# HIGH SCHOOL STUDENTS' PERCEPTIONS OF THEIR CLASSROOM LEARNING ENVIRONMENT, TEACHERS' COMMUNICATION BEHAVIOURS; AND THEIR LEARNING STRATEGIES

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**HIGH SCHOOL STUDENTS' PERCEPTIONS OF THEIR CLASSROOM LEARNING ENVIRONMENT, TEACHERS' COMMUNICATION BEHAVIOURS; AND THEIR LEARNING STRATEGIES**

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**ABSTRACT**

HIGH SCHOOL STUDENTS' PERCEPTIONS OF THEIR CLASSROOM LEARNING ENVIRONMENT, TEACHERS' COMMUNICATION BEHAVIORS; AND THEIR LEARNING STRATEGIES.

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The purposes of this study were to explore students' perceptions of the extent to which constructivist approaches are present in chemistry classes at high school level in Turkey, to assess students' perceptions of their chemistry teachers' communication behaviours in their classroom learning environments and to investigate the learning strategies of students in chemistry classes considering school type, gender, and grade level differences.

In this study, the Constructivist Learning Environment Questionnaire (CLES), the Teacher Communication Behaviour

Questionnaire (TCBQ) and the Motivated Strategies for Learning Questionnaire (MSLQ) were used as measuring instruments. In addition, the questionnaires included some questions for demographic characteristics of participants.

The study was conducted in conveniently selected two schools (private and public) in Ankara with a total of 994 ninth and tenth grade students in the second term of 2006-2007 semesters. Data obtained from the administration of measuring instruments by using the analysis of multivariate analysis of variance (MANOVA)

The results of the study indicated that school type, gender and grade level of the students had significant effect on perception of classroom learning environment, teacher' communication behaviour and perceived use of learning strategies. For instance, students in private schools perceived their classroom-learning environment more constructivist than student in public school. In addition girls rated that, their learning environment and teachers' communication behaviours more favourably than did boys. The study also showed that students use rehearsal-learning strategy mostly in their chemistry classrooms,

Keywords: Constructivist leaning environment, teacher communication behaviour, learning strategies, students' school type, gender and grade level.

# ÖZ

LİSE ÖĞRENCİLERİNİN KİMYA DERSİ SINIF ÖĞRENME ORTAMI, ÖĞRETMENİN İLETİŞİM DAVRANIŞLARI VE ÖĞRENME STRATEJİLERİNİ ALGILAMALARI

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Bu çalışma lise öğrencilerinin kimya dersinde sınıf öğrenme ortamını ne derecede bütünleştirici olarak algıladıklarını saptamak amacıyla yapılmıştır. Bu çalışma aynı zamanda öğrencilerin öğretmenlerinin iletişim davranışlarını nasıl algıladıklarını ve kimya dersinde çoğunlukla hangi öğrenme stratejilerini kullandıklarını belirlemek amacıyla düzenlenmiştir. Ayrıca, okul türü, cinsiyet ve sınıf düzeyinin algılamada farklılık yaratıp yaratmadığı da incelenmiştir. Bu Çalışmada Yapılandırmacı Öğrenme Ortamı Anketi (CLES), Öğretmenin İletişim Davranışları Ölçeği (TCBQ) ve

Öğrenmede Güdüsel Stratejiler Ölçeği (MSLQ) veri toplama araçları olarak kullanılmıştır.

Bu çalışma Ankara ili Çankaya ilçesinden seçilen iki okuldaki 994 öğrenciye 2006-2007 Eğitim ve Öğretim yılının 2. döneminde uygulanmıştır. Toplanan veriler çok yönlü varyans analizi (MANOVA) kullanılarak değerlendirilmiştir.

Sonuçlar, öğrencilerin sınıf öğrenme ortamı ve öğretmenin iletişim davranışlarını genellikle olumlu algıladıklarını göstermiştir. Ayrıca, okul türünün, cinsiyetin ve sınıf düzeyinin, sınıf öğrenme ortamı, öğretmenin iletişim davranışları ve kullanılan öğrenme stratejileri üzerinde önemli etkilerinin olduğu saptanmıştır.

Anahtar kelimeler: Bütünleştirici öğrenme ortamı, öğretmenin iletişim davranışları, öğrenme stratejileri, öğrenci okul türü, cinsiyeti ve sınıf seviyesi.

To My Family

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## LIST OF ABBREVIATIONS

CLES: Constructivist Learning Environment Survey

TCBQ: Teacher Communication Behaviour Questionnaire

MSLQ : Motivated Strategies for Learning Questionnaire

T-CLES: Turkish version of Constructivist Learning Environment Survey

T-TCBQ: Turkish version of Teacher Communication Behaviour Questionnaire

T-MSLQ : Turkish version Motivated Strategies for Learning Questionnaire

# CHAPTER I

## INTRODUCTION

Learning is the acquisition and development of memories and behaviours, including skills, knowledge, understanding, values, and wisdom. It is the goal education, and the product of experience. A number of factors have been found to influence students' approaches to learning. For instance, it has been recognised that students' perceptions of their learning environment have great influence on their approaches to learning and the quality of learning outcomes. (Fraser, 1998a; Ramsden, 1992; Waxman, 1991).

Most of the learning process occurs in the classrooms. Therefore, most educators agree on that the classrooms are the most important places for student's academic and personal development.

An area of research that has expanded rapidly over the past three decades focuses on classroom learning environments. Major interests of these researches were; the relationship between classroom learning environment and learning outcomes, impact of new curriculum or teaching method on a classroom's learning environment, effect of teacher on classroom environment, effect of students' age and gender on classroom environment, students' and teachers' perceptions on their

classroom environment and etc. ( Albridge, Fraser & Huang, 1999; Fraser, 1994, 1998; Margianti, Fraser & Aldridge, 2002; Ramsden, Martin & Bowden,1989; Ramsden, 1992; Waxman, 1991; Richardson & King, 1991; Young, Arbreton & Midgley,1992; Biggs & Moore, 1993). These studies have shown that classroom environment, teacher interpersonal skills, age and gender of the students have important influences on the students' outcomes.

The critical component of the classroom environment is heavily influenced by the interpersonal skills of a teacher (Creton, Wubbels, & Hooymayers, 1989). Teacher-student communication plays an important role in establishing a productive and stable classroom atmosphere (Levy, Wubbels, & Brekelmans, 1992). Özay, Kaya and Sezek (2004) stated that teacher-student interaction is an important part of secondary science school classrooms, because it builds friendly relationship between the teacher and students. When students feel that they can respect and trust their teacher, they tend to not only perform better but also grow more confident themselves. Many studies have shown the importance of positive teacher-student relationships (Cho, 2003; Wubbels & Levy, 1993; Fisher, Fraser, & Cresswell, 1995). In particular, teachers make a major contribution toward creating a positive learning environment in science classes through their interactions or communication with students (Wubbels & Levy, 1993). Teachers' affective reactions to students (attachment, concern, indifference, rejection) influenced their behaviour

toward them (Brophy & Everson,1981). Moreover, appropriate teacher-student interactions are also important to prevent discipline problems and to foster professional development (Fisher, Fraser, & Cresswell, 1995). Teacher and student interactions also have been shown to be particularly important to "constructivist" classrooms, where emotion plays a more prominent role (Warrs & Bentley, 1987). Wubbels & Levy (1993) stated that positive interactions and relationship between teachers and students promote students' interest and outcomes in science.

Teacher-student interactions are considered to be developmentally convenient when the students are responded quickly, directly and warmly by their teachers and when they are provided a variety of opportunities to participate in a two-way communication. In addition, identifying and elaborating on the feelings, interests, and activities of the students strengthen teacher-student interactions (Özay, Kaya, & Sezek, 2004).

In conclusion, studies conducted so far stated that classroom learning environment and student-teacher interactions play important roles in students' learning outcomes.

The initiative studies on learning environment firstly started in Western countries (Wubbels & Brekelmans, 1998; Wubbels & Levy, 1993; Fraser & McRobbie, 1995; Taylor, Dawson & Fisher, 1995; Taylor, Fraser & Fisher, 1995). In the following years Asian researchers focused on this field. Numerous striking studies were completed in Asian countries. Asian researchers have cross-validated the main contemporary classroom

environment questionnaires (e.g. Questionnaire on Teacher Interaction (Goh & Fraser, 1996; Riah, Fraser & Rickards, 1997),Science Laboratory Environment Inventory (Fraser & McRobbie, 1995; Wong & Fraser, 1995) Constructivist Learning Environment Survey (Fisher & Kim, 1999; Alridge, Fraser & Taylor, 2000) and What Is Happening In This Class?( Chionh & Fraser, 1998; Huang, Fraser & Alridge, 1998) that were originally developed in English. The questionnaires, which was originally developed in English have also been translated and validated in different languages such as Chinese, Indonesian, Korean and Malay. However, very few studies have been recorded in literature investigating learning environment in Turkey (Rakıcı, 2004; Özay et al. ,2004 ; Simseker, 2005; Telli, den Brok, & Cakiroglu, 2005; Güzel & Alkan, 2005).

As the past studies in this area reported that learning environment can be a determinants of students' achievement and their attitudes and should be taken into account. There is a great need for conducting research in the field of learning environment in Turkey.

Turkey is a developing country; accordingly, educators try to utilize new learning and teaching innovations in education field in order to improve students learning outcomes. These innovations have not always been successful, indeed mostly led to complex and negative results on the major components of the educational system. In addition, according to many national and international researches the level of education in Turkey couldn't achieve the goals set in the curriculum (Şahin, 2007). As a

result, the Ministry of National Education (MEB) started a reform action in primary curriculum in 2004. The Turkish curriculum for Grade 1 to 5 is redeveloped considering social constructivist theory of education. New curriculum was piloted in 2004-2005 school year and put into practice nationwide in 2005-2006 school year. A study carried by Güzel and Alkan (2005) in a pilot school showed that students have positive opinion on constructivist learning approach. The new curriculum based on constructivism is considered to be administrated in High Schools in Turkey in the following years. At this point, this study aimed to investigate which constructivist approach is present in high schools in Turkey.

"In a constructivist classroom, individuals construct knowledge by working to solve realistic problems, usually in collaboration with others. The focus is primarily on a student's motivation to learn and apply what they learn to the real world. Constructivists concentrate on showing students relevance in what they are learning. Learning is thought of as a change in meaning constructed from experience. The students are asked to construct knowledge themselves, not just receive it from the teacher. In the constructivist classroom teachers would pose good realistically complex and personally meaningful problems for students to solve" ( Russell, 2002, p.1).

The constructivist view of learning has made a major impact on science education, particularly during the past decade (Treagust, Duit, & Fraser, 1996). The implications for a science curriculum centred on a

constructivist philosophy were identified initially in a number of research studies, which focused on students' learning in science. Consequently, the aim of this study is to measure students' perceptions of the extent to which constructivist approaches are present in chemistry classes at high school level in Turkey. This study also aimed to assess students' perceptions of chemistry teachers' communication behaviours in their classroom learning environments. Lastly, the learning strategies of students in chemistry classes will also be investigated in this study.

Considering the fact that there are not so much studies regarding the classroom environment and teachers' communication behaviours in the field of science education, the current study can add valuable information to science education. The data obtained from the current study will make it possible for teachers, curriculum developers or administrators to obtain useful, reliable feedback on the classroom environment.

Moreover, teachers can use the information obtained in this study as a basis for systematic attempts to improve environments.

## 1.1. Problems and Hypothesis of the study

### 1.1.1. Main Problems of the Study

The aims of the present study are (1) to measure students' perceptions of the extent to which constructivist approaches are present in chemistry classes considering school type, gender and grade level of the students, (2) to assess students' perceptions of chemistry teachers'

interpersonal communication behaviours in their classroom learning environments considering school type, gender and grade level of the students and (3) to explore the effect of school type, gender and grade level of the students on thier perceived use of learning strategies (Rehearsal, Elaboration , Organisation, Critical thinking, Metacognitive Self regulation, Time and Study Environment).

1.1.2 Sub-problems of the Study.

The sub-problems related to main problem (1) are:

1. Is there a significant difference in the mean “personal relevance” scores for school type of students?
2. Is there a significant difference in the mean “uncertainty “scores for school type of students?
3. Is there a significant difference in the mean “critical voice” scores for school type of students?
4. Is there a significant difference in the mean “shared control” scores for school type of students?
5. Is there a significant difference in the mean “student negotiation” scores for school type of students?
6. Is there a significant difference in the mean “personal relevance” scores for girls and boys?
7. Is there a significant difference in the mean “uncertainty scores” for girls and boys?

8. Is there a significant difference in the mean “critical voice” scores for girls and boys?
9. Is there a significant difference in the mean “shared control” scores for girls and boys?
10. Is there a significant difference in the mean “student negotiation” scores for girls and boys?
11. Is there a significant difference in the mean “personal relevance” scores for ninth and tenth grade students?
12. Is there a significant difference in the mean “uncertainty scores” for ninth and tenth grade students?
13. Is there a significant difference in the mean critical “voice scores” for ninth and tenth grade students?
14. Is there a significant difference in the mean “shared control” scores for ninth and tenth grade students?
15. Is there a significant difference in the mean “student negotiation” scores for ninth and tenth grade students?

The sub-problems related to main problem (2) are:

16. Is there a significant difference in the mean “challenging” scores for school type of students?
17. Is there a significant difference in the mean “encouragement & praise” scores for school type of students?

18. Is there a significant difference in the mean “non-verbal support” scores for school type of students?
19. Is there a significant difference in the mean “understanding & friendly” scores for school type of students?
20. Is there a significant difference in the mean “controlling” scores for school type of students?
21. Is there a significant difference in the mean “challenging” scores for girls and boys?
22. Is there a significant difference in the mean “encouragement & praise” for girls and boys?
23. Is there a significant difference in the mean “non-verbal support” for girls and boys?
24. Is there a significant difference in the mean “understanding & friendly“ scores for girls and boys?
25. Is there a significant difference in the mean “controlling” scores for girls and boys?
26. Is there a significant difference in the mean “challenging” scores for ninth and tenth grade students?
27. Is there a significant difference in the mean “encouragement & praise” scores for ninth and tenth grade students?
28. Is there a significant difference in the mean “non-verbal support” scores for ninth and tenth grade students?

29. Is there a significant difference in the mean “understanding & friendly” scores for ninth and tenth grade students?
30. Is there a significant difference in the mean “controlling” scores for ninth and tenth grade students?

The sub-problems related to main problem (3) are:

31. Is there a significant difference in the mean “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “ scores for school type of the students?
32. Is there a significant difference in the mean “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “ scores for girls and boys?
33. Is there a significant difference in the mean “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “ scores for ninth and tenth grade students?

### 1.2. Null Hypotheses

The null hypotheses related to main problem(1) :

1. There is no significant main effect of school type on students' perceptions of classroom learning environment in chemistry classes.
2. There is no significant main effect of gender on students' perceptions of classroom learning environment in chemistry classes.
3. There is no significant main effect on gender of students' perceptions of classroom learning environment in chemistry classes.

The null hypotheses related sub-problems of main problem(1) :

4. There is no significant main effect of school type of students on the population means of the scores on "personal relevance" scale in T-CLES.
5. There is no significant main effect of school type of students on the population means of the scores on "uncertainty " scale in T-CLES.
6. There is no significant main effect of school type of students on the population means of the scores on "critical voice" scale in T-CLES.
7. There is no significant main effect of school type of students on the population means of the scores on "shared control" scale in T-CLES..

8. There is no significant main effect of school type of students on the population means of the scores on “student negotiation” scale in T-CLES.
9. There is no significant main effect of gender on the population means of the scores on “personal relevance” scale in T-CLES.
10. There is no significant main effect of gender on the population means of the scores on “uncertainty ” scale in T-CLES.
11. There is no significant main effect of gender on the population means of the scores on “critical voice” scale in T-CLES.
12. There is no significant main effect of gender on the population means of the scores on “shared control” scale in T-CLES.
13. There is no significant main effect of gender on the population means of the scores on “student negotiation” scale in T-CLES.
14. There is no significant main effect of grade level on the population means of the scores on “personal relevance” scale in T-CLES.
15. There is no significant main effect of grade level on the population means of the scores on “uncertainty ” scale in T-CLES.
16. There is no significant main effect of grade level on the population means of the scores on “critical voice ” scale in T-CLES.
17. There is no significant main effect of grade level on the population means of the scores on “shared control” scale of T-CLES.
18. There is no significant main effect of grade level on the population means of the scores on “student negotiation” scale in T-CLES.

The null hypotheses related to main problem (2) are :

19. There is no significant main effect of school type on students' perceptions of their teachers' communication behaviours in chemistry classes.
20. There is no significant main effect of gender on students' perceptions of their teachers' communication behaviours in chemistry classes.
21. There is no significant main effect of grade level on students' perceptions of their teachers' communication behaviours in chemistry classes.

