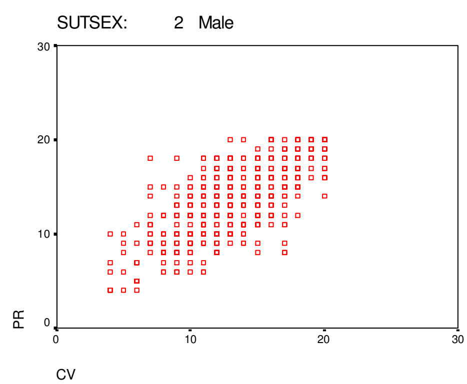
APPENDIX B

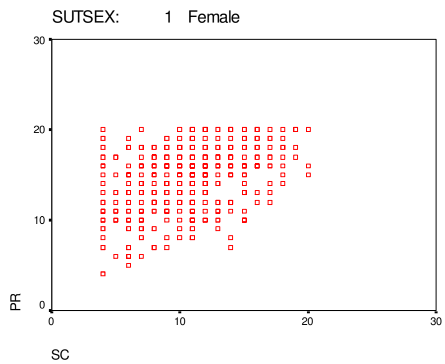
SCATTER PLOTS FOR EACH PAIR OF THE CONSTRUCTIVIST LEARNING ENVIRONMENT VARIABLES