The null hypotheses related to sub-problems of main problem (2) are :

22. There is no significant main effect of school type of students on the population means of the scores on "challenging" scale in T-TCBQ.
23. There is no significant main effect of school type of students on the population means of the scores on "encouragement & praise" scale in T-TCBQ.
24. There is no significant main effect of school type of students on the population means of the scores on "non-verbal support" scale in T-TCBQ.

25. There is no significant main effect of school type of students on the population means of the scores on “understanding & friendly” scale in T-TCBQ.
26. There is no significant main effect of school type of students on the population means of the scores on “controlling” scale in T-TCBQ.
27. There is no significant main effect of gender on the population means of the scores on “challenging” scale in T-TCBQ.
28. There is no significant main effect of gender on the population means of the scores on “encouragement & praise” scale in T-TCBQ.
29. There is no significant main effect of gender on the population means of the scores on “non-verbal support” scale in T-TCBQ..
30. There is no significant main effect of gender on the population means of the scores on “understanding & friendly“ scale in T-TCBQ.
31. There is no significant main effect of gender on the population means of the scores on “controlling” scale in T-TCBQ.
32. There is no significant main effect of grade level on the population means of the scores on “challenging” scale in T-TCBQ.
33. There is no significant main effect of grade level on the population means of the scores on “encouragement & praise” scale in T-TCBQ.
34. There is no significant main effect of grade level on the population means of the scores on “non-verbal support” scale in T-TCBQ.

35. There is no significant main effect of grade level on the population means of the scores on “understanding & friendly” scale in T-TCBQ.
36. There is no significant main effect of grade level on the population means of the scores on “controlling” scale in T-TCBQ.

The null hypotheses related to sub-problem (3) are :

37. There is no significant main effect of school type of students on the population means of the scores on “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “.
38. There is no significant main effect of gender of students on the population means of the scores on “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “.
39. There is no significant main effect of grade level of students on the population means of the scores on “perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self Regulation, Time and Study Environment) “.

# CHAPTER II

# REVIEW OF RELATED LITERATURE

The main points explained in this chapter are the reviews of the literature about classroom learning environment, teacher- student interactions and learning styles of the students.

## 2.1. Classroom Learning Environment

Classroom learning environment refers to a space where the learners and teachers interact with each other and use sorts of tools and information resources in their inquiry of learning activities (Wilson, 1996). Fraser (1994) regards these learning environments as the social-psychological context or determinants of learning. He also asserted that student outcomes are strongly influenced by learning environment and the learning environment has an important role in developing the effectiveness of learning from the level of the institution to the level of individual classroom.

Learning environment has been investigating by many researchers for many years. The first studies were done by Hartshorne and May (1928) and Newcomb (1929). They similarly noted that the environment could alter student behaviour. They confirmed that personality characteristics

and students' tendency to participate in deceiving behaviours, such cheating on exams, given the opportunity in differing situations were poorly correlated. The cornerstone of learning environment studies can be found in the theoretical and conceptual foundations of Lewin (1936) and Murray (1938). Lewin (1936) assumed that the environment and its interaction with the person mainly determine human behaviour. Murray (1938) extended this notion with his needs-press model. According to Murray (1938), motivational personality traits or personal needs show the tendency for individuals to move in the way of goals, and environmental press is the external factor that either supports or frustrates the expression of those needs. This model was extended to teaching-learning situations (Anderson & Walberg, 1974; Moos, 1974; Rentoul & Fraser, 1979) and to a view of the class as a social system (Getzels & Thelen, 1960). With the previous background, psychological characteristics of learning environments have been conceptualised, measured and investigated using perceptions of students since late 1960s (Fraser & Walberg, 1991). Some highlights from the field of classroom learning environments include (1) the use of qualitative methods in learning environment research (Tobin, Kahle & Fraser,1990), including the combination of quantitative and qualitative methods (Fraser & Tobin, 1991; Tobin & Fraser, 1998) (2) the development of preferred forms of instrument which permit investigations of differences between the actual and preferred classroom environments (Fisher & Fraser, 1983) and person environment fit studies whether

students achieve better in their preferred classroom environment (Fisher & Fraser, 1983) (3) teachers' use of assessments of actual and preferred classroom environment in the action research attempts to improve their classrooms (Fisher & Fraser, 1986) (4) the interoperations of learning environments ideas into teacher education (Fraser 1993) and school psychology (Burden & Fraser, 1993) (5) the idea of 'grain sizes' in learning environment research (Fraser 1996).

There has been little research on gender differences in perceptions of the learning environment at secondary level. According to Meece and Courtney (1992), classroom environments has been supportive for female students if they were characterised by low levels of competition and social comparison among students, high levels of individualised and cooperative learning, higher teacher support and equitable treatment of male and female students.

Huang and Waxman (1993) compared Asian- and Anglo-American students' perceptions of the learning environment in mathematics and found that girls have more positive perceptions of their mathematics-learning environment than did the boys.

Similarly, in a study of chemistry students' perceptions of their learning environments in Singapore secondary schools, Wong and Fraser (1994) found that female students held more positively perceptions of classroom environment than boys. On the other hand, a study of Terwel et al. (1994) indicated that girls in physics and mathematics perceived their

classroom learning environments less positively than boys. The study reported that, the participation of girls in physics classes was observed to be less than did the boys.

Another study conducted by Goh and Fraser in 1995. In this study, They measured the achievement and perceptions of the classroom learning environment of primary school mathematics students in Singapore. They found that girls generally viewed their classroom more favourable than boys. This was similar to Huang and Waxman's (1993) findings. The study of Huang and Waxman (1993) also revealed that students in the lower grade levels held more favourable perceptions of their mathematics learning environment- they were more involved, satisfied and had greater parental involvement.

The study carried by Midgley, Eccles and Feldlaufer (1991) supported the findings of Huang and Waxman. Midgley et al. (1991) performed a study to determine the grade level effect on perceived classroom learning environment. They reported that students experienced significant changes in the classroom environment as a result of transition. Changes were likely to result in less positive attitudes toward academic activities at higher-grade levels.

In another study, Ding and Hall (2007), indicated that students tended to feel more negative about their educational experience than younger students. Male students tended to have more negative attitudes than female students.

Finally, Waxman and Huang (1998), investigated students' gender grade level and subjects area to students' perceptions of classroom learning environment. Over 13000 students from 96 urban elementary, middle and high schools that served predominantly minority students were administrated a modified version of the classroom environment scale (CES) and the Instructional Learning Environment Questionnaire (ILEQ) . Female students generally reported higher score for their perceptions of the learning environment than did male students. In addition, there were many statistically and educationally significant differences by grade level. In general middle school classes had less favourably perceptions of their learning environment than did either elementary or high school students.

### 2.1.1. Constructivist Perspective of Learning Environments

Constructivism, which evolved from cognitive and developmental perspective of Piaget, interactional and cultural emphasis of Vygotsky works and philosophies of others, reflects a shift from teacher-centred approach based on behaviourism to student-centred approach based on cognitive theory. Therefore, in constructivist theory, emphasis is placed student rather than teacher. It is student who constructs his or her own knowledge with the guidance of the teacher so knowledge is not something to be transferred to but is a process of construction and reconstruction.

Constructivism has made strong impact internationally on the educational field for over 30 years. In particular, science educators have been concerned with teaching strategies based on notion of constructivism in an attempt to enhance students' conceptual understanding in science subjects. Those notions have been utilized as basic frameworks to reform traditional practices (Tregust, Duit & Fraser, 1996)

Table 2.1 compares the traditional classroom to the constructivist one. Significant differences can be seen in basic assumptions about knowledge, students, and learning.

Several studies indicate that application of constructivism lead to students who are more motivated, more excited about science, more able to science to real life situations, more gender accommodated, and more able in problem solving than traditionally taught students. (Boaler, 1998; Caprio, 1994; Baylor. 1997)

In the study of Hardy, Jonan, Möller, and Stern (1999) two curricula on floating and sinking were compared within constructivist learning environments, varying in instructional support. The two curricula differed in sequencing of content and teacher cognitively structuring statements. The study was carried out with 162 3$^{rd}$ grade students. The results of the study indicated that both instructed groups showed significant gains on test on understanding the concept of density and buoyancy force as compared to a baseline group without instruction. One year later, the high instructional support group was better than the low instructional support group on the

reduction of misconceptions and adopting of scientific explanations. Thus, instructional supports within constructivist learning environments fostered elementary school children' conceptual change of physics.

**Table 2.1** Comparison of Traditional Classrooms and Constructivist Classrooms.

| Traditional classrooms | Constructivist classrooms |
|---|---|
| Curriculum begins with the parts of the whole. Emphasizes basic skills. | Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts. |
| Strict adherence to fixed curriculum is highly valued. | Pursuit of student questions and interests is valued. |
| Materials are primarily textbooks and workbooks. | Materials include primary sources of material and manipulative materials. |
| Learning is based on repetition. | Learning is interactive, building on what the student already knows. |
| Teachers transfer information to students; students are recipients of knowledge. | Teachers have a dialogue with students, helping students construct their own knowledge. |
| Teacher's role is directive, rooted in authority. | Teacher's role is interactive, rooted in negotiation. |
| Assessment is through testing, correct answers. | Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product. |
| Knowledge is seen as inert. | Knowledge is seen as dynamic, ever changing with our experiences. |
| Students work primarily alone. | Students work primarily in groups. |

Table adapted from Brooks & Brooks (1993).

Puacharearn and Fisher (2004) performed a study to determine whether teachers can use cooperative learning integrated with constructivist teaching through an action research process in order to improve their classroom environments. In the first phase of the study, the Constructivist Learning Environment Survey (CLES), an instrument for assessing students' perceptions of the actual and preferred classroom environment through a constructivist perspective, 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 Nakornsawan Province, Thailand. Student Actual and Preferred Forms of the CLES, assessing Personal Relevance, Uncertainty, Critical Voice, Shared Control and Student Negotiation, were administered. Factor analysis and internal consistency measures supported a five-factor structure for both Actual and Preferred Forms. Students' attitudes to science were also measured. A number of teachers then participated in an attempt to improve their classroom environments, through the use of cooperative learning integrated with a constructivist teaching approach. 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.

Güzel and Alkan (2005) designed a study to determine the views of teacher and students regarding the new curriculum that is being piloted on the basis of constructivism in Turkey. For this purpose they used Turkish version of Constructivist Learning Environment Survey (T-CLES) developed by Taylor and Fraser at 1991 and translated by Güzel and Alkan in 2005. The sample of the study was 600 students; 253 male and 347 female , whose ages ranged between 10 and 12 and who attend the Pilot Elementary Schools in İzmir. The study showed that the teachers are strained in choosing activity in the stage of classroom management and the construction of the concept. Also the results showed that the teachers could not require the sharing of responsibility. The students had positive opinions about the application of the Constructivist Learning Approach (CLA); but they were negative about the subscales of the CLES. For instance, the students could not establish relation with the science, the real word and the school.

Alridge, Fraser and Taylor (2000) analysed the validation and use of English and Chinese versions of the CLES in a cross-national study of high school science classrooms Australia and Taiwan. The CLES was administered to 1081 students from 50 classes in Australia and 1879 students from 50 classes in Taiwan. Data analyses supported each scale's internal consistency reliability and ability to differentiate between

classrooms. A comparison of CLES scale mean scores in two countries revealed that Australian students perceived more Critical Voice and Student Negotiation and less Personal Relevance, Uncertainty and Shared Control than students in Taiwan.

Fisher and Kim (1999) conducted a research to investigate the effect of the science curriculum reform in Korea on the classroom-learning environment from a constructivist point of view. Constructivist Learning Environment Survey (CLES) was used as measuring instrument. It was administered to 1083 students and 24 science teachers in 12 different schools. One class of $10^{th}$ grade students and one class of $11^{th}$ grade students were sampled at each school. Results indicated that grade 10 students held more positive perceptions of their learning environment in general science classes than did grade 11 students. The $10^{th}$ grade general science classes were designed so that students would learn about and understand basic science concept through inquiry and negotiation; however, the $11^{th}$ grade students studied an academic centred science curriculum.

Another study that is conducted by Fraser and Lee (2001) examined the science classrooms in Korea from two perspectives: constructivism and student teacher interaction patterns. The Constructivist Learning Environment Survey (CLES) and the Questionnaire on Teacher Interaction (QTI) were used to obtain comprehensive information on science classroom environments. The study involved $10^{th}$ and $11^{th}$ grade

students from different streams, 145 from 10th grade and 195 from 11th grade level were participated in the study. The study revealed that science lessons sometimes conveyed the notions of constructivism as assessed by five factors described in the CLES. This suggest that active implementation of constructivism in practice by teachers has been supported by various bodies.

Yilmaz-Tüzün, Cakiroglu, and Boone. (2006) investigated the associations between students' perceptions of the learning environment and their attitudes, and the differences in students' perceptions by gender, grade levels and academic achievement. A total of 2290 students were involved in the study. The results pointed that female students had more opportunity to discuss their teachers' pedagogical strategies and had more engagement with learning about scientific knowledge. Tüzün et al., reported that grade level had significant effect on critical voice and student negotiation scales of the CLES. Namely, 11th grade students had lower mean scores than 9th and 10th grade students with respect to these two scales.

Tsai (2000) conducted a study to explore the interplay between students' scientific epistemological beliefs and their perceptions of constructivist learning environments. Through analysing 1,176 Taiwanese tenth-graders' (16-year-olds) questionnaire responses, this study found that students tended to perceive that actual learning environments were less constructivist orientated than what they preferred. Students having

epistemological beliefs more orientated to constructivist views of science tended to have a view that actual learning environment did not provide sufficient opportunities for social negotiations and prior knowledge integration. Furthermore, they show significantly stronger preferences to learn in the constructivist learning environments where they could (1) interact and negotiate meanings with others, (2) integrate their prior knowledge and experiences with newly constructed knowledge and (3) meaningfully control their learning activities. The main thrust of the findings drawn from this study indicated that, teachers need to be very aware of students' epistemological orientation towards scientific knowledge, and to complement these preferences when designing learning experiences, especially to provide constructivist-based lessons to enhance science learning for students who are epistemologically constructivist orientated.

Dorman and Adams (2004) designed a study to explore links between classroom environment and self-efficacy: specifically, how students perceived the learning environment of their mathematics classrooms and how this related to their own perceptions about their level of competence in the subject. They reviewed other researches in the fields of academic efficacy and classroom environment and undertook empirical research to investigate whether specific aspects of classroom environment were linked to measures of student academic efficacy. In this study 2651 mathematics students in Years 8,10 and 12 from nine

Australian and sixteen British secondary schools took part. They were asked to complete two questionnaires during a mathematics lesson. Both questionnaires required students to respond on a five-point scale ranging from 'almost never' to 'almost always'. One questionnaire set out to measure academic efficacy in mathematics. The other questionnaire consisted of 60 questions intended to provide a comprehensive assessment of the classroom environment. This questionnaire was composed of 42 items on seven scales taken from the What Is Happening In This Classroom? (WIHIC) instrument and 18 items on three scales derived from The Constructivist Learning Environment Survey (CLES). The latter was included to see whether constructivist environments had any specific effects on efficacy. They found that the three CLES scales contributed very little to differences between student efficacy scores. More of the differences (38%) in student efficacy were explained by the seven WIHIC scales. So, in this study, the instrument designed to measure constructivist aspects of the classroom contributed little to explaining student differences in self-belief.

McClure, Johnson and Jackson (2003) conducted a study to utilize the Constructivist Learning Environment Survey for Social Sciences (CLES-SS) as a means of assessing the constructivist nature of two selected American government classes taught by the same professor at Saint Mary's University. The classes were selected for ease of accessibility, and as an opportunity to pilot the CLES-SS instrument.

Lower average responses were observed in the fields of shared control and student negotiation, wheras students scores wre highers on the categories of relevancy and critical voice. The result of the study indicated that the instrument might have possibilities for application within college level social science classrooms. McClure et al. reported that, if properly utilized in college classrooms, the CLES-SS instrument could provide a valuable perspective into the characteristics of that learning environment.

### 2.2. Teacher-Student Interactions

There are many studies related to students and teacher interactions. However teacher communication behaviours are going to be considered mainly in this title. In fact, student-teacher interactions are desirable in terms of in class and out of the class activities. A very strong relation was observed between interactional teacher behaviour, which is relationship between teacher and student, and student outcomes in the study of Brekelmans, Wubbels, and Creton (1990). The interactional teacher behaviour and effective student outcomes seemed to be stronger than the relation between interactional teacher behaviour and cognitive student outcomes.

Tobin (1986) carried a research study with 13 teachers and their students. He stated a statistically significant relationship between the total teacher performance and measure and class average rates of student engagement. The correlation of the total score with class average

achievement was also statistically significant. The teacher performance indicators in the study of the researcher were significantly correlated with the student engagement.

In a study of McGarity and Butts (1984), 30 middle and high school science teachers and 672 students from six countries were involved. The results of the study showed that teacher management behaviour was related to both student engagement and student science achievement. Furthermore, student engagement was related to student science achievement gains. In addition, the relationship of classroom management with student science achievement and student engagement was consistent across differing levels of aptitude.

Akyıldız (1989) stated that teacher is an important factor that students perceived the learning environment. He also claimed that teacher should plan the teaching facilities and should take into consideration the personal difference among students. Furthermore, evaluations should be carried on according to the students' needs of reinforcements. Teachers had to be free from self-interests, instead; they should care into students' needs and interests.

In 1989, Taşkafa interviewed with 43 middle school students in Turkey and wanted them to write their teachers' desirable and non-desirable characteristics. The collected data showed that the desirable characteristics of the teachers by the students are: (1) using gesture and mimic in true way, (2) giving positive reinforcement to the students, (3)

being friendly, (4) understanding students' feelings. The non-desirable characteristics are; (1) isolating some of the students and giving more importance to them, (2) not giving chance to students talk in the class, (3) sneering at students (4) demanding to learn the subjects that were taught. Taşkafa emphasized that those teacher students' interactions were always important in teaching learning process to increase students' motivation and attitudes toward lesson since the students trust their teachers.

If students could trust their teachers, in the same way teachers could trust their students. Teacher should be democratic in the class activities and should make the lesson attractive as much as possible. Therefore the teachers were concluded as one of the best guide and supporters in the community (Güven, 1994).

Akboy (1991) in his study stated that a teacher should never be a strict disciplinarian instead he/she should give confidence with students. A teacher should take care of his/her words that were used in the classroom and he/she never swears.

Güner (1995) and Özler (1998) studied on the effects of teachers' characteristics on the students' achievement in general. According to Güner and Özler, teachers, which have the characteristics given below, are successful in creating a positive classroom-learning environment.

Teachers';

- Dynamic, energetic teachers,

- Smart,
- Friendly,
- Having leadership qualities,
- Trustable,
- Cheerful,
- Cooperative in the class activities,
- Relating to the personal problems of students,
- Relating to academic and social facilities designed by the students,
- Trying to increase his knowledge of profession
- Explaining the objective of the lesson,
- Setting proper connections between concepts,
- Announcing the result of the exams as soon as possible,
- Lecturing in a planned manner,
- Improving creative thinking of the students,
- Transforming scientific improvements to the lesson

Moreover, these teachers lead their students to achieve the goals of the courses and increase their learning outcomes.

Lawrenz (1975) conducted a study in the University of Minessota in USA to investigate the extent of the relationship between teacher characteristics and student outcomes and to provide an indication of the order of the importance among the teacher characteristics. This study directly covered the teachers who have some significant characteristics

and these characteristics were examined throughout of the study. The data of the study was collected by the researcher from 236 secondary science teachers from 14 states of which 84 were biology teachers, 111 were chemistry teachers, and 41 were physics teachers. The 14 states were stratified by the city size and a percentage of the schools from each population and were randomly selected. The results of the study showed that there were some differences among the science teachers in different courses that affected their Science Process Inventory scores. The study also showed that goal directed classes have higher achievement. This may be evidence for the usefulness of stating objectives, the student may know more about what is expected of them, therefore, accomplish more.

Harry and Fisher (1997) established a study to determine the associations between teacher personality and classroom environments. The study showed that the association between teacher personality type and perception of the classroom environment showed considerable consistency between students and teachers perceptions. Extravert teachers were positively associated with classrooms characterised by high levels of student cohesion. Perceiving type preferences were associated with both student and self-perceptions of informality and individualisation of work in the classroom. It was found that the classroom environments of "Sensating and judging" type teachers are likely to be seen by their students as task oriented (activities are clear and well organised) while

the classrooms of "Intuition and Perceiving" type teachers are seen informal (not strongly guided by formal rules).

Many studies mentioned so far demonstrated that a teacher has a important impact on how much pupils learn. Bressoux and Bianco (2004) carried a research on long-term effect of teachers on students' learning gains. The study was conducted at elementary school of France. Multilevel random crossed models were used to asses teacher effects over a period of two school years. The assessment of the study showed that the pupils' test scores in French and Mathematics after two years were linked to the second-year teachers' but not to the first-year teachers. These results suggest that teacher effects on pupils' learning gains wear off quickly over time. That is, immediate teacher effects on learning gains do exist, but not long-term ones.

### 2.2.1 Teacher Communication Behaviours

As discussed in the introduction part of the study, past researches have confirmed the important contribution made by teachers in creating a classroom environment or atmosphere conducive to science learning (Fraser 1998a). Teachers make a major contribution toward creating a positive learning environment in science classes, particularly through communication with their students. (Wubbels & Levy, 1993).

There are three common approaches to study teachers and their classrooms. These are (1) systematic observations, (2) descriptive case

studies, and (3) using students and teacher perceptions. Systematic observations and descriptive case studies have frequently used in the past; however now perceptual measures often are used, particularly when used investigating a large sample of classes (She & Fisher, 2002). The advantages of using student perceptions as indicators of the quality of the classroom environment have been elucidated in a number of studies (Rosenshine, 1971; Wolberg & Haertel, 1980; Stodolsky, 1984; Fraser 1998a; She & Fisher, 1999 ; Kent & Fisher,1997; Özay et al., 2004; den Brok et al., 2002; Black, 2005). Examples of past findings include: students are directly included in the classroom activities and observe more of the teacher's typical behaviour than does the observer(e.g., the researcher). Students are more familiar than with the teacher's features, which might be interpreted differently by an observer; using trained observers over a period of time is more expensive and time consuming than the administration and scoring the questionnaires; and the presence of observers could alter what generally occurs in the classrooms (She & Fisher, 2002)..

In the recent years, many studies have been conducted to develop and to use instruments that determine the qualities of classroom learning environment from the students' perspective. (Fraser & Walberg, 1991; Fraser, 1998a, 1998b). Furthermore, the association between learning environment variables and students outcomes has provided a particular focus for the use of classroom-learning environment instruments.

She and Fisher (1999a) developed a questionnaire, the Teacher Communication Behaviour Questionnaire (TCBQ), to assess students perceptions of the following five important teacher behaviours: Challenging, Encouragement and Praise, Non-verbal Support, Understanding and Friendly, and Controlling. The TCBQ was administered to 1202 students from 30 classes of Taiwan and to 301 students from 12 classes in Australia. The relativity and factorial validity of the TCBQ were found to be satisfactory for both the Taiwanese and Australian data. To further validate the questionnaire and understand the differences in teacher behaviour according to the perceptions of the students from the two countries, a qualitative approach was used. Students were interviewed in both Taiwan and Australia. The interview questions focused on these students' responses to selected questionnaire items. The results obtained from the interviews supported and helped to explain the quantitative results. In an application of the TCBQ in both countries, students' perceptions on four scales of the TCBQ were associated with the attitudes to their science classes.

In the same year, She and Fisher (1999b) focused on the validation of the TCBQ and its application in an investigation of students' perceptions of their teacher' communication behaviours in secondary schools science classrooms in Taiwan and the associations between these perceptions and the students' attitudes toward science and their academic achievement. In this study the TCBQ was administered to a sample of

1202 grades 7-9 students from 30 biology and physical science classes in Taiwan. Results indicated that all five scales in TCBQ were found to display satisfactory internal consistency reliability, discriminant validity and factor validity. There were strong associations between the scales of the instrument and students' attitudes towards science, and two of the scales were associated with cognitive teacher student-teacher interactions by focusing on the use of verbal and non verbal feedback to enhance students' attitudes toward science and their academic achievements outcomes.

In another study, She and Fisher (2002) employed the TCBQ to assess students' and teachers' perceptions of science teachers' communication behaviours in their classroom learning environments. The sample consisted of 1138 biological/physical science students from 28 classes in grades 7-9 in Taiwan. Each student in the sample responded to the TCBQ and 28 of the teachers responded to both the self and ideal teachers' version of the TCBQ. In addition, to provide cross-validation information for use of the English version of the TCBQ, 307 students in 12 classrooms of grades 7-9 science courses in Australia also responded to the questionnaire. According to the results of the study, girls perceived their teachers as more understanding and friendly than did boys, and teachers in biological science classrooms exhibited more favourable behaviour toward their students than did those in physical science classrooms. Differences were also noted between the perceptions of the

students and their teachers. Positive relationships were found between students' perceptions of their teachers' communication behaviours and their attitudes towards science. Students' cognitive achievement scores were higher when students perceived their teacher as using more challenging questions, as giving more non-verbal supports, and as being more understanding and friendly.

Özay, Kaya and Sezek (2004) designed a study to investigate students' perceptions of their science teachers' communication behaviours in their classroom learning environments. The TCBQ instrument was administrated to 389 biological, physical and chemical science students in grades 7-9 in Turkey. The result of the study indicated that girls perceived their teachers as being more understanding and friendly, giving more encouragement and praise than did the boys. In addition, the teachers in biological and chemistry science classrooms showed more favourable behaviour toward their students than did the teachers in physical science classrooms.

Similar to Özay et al. (2004), in the study of Yılmaz-Tüzün (2006), girls were appeared to perceive that their teachers as more understanding and friendly and as being more controlling. In addition, Yılmaz-Tüzün reported that, when the grade level increases students indicated fewer occurrence for challenging, encouragement and praise, non-verbal support, and understanding and friendly scales of the TCBQ in their classrooms.

Cirillo and Herbel-Eisenmann ( 2006 ) describes the results of a questionnaire, the Teacher Communication Behaviour Questionnaire (TCBQ), distributed to 178 students. The TCBQ assesses students' perceptions of five teacher communication behaviours. This exploratory study showed that the TCBQ, which was developed for science classrooms, could provide useful information about teacher communication behaviour in mathematics classrooms as well.

Brok, Bergen and Stahl (2002) conducted a study to investigate the empirical structure underlying students' perceptions of their teachers' behaviours in terms of the amount of control displayed in the regulation of the students' learning activities. A group of 2061 Dutch secondary school students taught by 67 teachers completed as 14-item survey that examined their perceptions. Data analysis indicated that students distinguished between three types of teacher control. These included: strong teacher control, mainly consisting of teachers providing students with strategies to perform their learning activities; shared teacher control, emphasizing the sharing of responsibility between student and teachers; and loose control, focusing on students' own decision making during the performance of learning activities. The shared control factor included items that referred to a situation in which students were asked to work cooperatively as well as items that referred to situations in which students showed initiative during whole class situations.

## 2.3 Learning Strategies

People may vary in how they perceive and acquire information, conceptualise, form ideas, process and memorize, form value judgements, and the way they behave. (Hickson & Baltimore, 1996). It has been recognised that understanding the way which students learn is a key element for the improvement of education. In the classroom each student has unique personality and motivational factors that influence the way they respond to school and acquire basic educational skills. (Collinson, 2000). Many researchers on learners reported that in order to increase the learning gains of the students, the instruction must be designed with students learning styles in mind. Educators are becoming increasingly aware that an essential element in improving the academic success of students is recognising the way, which they learn. (Dunn, Bruno, Sklar & Beudry, 1990).

Being a lifelong learner is becoming an essential capability for effective functioning as a professional in the 'information age'—an era characterized by the rapidly increasing amount of human knowledge. In order to become a lifelong learner one has to acquire strategies that help to regulate one's learning and to increase the likelihood of meaningful understanding (Schunk & Zimmerman, 1994; Pintrich, 2000).

Learning orientations or approaches have long been recognized as a prerequisite for effective application of learning strategies and as such have been subject to a great deal of research. Among the various

orientations and approaches to learning surface, deep and achieving approaches have accumulated a substantial body of international research (Entwistle, 1991). A deep approach to learning is characterized by the learner's intention to understand the material to be learnt by applying strategies such as reading widely, using a variety of resources, discussions, activating prior knowledge, practicing reflection, etc. A surface approach is indicated by an intention to reproduce the material to be learnt by means of rote-learning strategies. The achieving approach (also referred to as the strategic approach) is characterized by an intention to excel by using highly organized learning processes. As this approach relates to the particular learning context, whereas the other two approaches relate to the content of the material, it is possible to have composite approaches of surface achieving and deep achieving.

Learning strategies used in this study, which include rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation were derived from an appreciable body of cognitive research. They all indicated that cognitive processing affects the quality of student learning. Accordingly, students use different strategies for different learning demands. Students use rehearsal strategy for learning discrete information. However this strategy does not provide the intensity of knowledge to understand relationships between ideas within an academic area. Understanding the depth of the knowledge needs deeper processing using cognitive strategies, which attend to the structure of knowledge

within a field (Lynch, 2006). The second learning strategy, elaboration, helps students to develop stronger knowledge base. Summarizing, creating analogies, paraphrasing, and generative note taking are examples of elaborative strategies. Since academic disciplines consist of a variety of knowledge organized in a particular way, becoming proficient within a major therefore asks an organization cognitive strategy. This strategy involves clustering, outlining, and distinguishing between the main idea and supporting ideas in a text or lecture. Critical Thinking is "the extent to which students report applying previous knowledge to new situations in order to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence." (Pintrich, Smith Garcia, & McKeachie, 1991, p. 22). Metacognitive-regulation investigated in this study refers to metacognitive processing, a student's awareness, knowledge, and control of their learning. A large body of researches conducted before have demonstrated that learning is strengthened when students are aware of their learning strategies and change those strategies to fit their task demands. (Bransford, Brown & Cocking, 1999; Schneider & Pressley, 1997; Weistein & Mayer, 1986).

A few studies have been conducted in Turkey so far to investigate the learning strategies that the Turkish students used. One of these studies was belong to Akınoğlu and Sarıbayrakdar (2007). They reported that, students used repetition strategy mostly in studying history courses. Nevertheless, the least used strategy was reported to be giving meaning.

Another study, which was conducted by Sungur and Tekkaya in 2006, investigated the effectiveness of problem-based learning and traditional instructional approaches on different aspects of students' self-regulated learning involving motivation and learning strategies. The results of the study indicated that problem based learning students had higher level of intrinsic goal orientation and task value. Furthermore, the students instructed by problem-based learning had higher scores on use of elaboration, critical thinking, metacognitive self-regulation, effort regulation, and peer learning strategies.

Güvenç and Ün-Açıkgöz (2007) designed a study to study the effects of cooperative, individual concept mapping, and traditional teaching methods on learning strategy use. 122 students from an elementary school were participated in the study. The findings of the study showed that cooperative and individual concept mapping conditions promoted the use of effective learning strategies more than traditional teaching. In another study.

Özkal and Çetingöz (2006) studied the strategies used by the second grade elementary school students during social studies lessons in terms of the variables academic success, attitude towards the lesson and gender. 682 students were enrolled in this study. The data collected indicated that students' strategy use is affected by the attitudes of students towards the course, their success levels and genders.

As can be seen from the past studies, teachers should teach strategy which is appropriate to the students' ages and to the subjects matters. They should also give examples about how to execute those strategies and about when and how the strategies are beneficial. Finally, teaching curricula should be reviewed by considering learning strategies.

# CHAPTER III

# METHODS

This chapter presents information about populations and sampling, definition of variables, measuring instruments, data collection, expression of methods to analyse data, assumptions, and limitations of the study.

## 3.1 Population and Sampling

Target population of the study was all students attending to high schools students in Ankara. Accessible population of the study is assumed to be all the students attending to high schools in Çankaya, a district of Ankara. However, $11^{th}$ grade students were not involved in this study since, they had taken medical report for preparation of University Entrance Exam (ÖSS). That is; during the administration of the instruments, $11^{th}$ grade students were not attending to the school. The sample of the study was decided to be two high schools in Çankaya. One of them was public school and the other was private school. In determination of the sample of the study, some criterions, such as, number of students, number of teachers, socio-economic status of the parents, conditions of the schools etc. were taken into consideration. Namely, the criterions that may affect the learning environment were assumed to be the same for both schools.

A total of 994 students, 596 from private school and 398 from public school, were involved in the current study. Table 3.1 represents the demographic information of the students. 468 ( 47.1 %) of the students were female and 526 ( 52.9 %) were female. Moreover, 680 (68,4 %) of the students were ninth grade and 314 (31,6 %) of the students were tenth grade.

**Table 3.1** Some demographic characteristics of the subjects. ($N_{total}$ = 994)

| | | Grade Level | | | | Gender | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 9,00 | | 10,00 | | Female | | Male | |
| | | N | % | N | % | N | % | N | % |
| School | Private | 364 | 53.5% | 232 | 73.9% | 287 | 61.3% | 309 | 58.7% |
| | Public | 316 | 46.5% | 82 | 26.1% | 181 | 38.7% | 217 | 41.3% |
| Total | | 680 | 100.0% | 314 | 100,0% | 468 | 100,0% | 526 | 100,0% |

## 3.2 Variables

### 3.2.1 Independent Variables

Independent variables are variables that are controlled or manipulated in accordance with the purpose of the investigation. In this study, “type of school,” “grade level” and “gender” are the independent variables.