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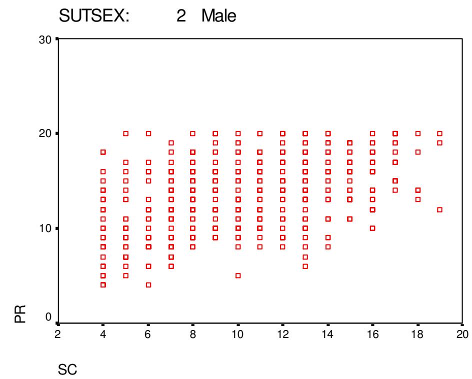
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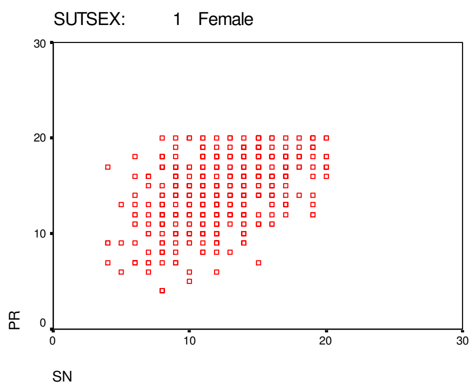
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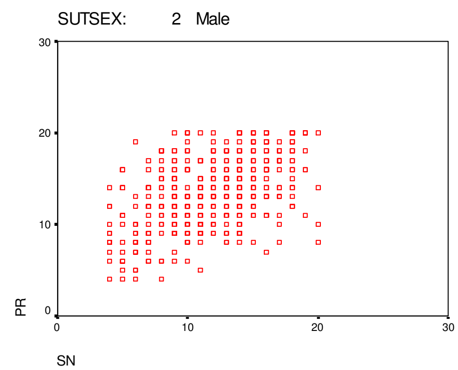
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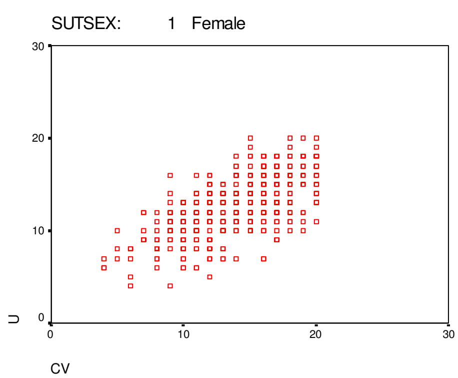
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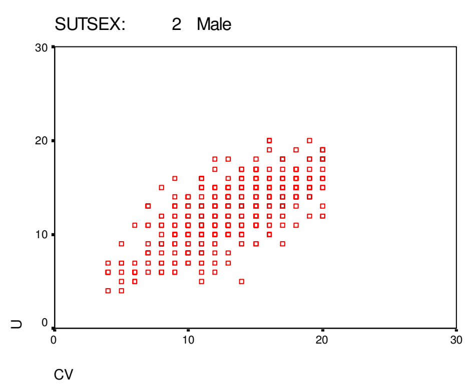
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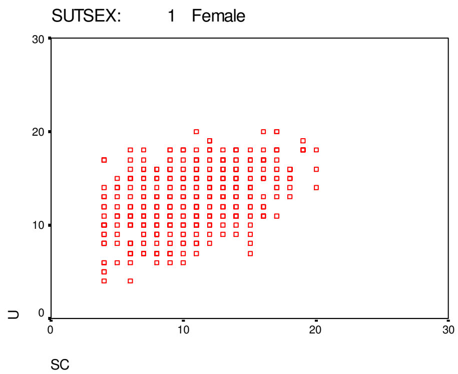