Type of School: This variable classifies the school of the subjects’ that they are attending as “Public School ” or “Private School”.

Grade Level: It labels the subjects' grade level as either 9th grade or 10th grade .

Gender: It labels the gender of the subjects as male or female.

3.2.2. Dependent Variables

A dependent variable is a measure of the effect of the independent variable. In this study the scales of the instruments that was administrated to the subjects are the dependent variables. Personal relevance, Uncertainty, Critical voice, Shared control and Student negotiation scales measured by Constructivist Learning Environment Survey (CLES); Challenging, Encouragement & Praise, Non-Verbal support, Understanding & Friendly and Controlling scales measured by Teacher Communication Behaviour Survey (TCBQ); Rehearsal, Elaboration, Organisation, Critical thinking, Metacognitive self regulation, Time & Study environment scales measured by Motivated Strategies for Learning Questionnaire(MSLQ) are the independents variables of this study.

## 3.3 Instruments

Three survey instruments were used in this study; they are,

- Constructivist Learning Environment Survey (CLES)
- Teacher Communication Behaviour Survey (TCBQ)
- Motivated Strategies for Learning Questionnaire (MSLQ)

### 3.3.1 Constructivist Learning Environment Survey (CLES)

The Constructivist Learning Environment Survey (CLES) (Taylor, Dawson, & Fraser 1995; Taylor, Fraser, & Fisher 1997) was developed to assist researchers and teachers to ascertain constructivism epistemology in their classroom environments. The CLES also "assists teachers to reflect on their epistemological assumptions and reshape their teaching practice" (Taylor, Dawson, & Fraser 1995, p. 535). Fraser and Tobin (1991) believed that combining qualitative methods such as, reflective annotations and quantitative methods using the CLES provided valuable insights into teachers' pedagogy, perceived from the students' viewpoint.

The original CLES (Taylor and Fraser,1991) was guided by 4 criteria. These consisted of; conceptual foundations as consistent in the literature, personalised response format where students indicated their own perceptions of their classroom experiences, economy of use as the CLES can be undertaken in a relatively short time and salience to researchers, teachers, and students. The revised CLES (Taylor et al., 1995) now contained 30 items altogether with 6 items for each scale. The 5 scales of, Personal Relevance, Shared Control, Critical Voice, Student Negotiation and Uncertainty, represented the key dimensions of critical constructivism. The revised questionnaire enables teacher and researchers to obtain measures of students' perceptions in these key dimensions of critical constructivism. Each item had a 5-point scale

response with alternatives of never, seldom, sometimes, often and very often, where scoring was reversed for approximately half the items. Table 3.2 contains a description of the meaning of each of the five scales and a sample item for each scale for the CLES.

**Table 3.2** Description of scales and a sample item for each scale of the CLES

| Scale Name | Description of Scale | Sample Item |
|---|---|---|
| *Personal Relevance* | Relevance of learning to students' lives | In this science class I learn about the world outside the school. |
| *Uncertainty* | Provisional status of scientific knowledge | I learn that the views of science have changed over time. |
| *Critical Voice* | Legitimacy of expressing a critical opinion | It's OK to ask the teacher, "why do we have to do this?" |
| *Shared Control* | Participation in planning, conducting and assessing of learning | I help the teacher to plan what I'm going to learn. |
| *Student Negotiation* | Involvement with other students in assessing viability of new ideas | I ask other students to explain their ideas. |

Johnson and McClure (2002) revised the CLES and developed a new shortened version of the CLES. The five original scales were retained, but the number of items in each scale was reduced from six to four. The single negatively worded item was eliminated. Some of the original items were rephrased.

In this study, shortened and revised version of the CLES, named the CLES2 (20) is administrated to the subjects of the study. CLES2 (20) was translated into Turkish by Yılmaz-Tüzün and Çakıroğlu(2006). In order to check the validity and reliability of the Turkish version of CLES2 (20) varimax rotation and cronbach alpha coefficient was run. Analysis of individual and class alpha coefficients of the five dimensions of the CLES revealed that all the coefficients were accepted as high enough for the reliability of the items for the study. Using the individual means as the unit of analysis, scale reliability estimates range from 0.54 to 0.73. Using the class mean as the unit of analysis, scale reliability estimates ranged. The results obtained from the study of Yılmaz-Tüzün and Çakıroğlu showed that the Turkish version of CLES2 (20) was valid and reliable.

In the current study the reliability coefficients findings for the Turkish version of the CLES were parallel with those calculated by Yılmaz-Tüzün and Çakıroğlu(2006).The reliability coefficients were found to be varying between .67 and .79 (n=994) for five scales of Turkish version of the CLES.

### 3.3.2 Teacher Communication Behaviour Questionnaire (TCBQ)

The development of this questionnaire was based on She's (1997, 1998, 1999, 2000) studies of teacher - student interactions in science classrooms in Taiwan and on previous researches with the QTI (Fisher, Henderson & Fraser, 1995; Fisher & Rickards, 1997; Wubbels &

Levy,1993). The initial version of the questionnaire, named the Teacher Communication Behaviour Questionnaire (TCBQ), contained a total of 60 items, with 12 items belonging to each of the five scales. Each item is responded to on a 5-point scale with the alternatives of almost never, seldom, sometimes, often, and very often. Table 3.3 contains a description of the meaning of each of the five scales and a sample item for each scale.

**Table 3.3** Description of Scales and a Sample Item for Each Scale of the TCBQ

| Scale Name | Description of Scale | Sample Item |
|---|---|---|
| *Challenging* | Extent to which the teacher uses higher-order questions to challenge students in their learning | This teacher asks questions that require me to apply what I have learned in order to answer |
| *Encouragement and Praise* | Extent to which the teacher praises and encourages students | This teacher praises me for asking good questions |
| *Non-Verbal Support* | Extent to which the teacher uses non-verbal communication to interact positively with students | This teacher smiles at me to show support while I am trying to solve a problem |
| *Understanding and Friendly* | Extent to which the teacher understanding and friendly towards the students | This teacher understands when I doubt something |
| *Controlling* | Extent to which the teacher controls and manages in the classroom | The teacher requires us to be quiet in his/her class |

Items for the TCBQ were written originally in Chinese and then translated into English. Then, a back translation of the English version into Chinese, by people not involved in the original translation, was then

completed. This resulted in the modification of both the original Chinese and English version.(She & Fisher, 2000).

Sixty items were written for the first version so that statistical analyses could be used to eliminate items to about 40. This reduced number was desirable in order to ultimately have a questionnaire that is economical in time for students to respond.

Özay, Kaya and Sezek translated the TCBQ into Turkish in 2004 and to check the reliability of the Turkish version cronbach alpha coefficient was used. The Cronbach alpha reliability scale was 0.93 for the attitude of the Turkey sample. The cronbach alpha reliability for the Attitude scale was 0.90 for the Taiwan sample and 0.85 for the Australian sample. These can be regarded as satisfactory (She & Fisher, 2000).

In the current study the reliability coefficients findings for the Turkish version of the TCBQ were calculated. The reliability coefficients were found to be varying between .71 and ..88 (n=994) for five scales of Turkish version of the TCBQ

### 3.3.3 Motivated Strategies for Learning Questionnaire (MSLQ)

The MSLQ was developed at the National Center for Research to Improve Postsecondary Teaching and Learning at the University of Michigan by Pintrich, Garcia and McKeachie revised the instrument in 1991. It was designed to assess college students' motivational orientations and their use of different learning strategies in college courses. Two

sections comprise the MSLQ, motivational section and a learning strategies section. Table 3.4 lists these two sections and their subscales.

**Table 3.4** Motivation and Learning Strategies in MSLQ

| Scale | Subscale |
|---|---|
| *Motivation* | 1. Value components<br>a. Instrict Goal Orientation<br>b. Extrinc Goal Orientation<br>c. Task Value<br>2. Expectancy components<br>a. Control Beliefs<br>b. Self efficacy for Learning and Performance<br>3. Affective Domain<br>a. Test anxiety |
| *Learning Strategies* | 1. Cognitive and Metacognitive Strategies<br>a. Rehearsal<br>b. Elaboration<br>c. Organization<br>d. Critical Thinking<br>e. Metacognitive Self-Regulation<br>2. Research and Management Strategies<br>a. Time and Study Environment<br>b. Effort Regulation<br>c. Peer Learning<br>d. Help Seeking |

In English version of the questionnaire, motivation section consisted of 31 items that determine students' goal and value beliefs for a course, their beliefs about their skills to succeed in a course, and their anxiety about tests in a course. The Learning Strategy section of the MSLQ

includes 31 items including students' use of different cognitive and metacognitive strategies, that is; Elaboration, Organisation, Critical Thinking, Metacognitive Self-Regulation and 19 items concerning student management of different resources, namely, Time and Study Environment, Effort Regulation, Peer Learning and Help Seeking.

Students rate themselves on a seven point Likert scale type from "not at all true for me " to "very true of me" concerning different aspects of their learning. The MSLQ was translated into Turkish by Sungur (2004). The Cronbach alpha reliability for each scale of the Turkish version of the MSLQ were tested by Sungur. The Cronbach alpha reliability coefficients of the scales used in this study ranged between 0.73 - 0.81. Namely; the results showed that Turkish version of the MSLQ was valid and reliable.

In the current study six scales (Elaboration, Organisation, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment) of learning strategies section of the Turkish version of MSLQ were used to investigate students' learning strategies. The reliability coefficients findings for the Turkish version of the MSLQ were parallel with those calculated by Sungur (2004).The reliability coefficients were found to be varying between .69 and .,80 (n=994) for six scales of Turkish version of the MSLQ. Table 3.5 contains six scales of learning strategies section of the Turkish version of MSLQ that were used in this study to and a sample item for each scale.

**Table 3.5** Sample item for each sub-scale of learning strategies section of the MSLQ

| Scale Name | Sample Item |
|---|---|
| *Rehearsal* | When studying for this class, I practice saying the material to myself over and over. |
| *Elaboration* | When I study for this class, I pull together information from different sources, such as lectures, readings, and discussion. |
| *Organisation* | When I study the readings for this course, I outline the material to help me organise my thoughts. |
| *Critical Thinking* | I often find myself questioning things I hear or read in this course to decide if I find them convincing. |
| *Metacognitive Self-Regulation* | When I become confused about something I'm reading for this class, I go back and try to figure it out. |
| *Time & Study Environment* | I usually study in a place where I can concentrate on my course work. |

### 3.4. Data Collection

In this study 9$^{th}$ grade and 10$^{th}$ grade students from a Public High School and a Private High School were enrolled. The questionnaires were administrated to entire classes at one time during the 2006-2007-spring semester. Students were advised to complete the questionnaires in its entirety, not to discuss their responses with others near them, to be as sincere as possible. Students were reminded that their responses would be kept confidential. After questionnaires were completed, data were entered into SPSS. 994 students were involved in this study.

## 3.5 Analysis of Data

All collected data, which includes demographic information of the subjects, and responses obtained from the questionnaires are transferred to computer environment as an SPSS data file. The data obtained from the study was analysed in two parts: descriptive statistics and inferential statistics by using SPSS 13.0.

### 3.5.1 Descriptive Statistics

The mean and standard deviation of the dependent variables for each scale of the instruments were calculated.

### 3.5.2 Inferential Statistics

MANOVA was used to measure the effects of school type, grade level and gender on sub-dimensions of constructivist learning environment, teacher communication behaviour and learning strategies of the subjects.

## 3.6 Assumptions and Limitations

### 3.6.1 Assumptions

1. All subjects of the study were sincere in answering question of the measuring instruments
2. The surveys were administrated under standard conditions.

3.6.2. Limitations

1. The subjects of the study were limited to 994 9th grade and 10th grade students.
2. Validity of the study is limited to the reliability of the instruments used in the study.
3. Validity is limited to the sincereness of the responses given to the instruments questions.

# CHAPTER IV

# RESULTS

The results of the study are explained in three different sections. The first section presents missing data. The second section is descriptive statistics in which dependent variables of the study are explored. The third section deals with the inferential statistics.

## 4.1 Missing Data

The first section is related with data analysis. It was carried out before descriptive and inferential statistics. The questionnaires were administrated to 994 students; however, some questions in the questionnaires had not been answered by the students. Thus, to increase the data validity, SPSS missing value analysis was performed. Accordingly, the missing data were not involved in the analysis.

## 4.2 Descriptive Statistics

Descriptive statistics related to students' each of the CLES, TCBQ and MSLQ subscales scores, that is; Personal relevance, Uncertainty, Critical voice, Shared control and Student negotiation scales measured by Constructivist Learning Environment Survey (CLES); Challenging,

Encouragement and Praise, Non-Verbal support, Understanding and Friendly and Controlling scales measured by Teacher Communication Behaviour Survey (TCBQ); Rehearsal, Elaboration, Organisation, Critical thinking, Metacognitive self-regulation, Time and Study environment scales measured by Motivated Strategies for Learning Questionnaire(MSLQ) are presented in Tables 4.1, 4.2, and 4.3.

### 4.2.1 Descriptive Statistics for Learning Environment

The mean, standard deviation, skewness and kurtosis of each scale of the Turkish version of CLES (T-CLES) were calculated to explore the nature of the learning environment of the classrooms in chemistry lessons. Table 4.1 displays the descriptive statistics for five scales of T-CLES. The data shows that students sometimes perceive their learning environment as constructivist with the mean scores ranging between 2.74 and 3.54 when the maximum value is equal to 5.00; which corresponds to “often” and the minimum value is equal to 1.00 which corresponds to “never”. The lowest mean score observed in the mean score of Shared Control scale of T-CLES (2.74) indicates that students are seldom willing to share with teachers the design and management of learning activities, assessment criteria and social norms of the classroom. However, the highest score observed in the mean score of critical voice scale of T-CLES (3.54) exhibits that students feel comfortable to interrogate the teacher’s pedagogical plans and teaching methods. The standard deviations are less

than 1 in all scales; namely, there is not large diversity in the students' perceptions of classroom environment. In addition , the skewness and kurtosis values of all five scales of the T-CLES lie between –1 and +1 that is accepted to be perfect for psychometric purposes.

**Table 4.1** Descriptive statistics for the Turkish version CLES scales

| CLES Scales | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|
| Personal Relevance | 3.14 | 0.85 | -.051 | -.263 |
| Uncertain | 3.27 | 0.73 | -.167 | .165 |
| Critical Voice | 3.54 | 0.85 | -.403 | -.183 |
| Shared Control | 2.74 | 0.94 | -.199 | -.359 |
| Student Negotiation | 3.24 | 0.87 | -.144 | -.131 |

4.2.2 Descriptive Statistics for Teachers' Communication Behaviour

The mean, standard deviation, skewness and kurtosis of each scale of the Turkish version of TCBQ (T-TCBQ) were calculated to explore the nature of chemistry teachers' communication behaviours in the classrooms of Turkey. Table 4.2 displays the descriptive statistics for five scales of T-TCBQ.

The mean scores of the scales of the T-TCBQ lie between 2.86 and 3.27 when the maximum value is equal to 5.00; which corresponds to "often" and the minimum value is equal to 1.00, which corresponds to "never". In fact, the mean scores for each scale are close to each other,

which is about 3. This indicates that student-teacher communication in chemistry classes in Turkey is at medium level.

**Table 4.2** Descriptive statistics for Turkish version TCBQ scales

| TCBQ Scales | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|
| Challenging | 3.23 | 0.89 | -.269 | -.175 |
| Encouragement & Praise | 2.86 | 0.90 | .052 | .295 |
| Non verbal Support | 3.03 | 0.90 | -.167 | -.161 |
| Understanding & Friendly | 3.27 | 0.93 | -.337 | -.313 |
| Controlling | 3.23 | 0.71 | -.163 | -.206 |

Table 4.2 indicates that students perceived their teachers as understanding and friendly. Nevertheless, they perceived their teachers as being less encouragement and praise. The skewness and kurtosis scores for five scales ranges between –1 and +1 indicating that the all the variables show normal distribution which is necessary for most statistical analysis.

### 4.2.3 Descriptive Statistics for Students' Learning Strategies

The mean, standard deviation, skewness and kurtosis of each scale of the Learning Strategies section Turkish version of MSLQ (T-MSLQ) were calculated to explore the nature of students' learning strategies in chemistry classes. In the Current study six scales (Rehearsal, Elaboration,

Organisation, Critical thinking, Metacognitive self-regulation, Time and Study environment) of Learning strategies section of Turkish version of the MSLQ were investigated.

**Table 4.3** Descriptive statistics for five scales of Turkish version of MSLQ

| MSLQ Scales | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|
| Rehearsal | 4.22 | 1.42 | -.093 | -.502 |
| Elaboration | 4.11 | 1.32 | .039 | -.445 |
| Organisation | 4.16 | 1.36 | -.059 | -.533 |
| Critical Thinking | 4.05 | 1.21 | .064 | -.229 |
| Metacognitive Self-regulation | 4.08 | 0.98 | -.093 | -.157 |
| Time & Study Environment | 4.51 | 0.88 | -.406 | .278 |

The mean scores of the scales of the T-MSLQ lie between 4.05 and 4.51 when the maximum value is equal to 7.00, which correspond to “very true of me ” and the minimum value is equal to 1.00, which corresponds to “not at all true for me. The lowest mean score was observed in the use of critical thinking strategies, whereas, the highest mean scores was observed in the managing time and study environment. As can be seen from Table 4.3, all the measured scales are close to each other, which is about 4.10. Table 4.3 displays students’ perceived use of learning strategies for chemistry courses. The skewness and kurtosis scores for

six scales ranges between –1 and +1 indicating that the all the variable shows normal distribution which is necessary for most statistical analysis.

## 4.3 Inferential Statistics

This section deals with the verification of one-way between-groups multivariate analysis of variance (MANOVA) assumptions. Nine separate MANOVAs were performed to investigate the effect of school type, grade level and gender on students' perceptions of the extent to which constructivist approaches are present in chemistry classes to investigate students' perceptions of chemistry teachers' communication behaviours in their classroom learning environments and to explore the effect of school type on students' perceived use of learning strategies (Rehearsal, Elaboration , Organisation, Critical thinking, Metacognitive self-regulation, Time and Study environment).

### 4.3.1 Assumptions of Multivariate Analysis of Variance

#### 4.3.1.1 Sample Size

Since the cases in the cell are greater than the number of the dependent variables the sample size of the study was enough to proceed MANOVA analysis.

#### 4.3.1.2 Normality and Outliers

For normality assumption, univariate and multivariate normalities were checked. Univariate normality was checked for each of the dependent variables by using histograms, skewness and kurtosis values given in section 4.2. Histograms for all groups appear to be normally distributed. Also skewness and kurtosis values were all in acceptable range lying between –1 and +1.

To check multivariate outliers, mahalanobis distances was calculated and compared with the critical values given in the chi-square table for the dependent variables. All the outlying cases were removed from the data.

#### 4.3.1.3 Linearity

To check the linearity of the scores the scatter plots are generated for each pairs of the dependent variables. These plots do not show any evidence of non-linearity; therefore, the assumption of linearity is satisfied.

#### 4.3.1.4 Multicollinearity and Singularity

Tables 4.4, 4.5, and 4.6 shows the correlation coefficients between the dependent variables in the study. They all ranged between .248 and .771. These values indicated that there is a linear correlation between the dependent variables. Since none of the correlations greater than .90, the assumption of multicollinearity and singularity was not violated.

**Table 4.4** Correlation coefficients between the dependent variables for T-CLES

| | Personal Relevance | Uncertain | Critical Voice | Shared Control | Student Negotiation |
|---|---|---|---|---|---|
| Personal Relevance | - | .395** | .362** | .367** | .377** |
| Uncertain | | - | .343** | .248** | .334** |
| Critical Voice | | | - | .428** | .421** |
| Shared Control | | | | - | .438** |
| Student Negotiation | | | | | - |

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

**Table 4.5** Correlation coefficients between the dependent variables for T-TCBQ

| | Challenging | Encouragement & Praise | Non-verbal Support | Understanding & Friendly | Controlling |
|---|---|---|---|---|---|
| Challenging | - | .726** | .710** | .756** | .556** |
| Encouragement & Praise | | - | .771** | .706** | .486** |
| Non-verbal Support | | | - | .712** | .494** |
| Understanding & Friendly | | | | - | .459** |
| Controlling | | | | | - |

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

**Table 4.6** Correlation coefficients between the dependent variables for T-MSLQ

| | Rehearsal | Elaboration | Organisation | Critical Thinking | Metacognitive Self-regulation | Time & Study Environment |
|---|---|---|---|---|---|---|
| Rehearsal | - | .598** | .679** | .548** | .702** | .451** |
| Elaboration | | - | .677** | .710** | .730** | .498** |
| Organisation | | | - | .709** | .719** | .465** |
| Critical Thinking | | | | - | .690** | .507** |
| Metacognitive Self-regulation | | | | | - | .540** |
| Time & Study Environment | | | | | | - |

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

4.3.1.5 Homogeneity of Variance-Covariance Matrices

The test used to assess this assumption is Box's M Test of Equality of Covariance Matrices. As nine MANOVA tests were conducted to investigate the effect of the three independent variables (school type, gender, grade level) on the dependent variables measured by T-CLES, T-TCBQ and T-MSLQ, nine different Box's M values are obtained. (Table 4.7, Table 4.8 and Table 4.9)

**Table 4.7** Box's Test of Equality of Covariance Matrices for School Type variable

| | T-CLES | T-TCBQ | T-MSLQ |
|---|---|---|---|
| Box's M | 58.756 | 22.761 | 60.084 |
| F | 3.895 | 1.509 | 2.842 |
| df1 | 15 | 15 | 21 |
| df2 | 2870774 | 2810217 | 2688877 |
| Sig. | .000 | .092 | .000 |

**Table 4.8** Box's Test of Equality of Covariance Matrices for Grade Level variable

| | T-CLES | T-TCBQ | T-MSLQ |
|---|---|---|---|
| Box's M | 50.149 | 36.176 | 66.665 |
| F | 3.321 | 2.396 | 2.359 |
| df1 | 15 | 15 | 28 |
| df2 | 1592638 | 1586159 | 14002968 |
| Sig. | .000 | .002 | .000 |

As can be inferred from table 4.7 and 4.8, Box's M Test result found to be significant for School Type and Grade Level variables. The significant Box's M statistics mainly indicated that homogeneity variance and covariance matrices assumption was violated for T-CLES scales and T-MSLQ scales. Analysis of variance is reasonably robust to violations of the homogeneity of variance-covariance assumption, if the size groups are reasonably similar (e.g., largest/smallest = 1.5, Stevens, 1996, p.249). Therefore a violation of this assumption does not lead to serious problems,

because group size ratio is less than 1.5. In addition, Tabachnick and Fidell, (1996, p.401) recommend to use significance of Pillai's Trace instead of significance of Wilks' Lambda when the data has problems(small sample, unequal N values, violation of assumptions) in multivariate tests in which statistically significant differences among the groups on a linear combination of dependent variables are investigated. However, in situations where only two groups are investigated, the F-tests for Wilks' Lambda, Hotelling's Trace and Pillai's Trace are identical (Tabachnick & Fidell, 1996, p. 400). Significance of Wilks' Lambda was used in the current study to determine the difference between groups.

**Table 4.9** Box's Test of Equality of Covariance Matrices for Gender variable

| | **T-CLES** | **T-TCBQ** | **T-MSLQ** |
|---|---|---|---|
| Box's M | 20.675 | 39.318 | 30.199 |
| F | 1.371 | 2.607 | 1.429 |
| df1 | 15 | 15 | 21 |
| df2 | 3840425 | 3773500 | 3518352 |
| Sig. | .151 | .001 | .092 |

Table 4.9, which displays the Box's Test of Equality of Covariance Matrices for Gender variable, shows that there is no violation for this assumption. ( p>. 000 for all MANOVA)

4.3.1.6 Homogeneity of variance

For the equality of variances assumption, Levene's Test of Equality was used. As indicated in Table 4.10, variances of personal relevance scores across school type and grade level and variances of understanding & friendly scores across grade level were not equal. Finally, variances of rehearsal and time & study environment scores across grade level were measured to be not equal.

**Table 4.10** Levene's Test of Equality Error Variance

| | F | df1 | df2 | Sig. |
|---|---|---|---|---|
| Students' perceptions on learning environment across students' school type | | | | |
| Personal Relevance | 16.587 | 1 | 990 | .000 |
| Uncertain | .424 | 1 | 990 | .515 |
| Critical Voice | 6.633 | 1 | 990 | .010 |
| Shared Control | .409 | 1 | 990 | .523 |
| Student Negotiation | .001 | 1 | 990 | .980 |
| Students' perceptions on learning environment across students' gender | | | | |
| Personal Relevance | .011 | 1 | 990 | .918 |
| Uncertain | .460 | 1 | 990 | .498 |
| Critical Voice | .035 | 1 | 990 | .851 |
| Shared Control | .741 | 1 | 990 | .390 |
| Student Negotiation | .183 | 1 | 990 | .669 |
| Students' perceptions on learning environment across students' grade level | | | | |
| Personal Relevance | 8.640 | 1 | 990 | .003 |

**Table 4.10** continued

| | F | df1 | df2 | Sig. |
|---|---|---|---|---|
| Uncertain | .078 | 1 | 990 | .780 |
| Critical Voice | .844 | 1 | 990 | .358 |
| Shared Control | .294 | 1 | 990 | .588 |
| Student Negotiation | 2.821 | 1 | 990 | .093 |
| Students' perceptions on teacher communication behaviour across students' school type | | | | |
| Challenging | .030 | 1 | 983 | .863 |
| Encouragement & Praise | .820 | 1 | 983 | .365 |
| Non verbal Support | 1.400 | 1 | 983 | .237 |
| Understanding & Friendly | .331 | 1 | 983 | .565 |
| Controlling | .468 | 1 | 983 | .494 |
| Students' perceptions on teacher communication behaviour across students' gender | | | | |
| Challenging | .136 | 1 | 983 | .712 |
| Encouragement & Praise | .104 | 1 | 983 | .747 |
| Non verbal Support | .000 | 1 | 983 | .992 |
| Understanding & Friendly | 1.434 | 1 | 983 | .231 |
| Controlling | .194 | | 983 | .660 |
| Students' perceptions on teacher communication behaviour across students' grade level | | | | |
| Challenging | .041 | 1 | 983 | .839 |
| Encouragement & Praise | 1.188 | 1 | 983 | .276 |
| Non verbal Support | 1.036 | 1 | 983 | .309 |
| Understanding & Friendly | 5.945 | 1 | 983 | .015 |
| Controlling | 2.615 | 1 | 983 | .106 |
| Students' perceptions on their learning strategies across students' school type | | | | |
| Rehearsal | 3.000 | 1 | 992 | .084 |
| Elaboration | .031 | 1 | 992 | .860 |

**Table 4.10** continued

| | F | df1 | df2 | Sig. |
|---|---|---|---|---|
| Organisation | .317 | 1 | 992 | .574 |
| Critical Thinking | .433 | 1 | 992 | .511 |
| Metacognitive Skills | .230 | 1 | 992 | .632 |
| Time & Study Environment | 1.038 | 1 | 992 | .309 |
| Students' perceptions on their learning strategies across students' gender | | | | |
| Rehearsal | .451 | 1 | 992 | .502 |
| Elaboration | .092 | 1 | 992 | .762 |
| Organisation | .090 | 1 | 992 | .764 |
| Critical Thinking | 4.141 | 1 | 992 | .042 |
| Metacognitive Skills | .345 | 1 | 992 | .557 |
| Time & Study Environment | .133 | 1 | 992 | .715 |
| Students' perceptions on their learning strategies across students' grade level | | | | |
| Rehearsal | 13.552 | 1 | 992 | .000 |
| Elaboration | .026 | 1 | 992 | .872 |
| Organisation | 1.258 | 1 | 992 | .262 |
| Critical Thinking | .009 | 1 | 992 | .924 |
| Metacognitive Skills | .018 | 1 | 992 | .895 |
| Time & Study Environment | 6.798 | 1 | 992 | .009 |

While interpreting the MANOVA results, these finding should be kept in mind and related F statistics should be interpreted cautiously.

4.3.2. Multivariate Analysis of Variance (MANOVA)

4.3.2.1 Effect of School Type on Students' Perceptions of Classroom Learning Environment

*Null hypotheses related to the effect of school type on students' perceptions of classroom learning environment:*

Null Hypothesis 1: There is no significant main effect of school type on students' perceptions of classroom learning environment in chemistry classes.

Null Hypothesis 4: There is no significant main effect of school type of students on the population means of the scores on "personal relevance" scale in T-CLES.

Null Hypothesis 5 : There is no significant main effect of school type of students on the population means of the scores on "uncertainty " scale in T-CLES.

Null Hypothesis 6: There is no significant main effect of school type of students on the population means of the scores on "critical voice" scale in T-CLES.

Null Hypothesis 7: There is no significant main effect of school type of students on the population means of the scores on "shared control" scale in T-CLES..

Null Hypothesis 8: There is no significant main effect of school type of students on the population means of the scores on "student negotiation" scale in T-CLES.

To determine the effect of school type of the students' on their perceptions of classroom learning environment, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected F (5,986) = 4.25, p=.001; Wilks's Lambda = .979; partial eta squared = .021). That is; there was a statistically significant difference between students in public and private schools on the combined dependent variables. When the results for the dependent variables were considered separately, the only difference to reach statistically significance using Bonferroni adjusted alpha level of .01, was uncertainty scale in T-CLES. The F value and significance were found as F(1,990) = 14.298, p= .000 for uncertainty scale in T-CLES (Table 4.11). An inspection of mean scores indicated that students in private schools have higher levels of uncertainty scores than the students in public schools. Tables 4.11 and 4.12 displays the overall mean ratings and mean scores of the students in private and public school.

**Table 4.11** Test of between-subjects effects for school type variable

| | df | Error df | F | p | Partial eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Personal Relevance | 1 | 990 | .391 | .532 | .000 | .026 |
| Uncertainty | 1 | 990 | 14.298 | .000 | .014 | .885 |
| Critical Voice | 1 | 990 | .054 | .817 | .000 | .012 |
| Shared Control | 1 | 990 | 3.796 | .052 | .004 | .264 |
| Student Negotiation | 1 | 990 | .919 | .338 | .001 | .053 |

**Table 4.12** Mean scores and standard deviations of T-CLES scales across school type

| | Private school | | Public school | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Personal Relevance | 3.16 | .916 | 3.12 | .751 |
| Uncertainty | 3.34 | .743 | 3.16 | .710 |
| Critical Voice | 3.54 | .884 | 3.55 | .794 |
| Shared Control | 2.79 | .947 | 2.68 | .916 |
| Student Negotiation | 3.27 | .878 | 3.21 | .847 |

Mean scores given in table 4.12 shows that students in private schools have higher mean scores in all dimension of constructivist learning environment measured by T-CLES instrument. As can be inferred from the table 4.12, students in both schools have low mean scores in shared control scale in T-CLES. These results indicate that students are seldom willing to share with teachers the design and management of learning activities, assessment criteria and social norms of the classroom.

4.3.2.2 Effect of Gender on Students' Perceptions of Classroom Learning Environment

*Null hypotheses related to the effect of gender on students' perceptions of classroom learning environment:*

Null Hypothesis 2: There is no significant main effect of gender on students' perceptions of classroom learning environment in chemistry classes.

Null Hypothesis 9: There is no significant main effect of gender on the population means of the scores on "personal relevance" scale in T-CLES.

Null Hypothesis 10: There is no significant main effect of gender on the population means of the scores on "uncertainty " scale in T-CLES.

Null Hypothesis 11: There is no significant main effect of gender on the population means of the scores on "critical voice" scale in T-CLES.

Null Hypothesis 12: There is no significant main effect of gender on the population means of the scores on "shared control" scale in T-CLES.

Null Hypothesis 13: There is no significant main effect of gender on the population means of the scores on "student negotiation" scale in T-CLES.

To determine the effect of gender of the students' on their perceptions of classroom learning environment, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected $F(5,986) = 8.62$, $p=.000$; Wilks's Lambda = .958; partial eta squared = .042). That is; there was a statistically significant difference between male and female students on the combined dependent variables. When the results for the dependent variables were considered separately, the

differences to reach statistically significance using Bonferroni adjusted alpha level of .01, were critical voice ( F(1,990) = 21.686, p = .000) and students negotiation ( F(1,990) = 11.919, p = .001) scales in T-CLES (Table 4.13). An inspection of mean scores indicated that female students perceive higher levels of critical voice and students negotiation in their classrooms than male students. Tables 4.13 and 4.14 displays the overall mean ratings and mean scores of male and female students.

**Table 4.13** Test of between-subjects effects for gender variable

| | df | Error df | F | p | Partial eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Personal Relevance | 1 | 990 | .006 | .940 | .000 | .010 |
| Uncertainty | 1 | 990 | .001 | .980 | .000 | .010 |
| Critical Voice | 1 | 990 | 21.686 | .000 | .021 | .981 |
| Shared Control | 1 | 990 | .302 | .583 | .000 | .022 |
| Student Negotiation | 1 | 990 | 11.919 | .001 | .012 | .808 |

Mean scores given in table 4.14 indicated that female students have higher means in critical voice and student negotiation; however, male students have slightly higher scores in personal relevance and shared control scales in T-CLES. Both have equal mean scores in uncertainty scale.