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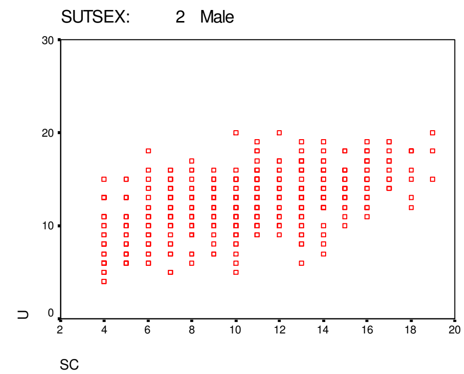
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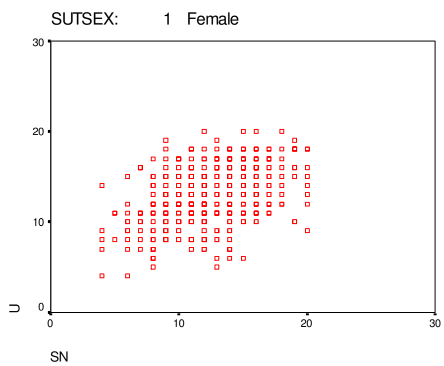
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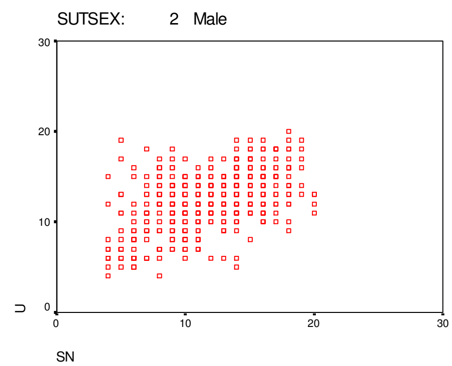
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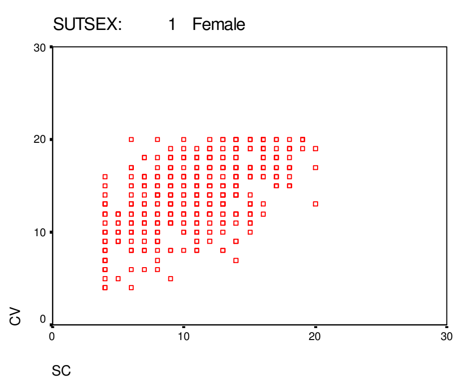
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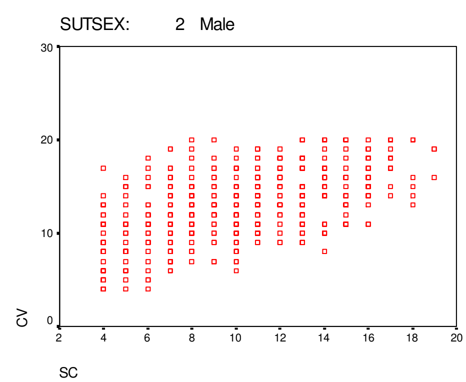
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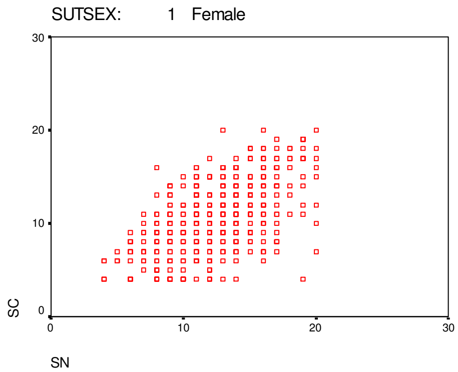