**Table 4.14** Mean scores and standard deviations of T-CLES scales across gender

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Personal Relevance | 3.14 | .848 | 3.15 | .860 |
| Uncertainty | 3.27 | .721 | 3.27 | .748 |
| Critical Voice | 3.67 | .828 | 3.43 | .851 |
| Shared Control | 2.73 | .917 | 2.76 | .954 |
| Student Negotiation | 3.35 | .855 | 3.16 | .867 |

4.3.2.3 Effect of Grade Level on Students' Perceptions of Classroom Learning Environment

*Null hypotheses related to the effect of grade level on students' perceptions of classroom learning environment:*

Null Hypothesis 3: There is no significant main effect on gender of students' perceptions of classroom learning environment in chemistry classes.

Null Hypothesis 14: There is no significant main effect of grade level on the population means of the scores on "personal relevance" scale in T-CLES.

Null Hypothesis 15: There is no significant main effect of grade level on the population means of the scores on "uncertainty " scale in T-CLES.

Null Hypothesis 16: There is no significant main effect of grade level on the population means of the scores on "critical voice " scale in T-CLES.

Null Hypothesis 17: There is no significant main effect of grade level on the population means of the scores on "shared control" scale in T-CLES.

Null Hypothesis 18: There is no significant main effect of grade level on the population means of the scores on "student negotiation" scale in T-CLES.

To determine the effect of grade level of the students' on their perceptions of classroom learning environment, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected F (5,986) = 6.83, p=.000; Wilks's Lambda = .967; partial eta squared = .033). That is; there was a statistically significant difference between 9$^{th}$ and 10$^{th}$ grade students on the combined dependent variables. When the results for the dependent variables were considered separately, grade level has significant effect on all dependent variables except the critical voice scale in T-CLES at Bonferroni adjusted alpha level of .01. (Table 4.15)

An inspection of mean scores (Table 4.16) indicated that 10$^{th}$ grade students have higher mean scores on all the dependent variables (personal relevance, uncertainty, critical voice, and shared control and

student negotiation). It can be concluded that, 10th grade students perceive higher level of constructivist learning environment in their classes than 9th grade students. Tables 4.15 and 4.16 shows the overall mean ratings and mean scores of 9th and 10th grade level students.

**Table 4.15** Test of between-subjects effects for grade level variable

| | df | Error df | F | p | Partial eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Personal Relevance | 1 | 990 | 9.909 | .002 | .010 | .715 |
| Uncertainty | 1 | 990 | 13.971 | .000 | .014 | .876 |
| Critical Voice | 1 | 990 | 5.114 | .024 | .005 | .375 |
| Shared Control | 1 | 990 | 26.598 | .000 | .026 | .995 |
| Student Negotiation | 1 | 990 | 8.887 | .003 | .009 | .656 |

**Table 4.16** Mean scores and standard deviations of T-CLES scales across grade level of students

| | 9th grade | | 10th grade | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Personal Relevance | 3.08 | .806 | 3.27 | .939 |
| Uncertainty | 3.21 | .733 | 3.40 | .724 |
| Critical Voice | 3.50 | .856 | 3.63 | .827 |
| Shared Control | 2.64 | .926 | 2.97 | .922 |
| Student Negotiation | 3.19 | .881 | 3.36 | .820 |

4.3.2.4 Effect of School Type on Students' Perceptions of Their Teachers' Communication Behaviours.

*Null hypotheses related to effect of school type on students' perceptions of their teachers' communication behaviours*:

Null Hypothesis 19: There is no significant main effect of school type on students' perceptions of their teachers' communication behaviours in chemistry classes.

Null Hypothesis 22: There is no significant main effect of school type of students on the population means of the scores on "challenging" scale in T-TCBQ.

Null Hypothesis 23: There is no significant main effect of school type of students on the population means of the scores on "encouragement & praise" scale in T-TCBQ.

Null Hypothesis 24: There is no significant main effect of school type of students on the population means of the scores on "non-verbal support" scale in T-TCBQ.

Null Hypothesis 25: There is no significant main effect of school type of students on the population means of the scores on "understanding & friendly" scale in T-TCBQ.

Null Hypothesis 26: There is no significant main effect of school type of students on the population means of the scores on "controlling" scale in T-TCBQ.

To determine the effect of school type of the students' on their perceptions of teachers' communication behaviours, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected F (5,979) = 10.75, p=.000; Wilks's Lambda = .948; partial eta squared = .052). That is; there was a statistically significant difference between students in private school and students in public school on the combined dependent variables. When the results given in Table 4.17 for the dependent variables were considered separately, it can be seen that all the dependent variable except controlling reach statistically significant difference using Bonferroni adjusted alpha level of .01. Tables 4.17 and 4.18 displays the overall mean ratings and mean scores of five scales of the T-TCBQ across school type variable.

**Table 4.17** Test of between-subjects effects for school type variable

| | df | Error df | F | p | Partial eta squared | Obs. Power |
|---|---|---|---|---|---|---|
| Challenging | 1 | 983 | 22.922 | .000 | .023 | .986 |
| Encouragement & Praise | 1 | 983 | 22.173 | .000 | .022 | .983 |
| Non-verbal Support | 1 | 983 | 33.112 | .000 | .033 | .999 |
| Understanding & Friendly | 1 | 983 | 35.783 | .000 | .035 | 1.000 |
| Controlling | 1 | 983 | .068 | .794 | .000 | .013 |

**Table 4.18** Mean scores and standard deviations of T-TCBQ scales across school type

| | Private school | | Public school | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Challenging | 3.34 | .874 | 3.07 | .881 |
| Encouragement & Praise | 2.97 | .891 | 2.70 | .895 |
| Non-verbal Support | 3,17 | .883 | 2,83 | .898 |
| Understanding & Friendly | 3.41 | .908 | 3.06 | .924 |
| Controlling | 3.23 | .700 | 3.22 | .718 |

As can be inferred from tables 4.18, Students in private schools have higher mean scores on all scales of the T-TCBQ. Namely, students in private school perceive more communication behaviours from their teachers. Although, the students in private schools perceived their teachers as more controlling than did the students in public school, there was not statistically significant difference between them about controlling.

4.3.2.5 Effect of Gender on Students' Perceptions of Their Teachers' Communication Behaviours.

*Null hypotheses related to effect of gender on students' perceptions of their teachers' communication behaviours*:

Null Hypothesis 20: There is no significant main effect of gender on students' perceptions of their teachers' communication behaviours in chemistry classes.

Null Hypothesis 27: There is no significant main effect of gender on the population means of the scores on "challenging" scale in T-TCBQ.

Null Hypothesis 28: There is no significant main effect of gender on the population means of the scores on "encouragement & praise" scale in T-TCBQ.

Null Hypothesis 29: There is no significant main effect of gender on the population means of the scores on "non-verbal support" scale in T-TCBQ.

Null Hypothesis 30: There is no significant main effect of gender on the population means of the scores on "understanding & friendly" scale in T-TCBQ.

Null Hypothesis 31: There is no significant main effect of gender on the population means of the scores on "controlling" scale in T-TCBQ.

To determine the effect gender of students' on their perceptions of teachers' communication behaviours, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected $F(5,979) = 9.19$, $p=.000$; Wilks's Lambda = .955; partial eta squared = .045). That is; there was a statistically significant difference between boys' and girls' perceptions on the combined dependent variables. When the results for

the dependent variables were considered separately, it can be seen that gender has significant effect on challenging and understanding & friendly scales of the T-TCBQ at Bonferroni adjusted alpha level of .01 (Table 4.19). The significances were found as $F(1,983) = 7.360$, $p = .007$ for challenging scale and $F(1,983) = 7.462$, $p = .007$ for understanding & friendly scale. Tables 4.19 and 4.20 display the overall means ratings and mean scores of five scales of the T-TCBQ across gender variable.

**Table 4.19** Test of between-subjects effects for gender variable

| | df | Error df | F | p | Partial eta squared | Observ-ed Power |
|---|---|---|---|---|---|---|
| Challenging | 1 | 983 | 7.360 | .007 | .007 | .553 |
| Encouragement & Praise | 1 | 983 | 1.667 | .197 | .002 | .099 |
| Non-verbal Support | 1 | 983 | 1.093 | .296 | .001 | .063 |
| Understanding & Friendly | 1 | 983 | 7.420 | .007 | .007 | .557 |
| Controlling | 1 | 983 | .642 | .423 | .001 | .038 |

As can be seen from Table 4.20, girls perceived their teachers as more understanding and friendly than did the boys. Furthermore, the girls perceived their teachers as being more challenging than did boys. On the other hand, the boys perceived their teachers as being more controlling and more encouragement and praise than did the girls but there were not statistically significant differences between boys' and girls' perceptions

about controlling, encouragement & praise and non-verbal support scales in the T-TCBQ.

**Table 4.20** Mean scores and standard deviations of T-TCBQ scales across gender

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Challenging | 3.31 | .873 | 3.16 | .893 |
| Encouragement & Praise | 2.82 | .887 | 2.90 | .914 |
| Non-verbal Support | 3.07 | .895 | 3.01 | .910 |
| Understanding & Friendly | 3.36 | .938 | 3.20 | .918 |
| Controlling | 3.21 | .703 | 3.24 | .710 |

4.3.2.6 Effect of Grade Level on Students' Perceptions of Their Teachers' Communication Behaviours.

*Null hypotheses related to effect of grade level on students' perceptions of their teachers' communication behaviours*:

Null Hypothesis 21: There is no significant main effect of grade level on students' perceptions of their teachers' communication behaviours in chemistry classes

Null Hypothesis 32: There is no significant main effect of grade level on the population means of the scores on "challenging" scale in T-TCBQ.

Null Hypothesis 33: There is no significant main effect of grade level on the population means of the scores on “encouragement & praise” scale in T-TCBQ.

Null Hypothesis 34: There is no significant main effect of grade level on the population means of the scores on “non-verbal support” scale in T-TCBQ.

Null Hypothesis 35: There is no significant main effect of grade level on the population means of the scores on “understanding & friendly“ scale in T-TCBQ.

Null Hypothesis 36: There is no significant main effect of grade level on the population means of the scores on “Controlling“ scale in T-TCBQ.

To determine the effect grade level of students’ on their perceptions of teachers’ communication behaviours, MANOVA was conducted. The result revealed that all the null hypotheses stated above were rejected F (5,979) = 13.102, p=.000; Wilks’s Lambda = .937; partial eta squared = .063). That is; there was a statistically significant difference between $9^{th}$ grade and $10^{th}$ grade students on the combined dependent variables. Analysing the results revealed that only controlling scale in the TCBQ could not reach statistically different significance at Bonferroni adjusted alpha level of .01. The significances were found as F(1,983) = 7.360, p = .105 for controlling scale (Table 4.21). On all four scale of the TCBQ, $10^{th}$ grade students have higher mean scores, which indicated that they

perceived more of these communication behaviours in their classrooms. Even though the mean scores of the 10th grade students on controlling scale have higher value than do the 9th grade students, there was not statistically significant difference between them on that variable. (Table 4.21 and 4.22)

**Table 4.21** Test of between-subjects effects for grade level variable

| | df | Error df | F | p | eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Challenging | 1 | 983 | 37.016 | .000 | .036 | 1.000 |
| Encouragement & Praise | 1 | 983 | 54.464 | .000 | .052 | 1.000 |
| Non-verbal Support | 1 | 983 | 31.548 | .000 | .031 | .999 |
| Understanding & Friendly | 1 | 983 | 39.938 | .000 | .039 | 1.000 |
| Controlling | 1 | 983 | 2.631 | .105 | .003 | .169 |

**Table 4.22** Mean scores and standard deviations of T-TCBQ scales across grade level

| | 9th grade | | 10th grade | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Challenging | 3.11 | .875 | 3.48 | .863 |
| Encouragement & Praise | 2.72 | .888 | 3.17 | .856 |
| Non-verbal Support | 2.92 | .902 | 3.27 | .861 |
| Understanding & Friendly | 3.15 | .945 | 3.54 | .840 |
| Controlling | 3.20 | .715 | 3.28 | .688 |

4.3.2.7 Effect of School Type on Students' Perceived Use of Learning Strategies

*Null hypothesis related to effect of school type on students' perceived use of learning strategies:*

Null Hypothesis 37: There is no significant main effect of school type of students on the population means of the scores on "perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment) ".

To determine the effect school type of students' on students' perceived use of learning strategies, MANOVA was conducted. The result revealed that all the null hypothesis stated above was rejected F (6,987) = 4.686, p=.000; Wilks's Lambda = .972; partial eta squared = .028). That is; there was a statistically significant difference between students in private school and public school on the combined dependent variables. Table 4.23 and 4.24 displays the overall mean scores on each scale of the T-MSLQ with respect to school type of the students. Inspection of the Table 4.23 indicated that the differences to reach statistical significance using Bonferroni adjusted alpha level of 0.0083, were rehearsal strategies ( F(1,992) = 8.716, p = .003) and metacognitive self-regulatory strategies (F(1,992) = 8.256, p = .004).

**Table 4.23** Test of between-subjects effects for school type variable

| | df | Error df | F | p | Partial eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Rehearsal | 1 | 992 | 8.716 | .003 | .009 | .621 |
| Elaboration | 1 | 992 | .242 | .623 | .000 | .017 |
| Organisation | 1 | 992 | 1.603 | .206 | .002 | .084 |
| Critical Thinking | 1 | 992 | 1.401 | .237 | .001 | .073 |
| Metacognitive Self Regulation | 1 | 992 | 8.256 | .004 | .008 | .590 |
| Time and Study Environment | 1 | 992 | .597 | .440 | .001 | .031 |

**Table 4.24** Mean scores and standard deviations of T-MSLQ scales across school type

| | Private School | | Public school | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Rehearsal | 4.11 | 1.382 | 4.38 | 1.470 |
| Elaboration | 4.13 | 1.321 | 4.09 | 1.318 |
| Organisation | 4.11 | 1.365 | 4.22 | 1.349. |
| Critical Thinking | 4.01 | 1.223 | 4.11 | 1.179 |
| Metacognitive Self Regulation | 4,01 | .980 | 4,19 | .966 |
| Time and Study Environment | 4,49 | .870 | 4,53 | .906 |

Table 4.24 revealed that students in private schools had higher mean scores on only using elaboration strategies. The students in private schools had higher mean scores on all other scales of the T-MSLQ.

4.3.2.8 Effect of Gender on Students' Perceived Use of Learning Strategies

*Null hypothesis related to effect of gender on students' perceived use of learning strategies:*

Null Hypothesis 38: There is no significant main effect of gender on the population means of the scores on "perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment) ".

To determine the effect gender on students' perceived use of learning strategies, MANOVA was conducted. The result revealed that all the null hypothesis stated above was rejected F (6,987) = 11.722, p=.000; Wilks's Lambda = .933; partial eta squared = .067). That is; there was a statistically significant difference between girls and boys on the combined dependent variables. Tables 4.25 and 4.26 displays the overall mean scores on each scale of the T-MSLQ with respect to gender of the students. Inspection of the table 4.25 indicated that the differences to reach statistical significance using Bonferroni adjusted alpha level of 0.0083, were rehearsal strategies ( F(1,992) = 29.801, p = .000),

organisation strategies ( F(1,992) = 35.919, p = .000), metacognitive self-regulatory strategies ( F(1,992) = 14.688, p = .000) and managing time and study environment ( F(1,992) = 11.795, p = .001).

**Table 4.25** Test of between-subjects effects for gender variable

| | df | Error df | F | p | Partial eta squared | Observed Power |
|---|---|---|---|---|---|---|
| Rehearsal | 1 | 992 | 29.801 | .000 | .029 | .995 |
| Elaboration | 1 | 992 | 5.384 | .021 | .005 | .281 |
| Organisation | 1 | 992 | 35.919 | .000 | .035 | .999 |
| Critical Thinking | 1 | 992 | .907 | .341 | .001 | .026 |
| Metacognitive Self Regulation | 1 | 992 | 14.688 | .000 | .015 | .824 |
| Time and Study Environment | 1 | 992 | 11.795 | .001 | .012 | .703 |

The mean scores listed in Table 4.26 indicated that girls have higher scores on all the dependent variables measured by T-MSLQ. Namely, girls appeared to perceive themselves using all the learning strategies measured in this study more than boys. However, there were not statistically differences between boys' and girls' perceptions about using elaboration and critical thinking strategies.

**Table 4.26** Mean scores and standard deviations of T-MSLQ scales across gender

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Rehearsal | 4.47 | 1.413 | 3.99 | 1.395 |
| Elaboration | 4.22 | 1.321 | 4.02 | 1.312 |
| Organisation | 4.43 | 1.322 | 3.92 | 1.348 |
| Critical Thinking | 4.09 | 1.249 | 4.02 | 1.166 |
| Metacognitive Self Regulation | 4.21 | .940 | 3.97 | .998 |
| Time and Study Environment | 4.61 | .876 | 4.42 | .883 |

4.3.2.9 Effect of Grade Level on Students' Perceived Use of Learning Strategies

*Null hypothesis related to effect of grade level on students' perceived use of learning strategies:*

Null Hypothesis 39: There is no significant main effect of grade level on the population means of the scores on "perceived use of learning strategies (Rehearsal, Elaboration, Organisation, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment) ".

To determine the effect gender on students' perceived use of learning strategies, MANOVA was conducted. The results revealed that all the null hypothesis stated above was rejected F (6,987) = 5.860, p=.000;

Wilks's Lambda = .966; partial eta squared = .034). That is; there was a statistically significant difference between 9th and 10th grade students on the combined dependent variables. Tables 4.27 and 4.28 displays the overall mean scores on each scale of the T-MSLQ with respect to grade level of the students.

**Table 4.27** Test of between-subjects effects for grade level variable

| | df | Error df | F | p | Partial eta squared | Observe -d Power |
|---|---|---|---|---|---|---|
| Rehearsal | 1 | 992 | .004 | .951 | .000 | .004 |
| Elaboration | 1 | 992 | 17.654 | .000 | .017 | .903 |
| Organisation | 1 | 992 | 6.580 | .010 | .007 | .369 |
| Critical Thinking | 1 | 992 | 15.251 | .000 | .015 | .842 |
| Metacognitive Self Regulation | 1 | 992 | 6.765 | .009 | .007 | .383 |
| Time and Study Environment | 1 | 992 | .192 | .661 | .000 | .007 |

As can be inferred from Table 4.27, when the results for the dependent variables were considered separately, the differences to reach statistical significance using Bonferroni adjusted alpha level of 0.0083, were elaboration strategies ( $F(1,992) = 17.654$, $p = .000$), and critical thinking strategies ( $F(1,992) = 15.251$, $p = .000$). An inspection of the mean scores indicated that 10th grade students have higher scores on all

the dependent variables measured by T-MSLQ (Table 4.28). Namely, 10th grade students appeared to perceive themselves using all the learning strategies measured in this study more than 9th grade students. But, there were not statistically differences between 9th grade and 10th grade students' perceptions about using rehearsal, organisation, metacognitive self-regulatory strategies, and managing their time and study environment. What is more, the results indicated that, students in both grade levels reported to have almost the same scores on using rehearsal strategy.

**Table 4.28** Mean scores and standard deviations of T-MSLQ scales across gender

| | 9th grade | | 10th grade | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Rehearsal | 4.22 | 1.477 | 4.22 | 1.302 |
| Elaboration | 3.99 | 1.305 | 4.37 | 1.315 |
| Organisation | 4.08 | 1.375 | 4.31 | 1.311 |
| Critical Thinking | 3.95 | 1.192 | 4.26 | 1.209 |
| Metacognitive Self Regulation | 4.03 | .968 | 4.20 | .993 |
| Time and Study Environment | 4.50 | .916 | 4.53 | .813 |

# CHAPTER V

# CONCLUSION, DISCUSSION AND IMPLICATIONS

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

## 5.1 Summary of the Study

The aims of this study were to explore students' perceptions of the extent to which constructivist approaches are present in chemistry classes at high school level in Turkey, to assess students' perceptions of chemistry teachers' communication behaviours in their classroom learning environments and to investigate the learning strategies used in chemistry classes considering school type, gender, and grade level differences. In this study, the Constructivist Learning Environment Questionnaire (CLES), the Teacher Communication Behaviour (TCBQ) and the Motivated Strategies for Learning Questionnaire (MSLQ) were used as measuring instruments. In addition, the questionnaires also included some questions for demographic characteristics of participants. The measuring

instruments were administrated to 994 students from public and private schools in Ankara.

### 5.2 Discussions and Conclusions of the Results

The data obtained by T-CLES showed that students occasionally perceive their learning environment as constructivist with the mean scores ranging between 2.74 and 3.54. The lowest mean score observed in the mean score of shared control scale of the T-CLES (2.74) indicates that students are seldom willing to share with teachers the design and management of learning activities, assessment criteria and social norms of the classroom. Actually, it was not a surprising result due to teacher-centred teaching strategies in chemistry classes in Turkey. The idea that the teacher is the authority in the learning environment was going on. Moreover, most students are not engaged in the learning process. The highest score observed in the mean score of critical voice scale of the T-CLES (3.54) exhibits that students feel comfortable to interrogate the teacher's pedagogical plans and teaching methods. The mean score of the personal relevance scale was measured to be 3.14. This revealed that, the students could still not understand the relation between the school learning and real world. It is highly recommended to the teachers to establish the relation between the school and real life by preparing the activities taken from real life situations.

The mean scores of the scales of the T-TCBQ, which was applied to measure students' perceptions on their teachers' communication behaviour, lie between 2.86 and 3.27. This indicated that student-teacher communication in chemistry classes in Turkey is at medium level. Namely, teachers sometimes communicate with their students in the classroom. It also reminds us of the fact that most of Turkish secondary school teachers use lecturing rather than any other teaching strategies even in private schools. Furthermore, teachers are expected to cover the curriculum in an academic year. Therefore, they do not allow their student to be free or to take responsibility in their lessons. As mentioned in chapter IV, the results indicated that students perceived their teachers as understanding and friendly. Nevertheless, they perceived their teachers as being less encouragement and praise.

The mean scores of the scales of the T-MSLQ lie between 4.05 and 4.51 when the maximum value is equal to 7.00, which correspond to "very true of me " and the minimum value is equal to 1.00, which corresponds to "not at all true for me. The lowest mean score was observed in the use of critical thinking strategies (M = 4.05), whereas, the highest mean scores was observed in the managing time and study environment (M = 4.51) followed by use of rehearsal strategies (M = 4.22). Actually, these were expected scores due to the educational system in Turkey. Students are expected to prepare University Entrance Exam (ÖSS) after graduation from high school. Therefore, the students have not obtained the habit of

analysing the concepts and the structures by asking questions such as “why?”, “what?”, “how?.” Instead, they prefer to memorise the concepts. What is more, in order to memorise, they read and repeat the concepts continuously, this is why the mean score of the rehearsal scale of the T-MSLQ was observed to be high. Since the parents of the participants of the study are expected to be families with above-average income, managing study environment does not cause a problem for students in the present study. As can bee seen from Table 4.3, the mean score of managing time and study environment was measured to be higher than the other scales of the T-MSLQ.

The present study also investigated the effects of school type, gender and grade level on students’ perceptions on classroom learning environment, their teachers’ communication behaviour and perceived use of learning strategies in chemistry classes. It was observed that, these three variables, namely, school type, gender and grade level has significant effect on students’ perceptions.

MANOVA analysis indicated that school type had significant effect on uncertainty scale of the T-CLES; on all scales of the T-TCBQ except controlling and on using elaboration and critical thinking strategies of the T-MSLQ. Inspection of the mean scores of scales of the T-CLES revealed that students in private schools had higher mean scores on all scales of the T-CLES. It can be concluded that, students in private schools perceive more constructivist oriented learning environments that do the students in

public schools. It was not a surprising result, because, there is a distinct division between state and private education. As is common, public schools rely exclusively on the government as its major source of revenue. In contrast, private schools depend on the parental support. Therefore, private schools are expected to meet parents' demands in order to survive. For this reason, new innovations were introduced in order to create positive learning environments. What is more, there are huge differences in physical environment and facilities between private schools and public schools in Turkey. Private schools provide modern classrooms fitted with video equipment, video players, camcorders, and computers and recording equipment. They also have updated libraries, conference and study halls, laboratories equipped with experimental materials and tolls, computer rooms with Internet connections and current software. Finally, private schools provide extra curricular activities, which allow students to express and to expand their creativity, including facilities for toning physical skills. The all around individual's physical, mental and inner well-being should be addressed by the learning environment. It is accepted by the authorities that private schools provide better physical environments, facilities and services than state schools in Turkey. When the effect of school type on students' perceptions of their chemistry teachers' communication behaviours was examined, it was seen that students in private schools perceived that their teachers displayed more challenging, encouragement and praise, non-verbal support and more

understanding and friendly than students in public schools. No significant difference was measured about controlling. Considering the prime differences between teachers in public and private schools, it can be concluded that the results were not surprising. The public school teachers are Civil Servants and, once accepted, there is little likelihood of dismissal. Whereas, private school teachers are hired on a yearly contract requiring more credentials and a higher performance level. The private school sector fosters teachers who give more of themselves to student achievement, in the way of contact time and private tutoring beyond lessons. This is partially based on performance oriented contract renewal, unlike the state school system. They are also supposed to be cooperative, understanding and friendly.

Investigation of effect of school type on students' perceived use of learning strategies indicated that students in private schools appeared to perceive themselves using the elaboration learning strategies more than the students in public schools. On the other hand, students in public school appeared to have higher mean scores on other dependent variables. Namely, they perceived themselves using rehearsal; organisation, critical thinking, metacognitive self-regulatory strategies and they manage their time and study environment more than the students in public school. Nevertheless, school type has only significant effect on using rehearsal and metacognitive self-regulatory strategies.

According to the results, gender has significant effect on critical voice and student negotiation scales of the T-CLES, on challenging and understanding & friendly scales of the T-TCBQ and on perceived use of using rehearsal, organisation, metacognitive self-regulatory strategies and managing time and study environment scales of the T-MSLQ. The quantitative data collected using the T-CLES indicated that boys perceived less critical voice and less student negotiation in their chemistry classes than did girls. That is; girls had more opportunity to question the teacher's educational plans and methods and voice their concerns about obstacles to their learning. In addition, girls were observed to be comfortable to explain and verify to other students their newly developing ideas and to reflect on the viability of their own and other students' ideas. Inspection of Table 4.14 indicated that girls generally perceived more constructivist-learning environment than did boys. When the results of this research were compared with those of previous ones, current research supports some findings from other studies. On the other hand, it does not support some others. Regarding gender, the results of the current study are consistent with the results of the study of Yılmaz-Tüzün, Çakıroğlu and Boone (2007), Huang and Waxman (1993), Wong and Fraser (1994). Yılmaz-Tüzün et al. also found significant difference between boys and girls on critical voice of the T-CLES. Huang and Waxman (1993) found that girls have more positive perceptions of their mathematics-learning environment than did the boys. Similarly, in a study of chemistry students'

perceptions of their learning environments in Singapore secondary schools, Wong and Fraser (1994) found that female students held more positively perceptions of classroom environment than boys. However, a study of Terwel et al. (1994) indicated that girls in physics and mathematics perceived their classroom learning environments less positively than boys. The results also underlined that both girls and boys rated low mean scores on shared control scale of the T-CLES. This can be explained by the examination-driven nature of the curriculum. The chemistry curriculum in Turkey is presented to students in the form of textbooks, and examinations are based on the content of these textbooks. Thus, it is important for teachers to cover all areas. Time constraints allow few diversions and fewer opportunities for students to exercise control over what they learn.

When the effect of gender on students' perceptions of their chemistry teachers' communication behaviours was examined, it was seen that gender had significant effect on two of five scales of the T-TCBQ. Girls perceived their teachers as more challenging and more understanding and friendly than did boys. Furthermore, the girls perceived their teachers as showing more nonverbal support than did boys. On the other hand, boys perceived their teachers as being more encouragement and praise and more controlling than girls. Since girls rated higher mean scores on three scales of five scales of the T-TCBQ, it can be assumed that, girls tend to perceive their learning environment in more positive ways than boys.

These results are similar to those of previous ones (Fraser et al., 1995; Rawnsley & Fisher, 1997; She & Fisher, 2002, Özay et al., 2004; Yılmaz-Tüzün, 2006). She & Fisher, (2000) , Özay et al., (2004), and Yilmaz-Tüzün (2006) found that girls perceived their teachers as more understanding and friendly than did boys as in the present study. Moreover, in the study of Özay et al. and Yılmaz-Tüzün, boys' mean scores on controlling scale were observed to be higher than those of the girls. This was also similar in the current study. den Brok, Fisher, and Rickards (2004) indicated that various factors may affect student's perceptions. These include gender of student and teacher, ethnic background of student and teacher, age of student, teacher experience, class size, student achievement and subject. She and Fisher (1999b) found that the girls in Taiwan generally were more favourable about their teachers than were the boys. According to She in Taiwan situation, boys usually were dominant in the science classroom, and some of them became actively involved in class discussions to get the teachers' attention. This often resulted in negative response from the teacher. On the other hand, girls generally perceived by their teachers as being more passive learners. Therefore, the teachers were less likely to give the girls a negative response. Unfortunately, no studies were seen in the literature to explain the situation in Turkey. Further studies are needed to conduct to explain the causes of these observed differences.

As it can be inferred from the Table 4.25, concerning gender, the dependent variables of rehearsal, organisation, metacognitive self-regulatory and time and study environment were significant indicating that there was a statistically significant mean difference between boys and girls with respect to these four variables. The mean scores presented in Table 4.26 indicated that girls have higher scores on all the dependent variables measured by T-MSLQ. Namely, girls appeared to perceive themselves using all the learning strategies measured in this study more than boys. However, there were not statistically differences between boys' and girls' perceptions about using elaboration and critical thinking strategies. The findings were similar to that of Sungur (2004). In the study of Sungur, girls also had higher mean scores on all perceived learning strategies, however, significant differences were appeared only in using elaboration and organisation strategies.

Grade level was determined as another factor affecting students' perceptions related to learning environment, teachers' communication behaviour and use of learning strategies. According to the results presented in chapter IV, concerning grade level, significant differences were seen in all scales of the T-CLES, in four of five scales of the T-TCBQ and in two of five scales of the T-MSLQ. $10^{th}$ grade students perceived their learning environment as more constructivist oriented than did $9^{th}$ grade level. The results may be considered almost similar to that of Yılmaz-Tüzün et al. (2007), and Waxman and Huang (1998).

Nevertheless, the results of the study are not consistent with some studies in the literature (Midgley, Eccles & Feldlaufer, 1991; Huang & Waxman, 1993; Ding C & Hall, A., 2007). In Turkish Educational System, Students are supposed to attend chemistry classes at 9th grade level. when students complete the 9th grade, they select streams leading to certain specializations. The four tracks are: Turkish language-Mathematics, Science, Social Sciences and Languages. Therefore, only the students who select sciences stream are supposed to attend chemistry classes. This may be assumed to be the reason for the difference observed on students' perceptions concerning learning environment.

Analysis of association of students' grade level on perceptions of their chemistry teachers indicated that, 10th grade students perceived their teachers as being more challenging, more encouragement and praise, show more nonverbal support and more understanding and friendly than 9th grade students. Although 10th grade students have higher mean scores on controlling scale of the T-TCBQ, it did not create statistically significant difference. This is in contrary to findings of previous studies. Yılmaz-Tüzün (2006) reported that teachers exhibited lower levels of challenging, encouragement and praise, nonverbal support and understanding and friendly communication as the grade level increases.

Finally, effect of grade level on students' perceived use of learning strategies investigated, grade level had significant effect on using elaboration strategies and critical thinking strategies. The mean scores

indicated that 10th grade students have higher scores on all the dependent variables measured by T-MSLQ. Namely, 10th grade students appeared to perceive themselves using all the learning strategies measured in this study more than 9th grade students. But, there were not statistically differences between 9th grade and 10th grade students' perceptions about using rehearsal, organisation, metacognitive self-regulatory strategies, and managing their time and study environment. In addition, the results indicated that, students in both grade levels reported to have almost the same scores on using rehearsal strategy.

In conclusion, the main aim of education is to generate healthy minded productive citizens considering the needs of each learner and also to make them develop intellectually, emotionally, physically and socially as a whole individual. This can be accomplished by creating an enjoyable and productive learning environment. Incorporating more positive practices, which will give an atmosphere of thriving to students and teachers specifically and ultimately leading us towards a much healthier society, reinforces the existing learning environment. (Koul & Fisher, 2002).

### 5.3 Internal Validity of the Study

Internal validity of the study refers to the degree to which the observed differences on the dependent variables are directly related to the independent variable, not to extraneous variables that may affect the

results of the research (Fraenkel and Wallen, 1996). Possible threats to internal validity and methods to deal with them were discussed in this section.

The schools are selected convenience manner rather than randomly selected. The instruments were administrated to all groups in similar physical arrangement of the certain classrooms, therefore, location and instrumentation could not be threat to the study. Data collector characteristics bias threats were assumed to be controlled by training and informing the teachers to ensure standard procedures under which data were collected. Since names of the participants were not requested, confidentially was not a possible threat for the study. Finally, responses rate was about 86% in the study. Thus, regression threat was minimized for this study.

### 5.4 External Validity of the Study

All the administration procedure took place in ordinary classrooms during class hours. In other words, there were no remarkable differences among environmental conditions. Therefore, it was believed that external effects were sufficiently controlled by the setting used in the study.