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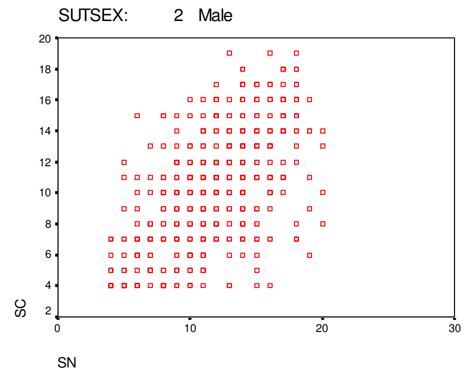
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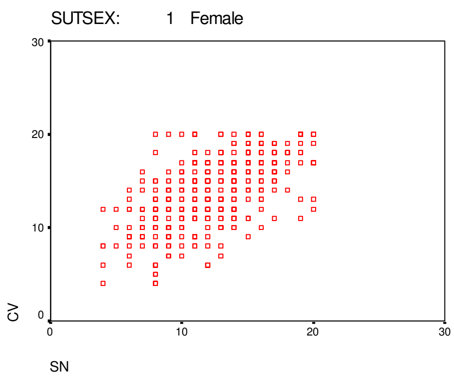
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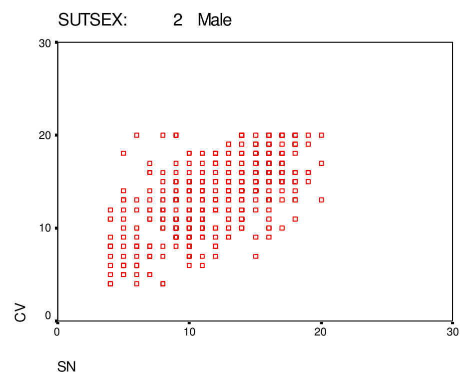
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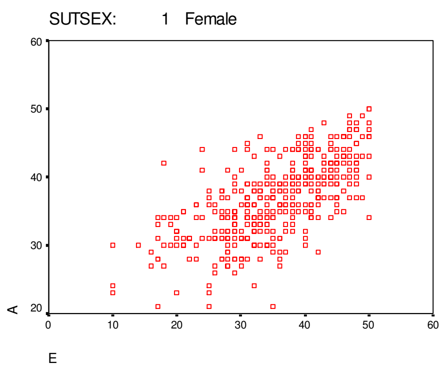
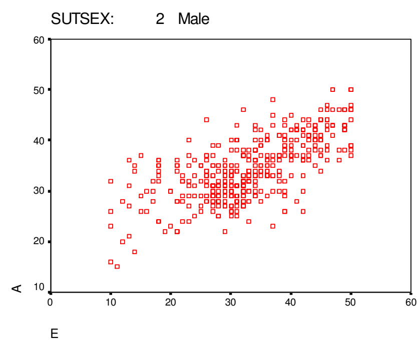
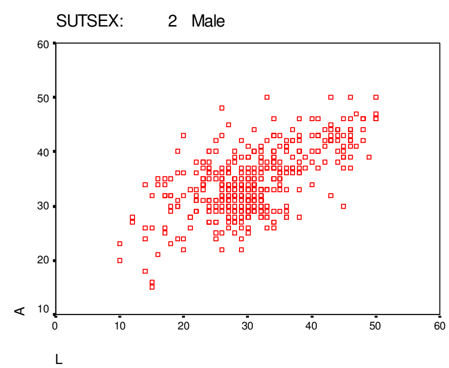
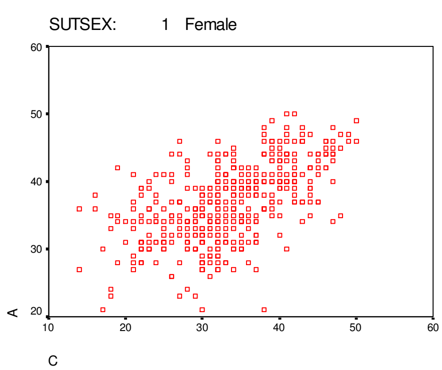
APPENDIX C

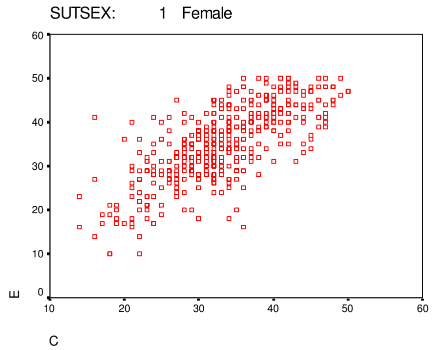
SCATTER PLOTS FOR EACH PAIR OF ATTITUDE VARIABLES



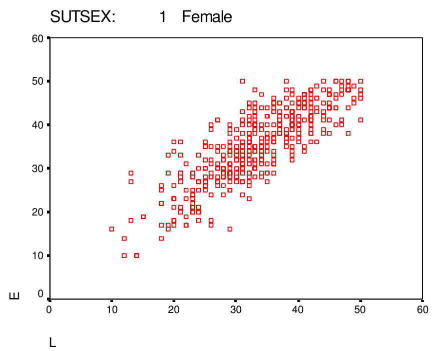







SUTSEX: 1 Female
E
C
0
10
20
30
40
50
60


SUTSEX: 2 Male
E
C
0
10
20
30
40
50
60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L
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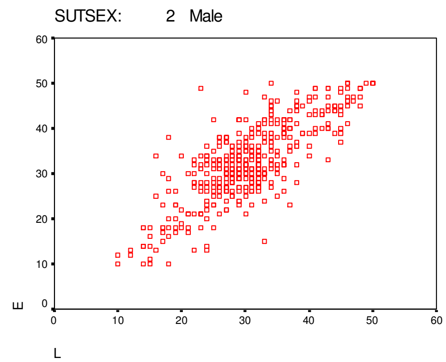
20
30
40
50
60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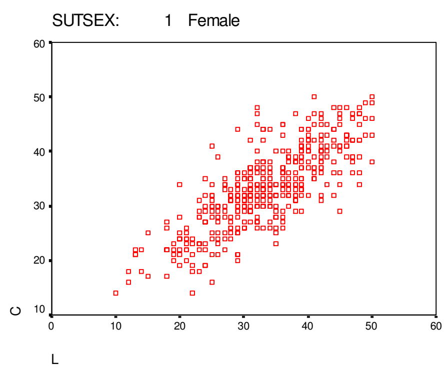
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L
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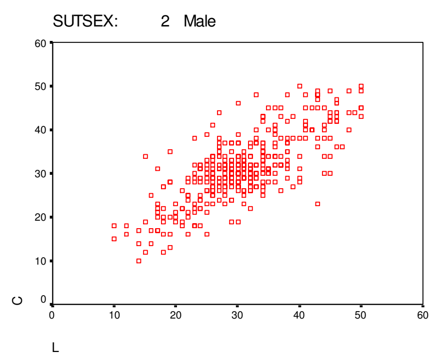
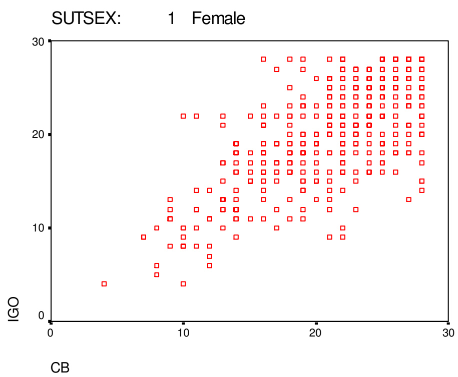
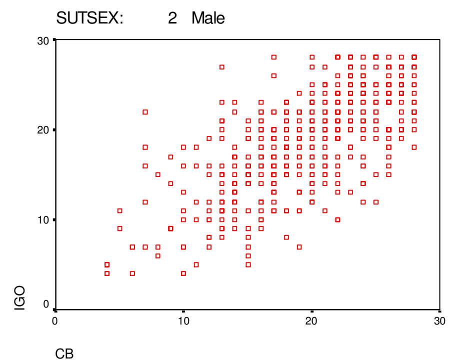
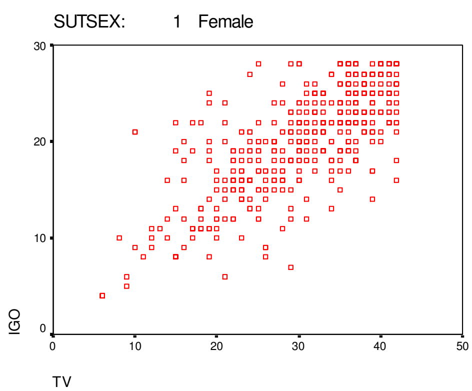

SUTSEX: 2 Male
C
L
0
10
20
30
40
50
60

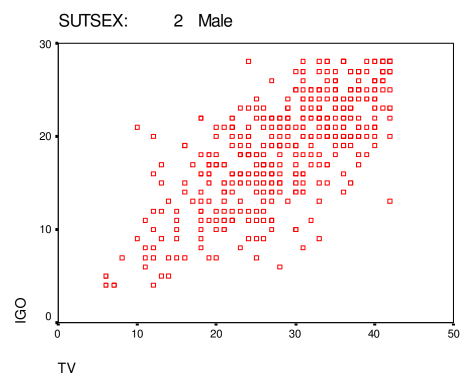
APPENDIX D

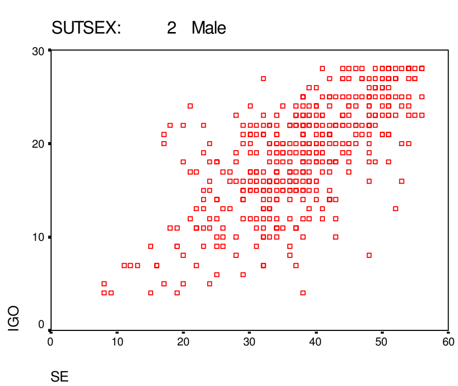
SCATTER PLOTS FOR EACH PAIR OF MOTIVATIONAL VARIABLES

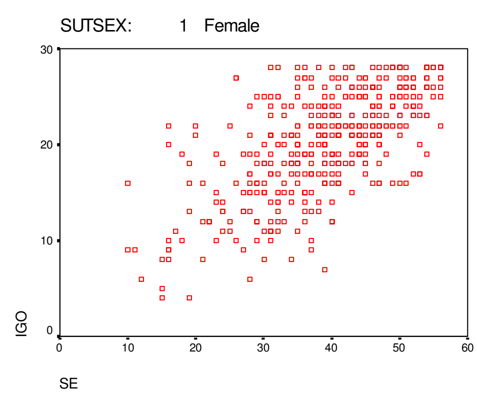


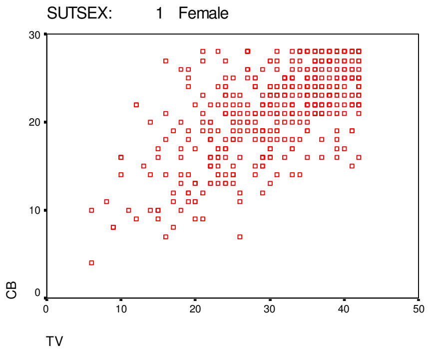








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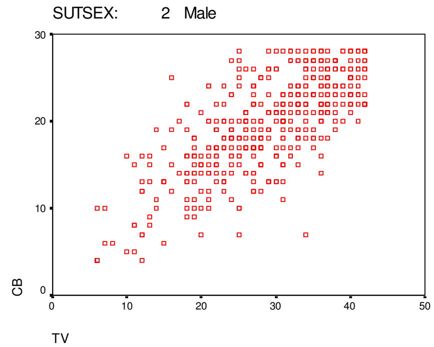
CB
TV
0
10
20
30
40
50


SUTSEX: 2 Male
CB
TV
0
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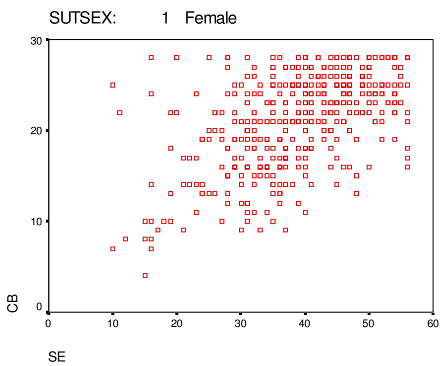
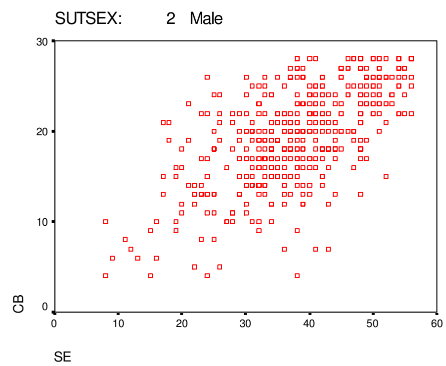
30
40
50


SUTSEX: 1 Female
CB
SE
0
10
20
30
40
50
60


SUTSEX: 2 Male
CB
SE
0
10
20
30
40
50
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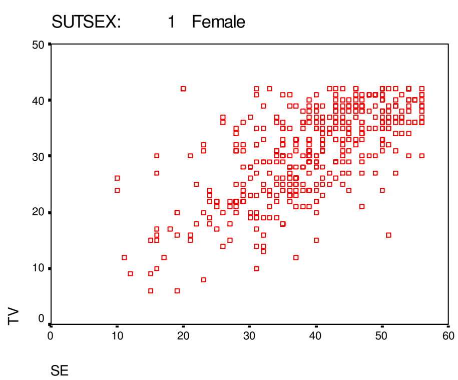
SUTSEX: 1 Female
TV
SE
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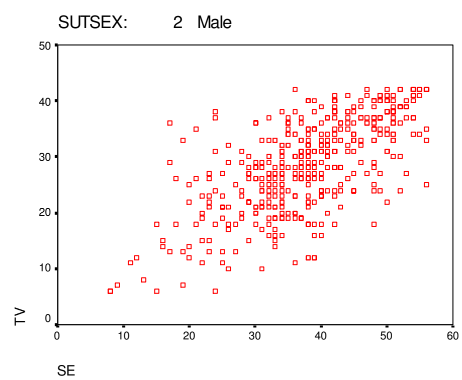
SUTSEX: 2 Male
TV
SE
0
10
20
30
40
50
60