## 5.5 Implications of the Study

Based on the findings of this study the followings suggestions can be offered;

- This study showed that the instruments, CLES and TCBQ, have an important contribution to measuring students' perceptions on classroom learning environment from constructive perspective and teachers' communication behaviours. The teachers can make use of the CLES and TCBQ to find out what is going on in their classrooms and how the students perceive their communication behaviours.
- School type has an important effect on creating positive learning environment. It is known that private schools provide better physical environments, facilities and services than state schools in Turkey. Therefore, the first duty of the administrators should be eliminating the differences between private schools and public schools in terms of physical environments, facilities and services. We all must aware of that effective schools do influence and enhance students success rate.
- The mean scores critical thinking scale in MSLQ and critical voice scale in CLES, indicated that, Turkish students do not obtain the habit of analysing the concepts and the structures by asking questions such as "why?", "what?", "how?." Instead, they prefer to memorise the concepts. Moreover, they do not question teacher's knowledge and teaching methods. For meaningful learning, students should be allowed to construct their own knowledge through challenging personal experience.

Moreover, peer interactions and social negotiation should be encouraged in the classroom.

- Both this study and also previous studies showed that girls perceived their teachers' communication behaviour more positively, namely, they found their teachers more friendly than did boys. Teachers should be aware of this fact, and give more attention to their male students to increase their motivation.
- According to current study grade level also created significant difference in students' perceptions. Teachers should show better performance towards students in lower grades to increase their motivation, attitudes and achievements toward their courses.
- Teachers should use challenging questions, give more encouragement and praise, show nonverbal support and be understanding and friendly to improve their students' attitudinal outcomes.

### 5.6 Recommendations for Further Studies

Present study has suggested several useful topics for further research:

- Similar study can be conducted with a larger sample. Because, the participant of the study is limited to two schools in Ankara.
- A study can be conducted to investigate students' perceptions regarding to other science classes (physics and biology).

- A qualitative research may be conducted to gather data for better understanding of students' perceptions related to learning environment, teachers' communication behaviours and use of learning strategies.
- A study can be conducted to investigate the reason of the difference between boys' and girls' perceptions related to learning environment, teachers' communication behaviours and use of learning strategies.
- A study can be conducted to investigate the reason of the difference between $9^{th}$ grade and $10^{th}$ grade students' perceptions related to learning environment, teachers' communication behaviours and use of learning strategies.

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# APPENDIX A

**Değerli öğrenciler,**

Bu çalışma üç anket içermektedir. İlk ankette Kimya dersinde sınıf ortamının değerlendirilmesi hakkında bilgiler toplanacaktır. İkinci ankette ise öğretmeninizin sizlerle olan iletişimi ve sınıf içindeki davranışları ile ilgili bilgi toplanmaya çalışılacaktır. Üçüncü ankette öğrenme ve çalışma stratejileriniz hakkında bilgi toplanacaktır. Anketlere geçmeden önce lütfen aşağıdaki soruları doldurunuz. Çalışmaya olan katkınız için çok teşekkürler.

**Kişisel Bilgiler**

1. Okulunuzun Adı _____

2. Sınıfınız: ❑ 9 ❑ 10 ❑ 11

3. Şubeniz: ❑ A ❑ B ❑ C ❑D ❑ E ❑ F ❑ G ❑ H ❑ İ ❑ J ❑ K ❑ L ❑ M ❑ N

❑ O ❑ P ❑ R ❑ S ❑ T ❑ U ❑ V ❑ Y ❑ Z

4. Cinsiyet: ❑ Kız ❑ Erkek

5. Doğum Yılınız: _____

6. Geçen dönem ki Kimya dersi karne notunuz:_____

**KİMYA DERSİNDE SINIF ORTAMININ DEĞERLENDİRİLMESİ**

Bu ankette kimya dersinde sınıf ortamının değerlendirilmesine yönelik bilgi toplanmaya çalışılacaktır. Yapmanız gereken düşüncelerinizi en iyi tanımlayacak karenin içerisine çarpı işareti koymaktır.

| | **Kimya Dersinde** | **Hiçbir zaman** | **Nadiren** | **Bazen** | **Sık Sık** | **Her zaman** |
|---|---|---|---|---|---|---|
| 1. | Okul içindeki ve dışındaki dünya hakkında bilgi edinirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 2. | Öğrendiklerim okul içindeki ve dışındaki edindiğim deneyimler ile ilişkilidir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 3. | İşlenen konuların okul içindeki ve dışındaki yaşantının nasıl bir parçası olduğunu öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 4. | okul içindeki ve dışındaki dünya hakkında ilginç şeyler öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 5. | Bilimin problemlere her zaman bir çözüm **üretemediğini** öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 6. | Bilimsel açıklamaların zaman içinde değiştiğini öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 7. | Bilimin, insanların kültürel değerlerinden ve fikirlerinden etkilendiğini öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 8. | Bilimin soruların oluşturulmasında ve araştırılmasında bir yol olduğunu öğrenirim. | ❑ | ❑ | ❑ | ❑ | ❑ |

| | | | | | |
|---|---|---|---|---|---|
| 9. Öğretmenin **neyi nasıl** öğrettiğini öğrenciler rahatlıkla sorgular. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 10. Öğrencilerin **neyi nasıl** öğrendikleri hakkında soru sormalarına izin verilmesi öğrenmeme yardımcı olur. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 11. Karmaşık olan etkinlikler için öğrenciler aydınlatıcı bilgi isterler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 12. Öğrenciler öğrenmelerine engel olabilecek durumlar için düşüncelerini dile getirirler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 13. Öğrenciler öğretmenlerine dersin planlanmasında yardımcı olurlar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 14. Öğrenciler nasıl iyi öğreneceklerine karar vermede öğretmenlerine yardımcı olurlar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 15. Öğrenciler hangi etkinliklerin onlar için en iyi olacağına karar vermede öğretmenlerine yardımcı olurlar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 16. Öğrenciler herhangi bir etkinlik için ne kadar zamana ihtiyaçları olduğunu öğretmenlerine bildirirler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 17. Öğrenciler problemleri nasıl çözeceklerini diğer öğrenciler ile tartışırlar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 18. Öğrenciler fikirlerini diğer öğrencilere açıklarlar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 19. Öğrenciler diğer öğrencilerin fikirlerini açıklamalarını isterler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 20. Öğrenciler benim fikrimi açıklamamı beklerler. | ❑ | ❑ | ❑ | ❑ | ❑ |

# APPENDIX B

## ÖĞRETMENİN ÖĞRENCİ İLE İLETİŞİMİ VE SINIF İÇİNDEKİ DAVRANIŞLARI ANKETİ

Bu ankette kimya dersinde öğretmeninizin sizinle olan iletişimini ve size karşı olan davranışlarını belirlemeye yönelik ifadeler yer almaktadır. Yapmanız gereken düşüncelerinizi en iyi tanımlayacak karenin içerisine çarpı işareti koymaktır **Eğer verilen ifadede söylenen iletişim veya davranış ders süresince her zaman oluyor ise, her zamanı gösteren karenin içine çarpı koyunuz. Eğer ifadedeki iletişim şekli hiç olmuyorsa hiçbir zamanı gösteren karenin içine çarpı koyunuz. Öğretmeninizin sizinle olan iletişimi ve davranışları diğer seçeneklere uyuyor ise o seçeneği gösteren kutunun içerisine çarpı koyunuz.**

| | Hiçbir zaman | Nadiren | Bazen | Sık Sık | Her zaman |
|---|---|---|---|---|---|
| 1. Öğretmenim, çözüm yollarını ya da çözüm için gerekli adımları bulmamı gerektiren sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 2. Öğretmenim, tartışmalar sırasında benim düşüncelerimi sorar | ❑ | ❑ | ❑ | ❑ | ❑ |
| 3. Öğretmenim, benim görüşlerimi anladığını başını sallayarak gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 4. Öğretmenim bana güvenir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 5. Öğretmenimin öğrencilerin uyması için koyduğu kurallar oldukça ağırdır. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 6. Öğretmenim, soruların cevaplarını tartışmam için beni teşvik eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 7. Öğretmenim, bir soruyu cevaplarken zorlandığım zaman başını sallayarak beni destekler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 8. Öğretmenim, beni desteklediğini hiç konuşmadan yüz ifadeleri ile gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 9. Öğretmenim, öğrendiğim bilgileri kullanmamı gerektiren sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 10. Öğretmenim, fikirlerimi diğer öğrenciler ile tartışmam için beni teşvik eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 11. Öğretmenim, bir konu hakkındaki görüşlerimi açıklamam konusunda beni teşvik eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 12. Öğretmenim, sorularımdan memnun olduğunu hiç konuşmadan yüz ifadeleri ile gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 13. Öğretmenim, verdiğim cevapları över. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 14. Öğretmenim, benim ne zaman anlamadığımı fark eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 15. Öğretmenim, sınıfta öğrencilerin nasıl davranması gerektiği konusunda bana göre çok | ❑ | ❑ | ❑ | ❑ | ❑ |

| | | | | | |
|---|---|---|---|---|---|
| davranması gerektiği konusunda bana göre çok açık kuralları olan birisidir. | | | | | |
| 16. Öğretmenim, bilgileri dikkatli analiz ederek cevaplayacağım sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 17. Öğretmenim, derste öğrendiğim bilgileri anlayarak cevaplayacağım sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 18. Öğretmenim, kendi cümlelerimi kullanarak açıklama yapmamı gerektiren sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 19. Öğretmenim, bir sorunla karşılaştığım zaman beni hiç konuşmadan yüz ifadeleri ile destekler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 20. Öğretmenim bana karşı sabırlıdır. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 21. Öğretmenim koyduğu kurallara uymam konusunda ısrar eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 22. Öğretmenim güzel bir soru sorduğum zaman beni över. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 23. Öğretmenim, beni desteklediğini hiç konuşmadan yüz ifadeleri ile gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 24. Öğretmenim, düşünerek cevaplamam gereken sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 25. Öğretmenim, yapacağım işlerin kendi beklentilerinin dışında olmasına izin vermez. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 26. Öğretmenim bir şey söylemek istediğim zaman beni dinler. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 27. Öğretmenim, benim fikirlerimi dersinde kullanır. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 28. Öğretmenim, benim düşüncelerimi anladığını hiç konuşmadan yüz ifadeleri ile gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 29. Öğretmenim benimle arkadaş gibidir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 30. Öğretmenim, yapmam gereken işlerin tamamen kendi istediği şekilde yapılmasını ister. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 31. Öğretmenim bana karşı duyarlıdır. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 32. Öğretmenim, derste öğrendiğim bilgileri kullanarak cevaplayacağım sorular sorar. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 33. Öğretmenim söylediklerine uymamı ister. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 34. Öğretmenim, cevaplarımdan memnun olduğunu hiç konuşmadan yüz ifadeleri ile gösterir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 35. Öğretmenim, bana yapmamı söylediği her şeyi yapmam için ısrar eder. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 36. Öğretmenim benim güveneceğim birisidir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 37. Öğretmenim konuları bana açıklama konusunda isteklidir. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 38. Öğretmenim, benim cevaplarımı dersi anlatırken kullanır. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 39. Öğretmenim dersi dinlememi ister. | ❑ | ❑ | ❑ | ❑ | ❑ |
| 40. Öğretmenim, benim derste öğrendiğim konular hakkında çok iyi düşünmemi gerektiren sorular sorar.. | ❑ | ❑ | ❑ | ❑ | ❑ |

# APPENDIX C

## ÖĞRENMEDE GÜDÜSEL STRATEJİLER ANKETİ

Bu kısımda kimya dersinde kullandığınız öğrenme stratejileri ve çalışma becerilerini belirlemeye yönelik ifadeler yer almaktadır. Cevap verirken aşağıda verilen ölçeği göz önüne alınız. **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.** Unutmayın Doğru ya da Yanlış cevap yoktur yapmanız gereken sizi en iyi tanımlayacak numarayı yuvarlak içine almanızdır.

1 --- 2 --- 3 --- 4 --- 5 --- 6 -- 7
beni hiç yansıtmıyor — beni tam olarak yansıtıyor

### Öğrenme Stratejileri

| | beni hiç yansıtmıyor | | | | | | beni tam olarak yansıtıyor |
|---|---|---|---|---|---|---|---|
| 1. Kimya dersi ile ilgili bir şeyler okurken, düşüncelerimi organize etmek için konuların ana başlıklarını çıkarırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Kimya dersi sırasında başka şeyler düşündüğüm için önemli kısımları sıklıkla kaçırırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Kimya dersi ile ilgili bir şeyler okurken, okuduklarıma odaklanabilmek için sorular oluştururum. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Kimya dersine çalışırken, önemli bilgileri içimden defalarca tekrar ederim | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Kimya dersi ile ilgili bir şeyler okurken bir konuda kafam karışırsa, başa döner ve anlamak için çaba gösteririm. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Kimya dersine çalışırken, daha önce okuduklarımı ve aldığım notları gözden geçirir ve en önemli noktaları belirlemeye çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Kimya dersine çalışmak için ayırdığım zamanı iyi değerlendirebiliyorum. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8.Eğer Kimya dersi ile ilgili okumam gereken konuları anlamakta zorlanıyorsam, okuma stratejimi değiştiririm. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Genelde ödevlerimi rahat konsantre olabileceğim bir yerde çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Kimya dersine çalışırken, dersle ilgili okumaları ve ders sırasında aldığım notları defalarca okurum | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11. Ders sırasında veya ders için okuduğum bir kaynakta bir teori, yorum ya da sonuç ifade edilmiş ise, bunları destekleyen bir bulgunun var olup olmadığını sorgulamaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Kimya dersi ile ilgili duyduklarımı ya da okuduklarımı ne kadar gerçekçi olduklarına karar vermek için sıklıkla sorgularım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. Dersle ilgili konuları organize etmek için basit grafik, şema ya da tablolar hazırlarım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Kimya dersinde işlenen konuları bir başlangıç noktası olarak görür ve ilgili konular üzerinde kendi fikirlerimi oluşturmaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. Çalışma planına bağlı kalmak benim için zordur. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. Kimya dersine çalışırken, dersten, okuduklarımdan, sınıf içi tartışmalardan ve diğer kaynaklardan edindiğim bilgileri bir araya getiririm. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. Yeni bir konuyu detaylı bir şekilde çalışmaya başlamadan önce çoğu kez konunun nasıl organize edildiğini anlamak için ilk olarak konuyu hızlıca gözden geçiririm. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. Kimya dersinde işlenen konuları anladığımdan emin olabilmek için kendi kendime sorular sorarım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19. Çalışma tarzımı, dersin gereklilikleri ve öğretmenin öğretme stiline uygun olacak tarzda değiştirmeye çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. Genelde derse gelmeden önce konuyla ilgili bir şeyler okurum fakat okuduklarımı çoğunlukla **anlamam** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. Kimya dersindeki önemli kavramları hatırlamak için anahtar kelimeleri ezberlerim. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22. Kimya dersine çalışırken, konuları sadece okuyup geçmek yerine ne öğrenmem gerektiği konusunda düşünmeye çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 23. Mümkün olduğunca kimya dersinde öğrendiklerimle diğer derslerde öğrendiklerim arasında bağlantı kurmaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24. Kimya dersine çalışırken notlarımı gözden geçirir ve önemli kavramların bir listesini çıkarırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 25. Kimya dersi için bir şeyler okurken, o anda okuduklarımla daha önceki bilgilerim arasında bağlantı kurmaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 26. Ders çalışmak için devamlı kullandığım bir yer (oda vs.) vardır | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 27. Kimya dersinde öğrendiklerimle ilgili ortaya çıkan fikirlerimi sürekli olarak gözden geçiremeye çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 28. Kimya dersine çalışırken, dersle ilgili okuduklarımı ve derste aldığım notları inceleyerek önemli noktaların özetini çıkarırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 29. Kimya dersiyle ilgili konuları, ders sırasında öğrendiklerim ve okuduklarım arasında bağlantılar kurarak anlamaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 30. Kimya derslerinde verilen ödevleri ve derse ilgili okumaları zamanında yaparım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 31. Kimya dersindeki konularla ilgili bir iddia ya da varılan bir sonucu her okuduğumda veya duyduğumda olası alternatifler üzerinde düşünürüm | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 32. Kimya dersinde önemli kavramların listesini çıkarır ve bu listeyi ezberlerim. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 33. Kimya derslerini düzenli olarak takip ederim | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 34. Kimya dersine çalışırken iyi anlamadığım kavramları belirlemeye çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 35. Başka faaliyetlerle uğraştığım için çoğu zaman kimya dersine yeterince zaman ayıramıyorum | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 36. Kimya dersine çalışırken, çalışmalarımı yönlendirebilmek için kendime hedefler belirlerim. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 37. Ders sırasında not alırken kafam karışırsa, notlarımı dersten sonra düzenlerim. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 38. Kimya sınavından önce notlarımı ya da okuduklarımı gözden geçirmek için fazla zaman **bulamam**. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 39. Kimya dersinde, okuduklarımdan edindiğim fikirleri sınıf içi tartışma gibi çeşitli faaliyetlerde kullanmaya çalışırım. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |