SELF-EFFICACY, LEARNING STRATEGIES, TASK VALUE AND GENDER: PREDICTORS OF 11TH GRADE BIOLOGY ACHIEVEMENT

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ABSTRACT

SELF-EFFICACY, LEARNING STRATEGIES, TASK VALUE AND GENDER: PREDICTORS OF 11TH GRADE BIOLOGY ACHIEVEMENT

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The purpose of this study was to examine the contribution of the gender, self-efficacy beliefs, task value, and learning strategies to the 11th grade students' biology achievement.A total of 1035 students from different high schools in Yenimahalle and Çankaya districts of Ankara participated in the study.The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia & McKeachie; 1991) and Biology Achievement Test(BAT) were used to collect data. Results of the the simultaneous multiple regression analysis indicated that 11th grade students' gender, task values, self-efficacies and elaboration learning strategies were statistically significant predictors of their Biology achievement; whereas rehearsal and organization learning strategies were not.

Keywords: Biology achievement, Self-efficacy, Task value, Learning Strategies

ÖZ

ÖZ-YETERLİK, ÖĞRENME STRATEJİLERİ, DEĞER VERME VE CİNSİYET: 11'İNCİ SINIF ÖĞRENCİLERİNİN BİYOLOJİ BAŞARISININ YORDAYICILARI

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Bu çalışmanın amacı, 11.sınıf öğrencilerinin cinsiyetlerinin, sahip oldukları öz-yeterlik ve değer verme inançlarının ve öğrenme stratejilerininBiyoloji dersi başarılarına katkılarını araştırmaktır.Çalışmaya Ankara'nın Yenimahalle ve Çankaya ilçelerindeki farklı liselerden toplam 1035 öğrenci katılmıştır. Çalışmada veri toplama aracı olarak Öğrenmede Motivasyonel Stratejiler Anketi (MSLQ; Pintrich, Smith, Garcia & McKeachie; 1991) ve Biyoloji Kavramları Testi kullamılmıştır. Çalışmada uygulanan çoklu regresyon analizi sonuçları 11'inci sınıf öğrencilerinin cinsiyetlerinin,değer verme ve öz-yeterlilik inançlarının ve öğrenme stratejilerinin öğrencilerin biyoloji dersi başarısını açıklayan, istatistiksel olarak anlamlı, yordayıcı değişkenler olduğunu; bunun yanısıra tekrar etme ve değerlendirme öğrenme stratejilerinin ise yordayıcılıklarının istatistiksel olarak düşükolduğunugöstermiştir.

Anahtar Kelimeler: Biyoloji başarısı, Öz-yeterlik, Değer verme, Öğrenme Stratejileri

“To my parents, whom I adore….”

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Finding a starting point to the paragraphs I sincerely desire to write for years is harder than I imagined. But luckily I know to whom I should thank to with full of gratitude stemming from deep inside my heart.

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BAT: Biology Achievement Test

CI: Condition Index

CFI: Comparative Fit Index

ELA: Elaboration

GOF: Goodness of Fit

GPA: Grade Point Average

KMO: Kaiser-Meyer-Olkin measure of sampling adequacy

MSLQ: Motivated Strategies for Learning Questionnaire

ORG: Organization

REH: Rehearsal

RMSEA: Root Mean Square Error of Approximation

SE: Self-efficacy beliefs

TLI:Tucker-Lewis Index

TV: Task Value beliefs

VIF: Variance Inflation Factor

χ^2 : Chi-square

CHAPTER I

INTRODUCTION

This chapter aims to give detailed information about the background, purpose and educational significance of the study. Additionally, definitions of the terms related with the research were given.

1.1. Background of the Study

How students learn is a complex concept to be explained by teachers, researchers, and also for students. According to Gabel (1994), the behaviors that students show in the learning environments are influenced by the values the students hold, the motivation or beliefs they have, and the attitudes they have about school, science, and life in general.Therefore, for a better explanation on how students learn, not only cognitive; but also the affective variables should be considered. The affective variables are important stakes of learning in the mean of interpreting students' task related thinking, emotions, and actions.

Self-efficacy is one of these affective variables, which mainly influences students' commitment to facilitate own achievement (Schunk, 2008). This concept came into being primarily by Bandura's theory of self-efficacy by 1970s. The theory proposed by Bandura connects individuals' behavior to a factor termed as self-

efficacy. As defined by Bandura (1997) self-efficacy is students' judgments about their own capabilities for acquiring educational objectives by providing their own learning. Stemming from this main idea,it is simply defined as a specific belief about one's own ability to acquire a task successfully.

Self-efficacy has been found to be related to positive teaching behaviors and better studental outcomes in various studies (Bandura, 1997; Pietsch, Walker,& Chapman,2003; Schunk, 1991; Schunk & Zimmerman, 1994). Shaughnessy (2004) reported that self-efficacy beliefs have positive influence on one's goal settings, actions, choices, persistence, self-regulation, learning strategies, attributions, and achievement in an in/direct way.Higher levels of self-efficacy are found to be related with students' achievement levels (Bandura, 1997).It was also mentioned that self-efficacy belief is context and task specific as defined by Bandura in his theory of self-efficacy (Bandura, 1997).Therefore these findings given may change through experiences, time, context, and task.

According to Pintrich and Schunk (2002) task values are also another influencing variable explaining the reasons why a student engages in a task or prefers not to.Based on this perspective, task values are simply defined as one's detailed former evaluation constituted on a task, describing it in terms of worth learning or not. Task values are also stated to be an individual's general understanding of a specific task as defining it in terms of being useful, joyful, and satisfactory (Eccles&Wigfield,1995; Wigfield,1994; Wigfield& Eccles,1992). Therefore, task values help one to foresee tasks' possible advantages and disadvantages (Pintrich, 1999).According to Wigfield (1994), students with higher achievement hold more specific task values. Wigfield and Eccles (1992) also proposed that task values

collaboratively with expectancies are significant predictors of individuals' performance, persistence, and choice behaviors.

A considerable body of research is additionally defending that students' use of learning strategies are one of the major determinants of their successful achievement (Garcia & Pintrich, 1996; Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1990). For Pintrich (1995) individual's control over cognition can be processed by the use of various learning strategies. Entwistle (1988) divided learning strategies into two classes; which namely are surface processing strategies and deep processing strategies. Garcia and Pintrich (1995) revealed that, use of deeper learning strategies, more positive motivation possessed and higher levels of self-efficacy is an indicator of higher academic achievement in students.

Looking with a broader perspective, these beliefs and strategies can also be assumed to be influencing students' behavior and educational outcomes that are aimed at the very beginning of teaching process bi-directionally and cyclically. So, the development of such context-specific, conceptual variables defined is attracting a great deal of interest among researchers, according to their relations with key concepts mainly mentioned. Therefore, determining factors constituting and contributing students' beliefs and revealing how these beliefs are constituted is an important factor in education.

The need for the research on determining the independent variables that predict Turkish high school students' achievement levels in biology is an incomplete area to research. Therefore, the related contextual variables should be taken into account to acquire a level of conclusion for interpreting and proposing new perspectives about the effectiveness of curricula, instruction, and education in general. Research studies

should firstly determine the factors affecting students' achievement to propose new ways to facilitate it, as well. Due to the theoretical basis explained above, the aim conducting this study is revealing the predictors of the Biology achievement levels of the 11th grade high school students. These predictor variables are found to be the students' gender, elaboration learning strategies, self-efficacy, and task value.

1.2. Educational Significance

Learning is influenced by learners' values, beliefs, attitudes, and thoughts (Schunk, 2008; Volet, 1997). Therefore, not only the cognitive processes but also the affective processes about students, should be taken into account while explaining the learning (Shaughnessy 2004; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). The recent change in the High School Biology Curriculum pointed out the importance of active learning rather than passive information receiving process. In Biology curriculum it is stated that learning is an active process (including students as well as the teachers) which can be affected by many other factors such as affective status and learning strategies.Researchers have additionally proposed that science achievement in school is a function of many interrelated variables such as students' ability, attitudes and perceptions, socioeconomic variables, parent and peer influences and school-related variables (Singh, Granville,& Dika, 2002). Therefore in order not to be causing any distortions among learning processes of the students, teachers must be aware of such terms related to student learning in the classroom. Considering the association of achievement with self-efficacy and task value reported by research studies(Gungoren, 2009; Pintrich&DeGroot,1990; Pintrich, Smith, Garcia, &

McKeachie, 1993),the present study aims to examine the role self-efficacy and task value on high school students' biology achievement. In addition, learning strategies are another major factors influencing students' achievement(Entwistle, 1988; Pintrich & DeGroot, 1990; Pintrich & Schrauben, 1992;Pintrich, Smith, Garcia, & McKeachie, 1993;Stoffa, 2009; Weinstein & Mayer, 1986). Consequently, identifying which learning strategies students employ while studying biology and how those strategies are related to their achievement in biology is deemed as important in instructional process in order to increase student learning and improve the quality of instruction. The current study, therefore, adds the knowledge to the body of literature including learning strategies along with self-efficacy and task value to predict biology achievement. The present study is also useful for biology teachers in that they can use the findings and implications of this study during planning their instruction in the classroom.

1.3. Definition of Terms

Self-Efficacy:Self-efficacy is defined as theindividuals'own beliefs on fulfilling a task at a suitable level of accomplishment (Bandura, 1986). It is the task specific belief of an individual on feeling capable of affecting own thoughts and behaviors (Pajares, 1996).

Task Value:Task values are the perceived importance of an achievement task, mediated by individual's needs, interest and the perceived utility of the task itself (Garcia & Pintrich, 1995; Pintrich et al. 1991).

Learning Strategies: Learning strategies are the way of applying various activities during learning process, through which an aimed achievementon a task is accomplished (Miltiadou, 1999).

Rehearsal: Rehearsal is a learning strategy heavily emphasizing on rote memorization and recalling of information (Zusho et al., 2003). As a surface learning strategy, rehearsal strategies focus on repeating the information in the same form it is reached, to stabilize it into short-term memory (Garcia & Pintrich, 1995; Pintrich et al., 1991)

Organization: Organization is a deep learning strategy requiringindividuals' close relation of the task (Pintrich et al., 1991). Organization learning strategy can be used by the student through outlining important parts of a learning material or drawing schemas, figures, charts, diagrams, graphs and tables (Zusho et al., 2003) or grouping and specifying the important ideas in a learning material (Garcia & Pintrich, 1995; Pintrich et al., 1991).

Elaboration: Elaboration is a deep learning strategy requiring students' specifying meaning, summarizing or paraphrasing the learning material to be used in the learning process (Zusho et al., 2003). This strategy helps individual to store the information in long-term memory (Pintrich et al., 1991).

Biology Achievement: Biology achievement is measured through using the scores students' gained from the BAT.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

This chapter gives brief information on three main concepts themed in this study; which namely are self-efficacy, task value, and learning strategies. Self-efficacy construct is discussed under social cognitive theory along with human agency, triadric determinism. Under the task value topic expectancy value theory, as well as properties of the task value concept, are described briefly. Lastly, in this chapter, the learning strategies as the cognitive perspective of the study are explained.

2.1. Social Cognitive Theory

What the social cognitive theory, proposed primarily by Albert Bandura, mainly stated the core idea that human learning is affected by both internal and external factors (Bandura, 1989, 1997, 1999). Based on this theory, it was stressed that due to its being constituted in a social environment, rather than a socially isolated area; meaningful learning is also a social event (Schunk, 2008). Understanding human learning therefore requires taking both the social and psychological factors into account; rather than just focusing on the quality of the information given (Bandura, 1997).

For Bandura (1997) people have an inborn capability to control their nature and own life consciously, which is conceptualized in social cognitive theory as human agency.This power performed by individuals' consciousness, possessed to maintain control over own environment therefore own life, is a core matter of being human (Bandura, 2001).Pintrich (2002) defended that human agency is both the purpose and meaning of life for keeping one busy with something to be interested in.Pajares (1996) detailed the definition more specifically that individuals are not only the producers but also the products of the social systems. Bandura (1997) specified that, human agency, which is not only stemming from one's efficacy beliefs but also constitutes them, by its enlightening power objectifies one's abilities, beliefs, and performance.

According to Bandura (1986), the four core features of human agency are intentionality, forethought, self-regulation and self-reflectiveness:*Intentionality*is defined as the core property of human agency helps one to constitute actions for own purposes adopted. Pintrich (2003) also defined intentions as the linkages between goals, use of learning strategies, and actions. According to Pintrich (2002), intention is not only an expectation, prospection or representation about a future action but also consistently aiming at that act. Therefore, intentionality is assumed to be the one of the core features of human agency. For Bandura (1997), intention is precisely defined as individuals' planning the action to be acted by representating it internally. Planned agency is assumed to be giving various results or outcomes, which are consequences of acts (Pintrich, 2002). For Davidson (1971, as cited in Bandura, 2001), actions planned internally based on a specified purpose may give different results to come by. Thus, intentions are defended to be far different than outcome

expectations mainly considering the possible overall consequences of acts performed.

Social learning needs the capacity to being able to make plans for the future. People must be able to predict about how others will behave their selves, must be able to set goals and plan their own future. Shortly, thinking comes first then comes action. Thus, people must be able to *forethought*, as to make better social learning. Bandura (1997) defined forethought based on this perspective as the ability to anticipate the consequences of own acts. Bandura (2001) proposed that forethought is a core feature of human agency, because it gives one the required perspective of thought to regulate own actions in a meaningful way. For Pintrich (2002) individuals, based on their goals, tend to choose actions which are more likely to give desired outcomes; whereas they avoid actions which may give unwanted consequences in the end. Pajares (2004) stated that individuals set their own standards by this way and then regulate their motivation, therefore, behavior based on these own perceptions mentioned.

According to Bandura (2001), an individual not only intends, forethoughts, and plans an action but also motivates and self-regulates oneself as well. Due to explaining the human agency wholly and bades on these reasons defined, another concept in human agency, *self-regulation*, is described as the relation between one's thoughts and actions (Pintrich, 2002). Goals play a prominent role in this self-regulating process, by constituting a value system at the background of one's thoughts, which also gives meaning to the actions of interest (Bandura, 2001). Individuals also regulate their own actions based on personal standards using self-monitoring, self-guidance, and self-evaluation processes (Bandura, 1997).

Bandura (2001) lastly specified *self-reflectiveness* as the most dominant feature of human agency based on social cognitive theory. According to this concept, people have the capacity to think, judge, and reflect about their selves. Individuals record the ideas about themselves in their minds and according to the results of their actions they make interpretations or judgements about the adequacy of their ideas and behaviors. This process affects their behaviors and learning. Based on this view, Pintrich (2002) described self-reflectiveness as the metacognitive ability to reflect the overall process, outcomes and meanings of one's own actions. For Bandura (2001), what self-reflection provides one is the capability to evaluate the correctness of their own level of motivation, values, and actions.

The social cognitive theory additionally describes the model called "triadric reciprocality interactions", which explains human learning to be constituted cumulatively on three major factors; personal, behavioral,and environmental factors (Bandura, 1986). Triadric determinism proposed assumes that behavior environment and cognition of an individual reciprocally influences each other. To summarize it in a more practical way, behavior influences one's environment, so do the environmental factors affect behavior; whereas personal factors like beliefs and cognitions affect what was mentioned earlier, bi-directionally.The events that affect human behavior are various based on the social cognitive theory. Possessing a crucial and central role in human agency, self-efficacy is a major concept, which lies at the core of social cognitive theory.

2.1.1. Self-Efficacy

By Bandura's introduction of social cognitive theory in 1970s, the term self-efficacy was also put forth as a core feature of this theory. Based on a simplistic aspect of the theory, Bandura (1986) described students' own judgment in organizing to accomplish a specific task as a multidimensionalconcept termed self-efficacy. Self-efficacy is a kind of perception on future actions concerning about the beliefs of own capabilities to organize own actions to acquire own goals.That is, self-efficacy is a belief that one perceives his capabilities to do something specific (Schunk, 2008). Basically, it is the judgment about own capabilities of handling a specific problem or not. Based on the initial description made by Albert Bandura, the term self-efficacy is assumed to be a major term used in asserting student achievement in terms of individual's perceptions on own ability (Schunk, 2008).

The social cognitive theory gives considerable importance on "self-efficacy" possessed throughout the learning process.Self-efficacy is a concept which helps determine what people decide to do, based on their impressed capability beliefs. Notwithstanding self- efficacy is not a function of individual's ability levels (Schunk, 2008). Rather, it is a product of individual's judgments about what he/she can do due to his/her abilities. More specifically, it is the individual's perception about his/her capacity about dealing with specific or different cases and situations. Self-efficacy affects individuals' motivation in different ways for different motivation theories (Eccles et al., 1998 as cited in Tassone (2001); Pintrich&Schunk, 1996). Pintrich and DeGroot (1990) stated that students' self-efficacy, cognitive engagement, and

performance, which are also components of self-regulated learning, are intimately related with each other. Bandura (1997) specified that self-efficacy majorly influences the amount of effort shown on a specific task and the level and duration of persistence during this process, even faced with obstacles. Due to this reason, individuals with lower self-efficacy on a specific task tend to avoid that task; whereas the ones with higher efficacy eager to accomplish the task (Schunk, 2008).

Low self-efficacy may provide an incentive to learn more about the subject; whereas, higher self-efficacy in a task may avoid one from preparing sufficiently for that task (Schunk, 2008). People with low self-efficacy may possess positive outcome expectations (Bandura, 1997). But low self-efficacy generally leads to a subjective, unrealistic belief in task, that it is harder than it actually is; which causes one to plan the task poorer, therefore increases stress (Schunk, 2008). Therefore, students' self-efficacy is desired to be not too high, nor too low in achievement situations. Pajares (2002) defended that the desired level of self-efficacy is just a little above of the actual ability. This level specified causes one to select challenging tasks. Efficacious people perceive that, the control of their lives is in their own hands; whereas inefficacious people take external uncontrollable factors into account while explaining the factors shaping their lives (Bandura, 1997). Efficacious people are prone to put more effort and persistence forth (Schunk, 2008). Inefficacious people are easily distracted and discouraged by environmental effects (Pintrich, 2002). According to Bandura (1993) efficacious people are the ones who take the advantages of a possible opportunity immediately; whereas inefficacious ones are lack of such an inference. Self-efficacy also affects one's attributions of failure. Efficacious people tend to attribute failure to external factors; on the other hand

inefficacious ones attribute it to lack of own ability (Bandura, 1997). Inefficacious people are reluctant to improve their task specific skills (Schunk, 2008). Repeated successes increase the level of self-efficacy; whereas repeated failures lower it (Bandura, 1997). These properties described also highlight the reciprocal relationships among the environment, self, and behaviors posited by Bandura's social cognitive theory.

Bandura (1997) noticed that, successful people usually have higher self-efficacy and defined the role of self-efficacy beliefs in human functioning as "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true"(p.2).This description helps in explaining why people's behaviors are sometimes irrelevant with their actual capabilities and why their behavior may differ widely even when they have similar knowledge and skills (Pajares, 2002).Individual's capability to handle a specific situation can generally be predicted by their self-efficacy beliefs better than by their previous attainments, knowledge, or skills that they have (Pajares, 1996; Schunk, 2008). An individual's sense of self-efficacy can play a major role in how s/he approaches goals, tasks, and challenges (Pajares, 2002).Therefore, determining the levels of efficacy is important.

According to social cognitive theory, the events over which personal influence is exercised vary (Bandura, 1997).Self-efficacy, which was defined as perception about own capabilities to learn or perform a task at the desired level (Bandura, 1997) affects the perception of the ease of learning (Bandura, 1997; Pajares, 1996; Wigfield, 1995). Therefore of all the factors affecting human functioning, the most dominant ones are theself-efficacy beliefs. Self-efficacy and

other expectancy beliefs have in common that they are the beliefs about one's perceived capability about his/her own. Where they majorly differ is that only self-efficacy is defined in terms of individuals' perceived capabilities to attain designated types of performances and achieve specific results. The sense of self-efficacy may play a major role in how one approaches goals, tasks, and challenges. Depending on what is being managed, it may entail regulation of one's own motivation, thought processes, affective states and actions, or changing environmental conditions (Pajares, 2002). So, it is inaccurate to label it a non-cognitive skill because it involves cognitions and is a belief rather than a skill per se (Lenon, 2010). According to Bandura (1997), it is one and the same person who does the strategic thinking about how to manage the environment and later evaluates the adequacy of his/her knowledge, thinking skills, capabilities, and action strategies.The main question defining to specify self-efficacy is "Do I have the ability to organize and execute the actions necessary to accomplish a specific task at a desired level?"(Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998).

Pajares and Miller (1995) stated that predicting general academic achievement is likely possible with a general measure of academic self-efficacy; but then added that best predictions of specific academic achievement situations should be done with specified measurements (Pajares, 1996). Based on this view Pintrich (2002) also stated that self-efficacy is a context-specific belief, which can be evolved in different area and different degrees by people. For example, while one student may own higher self-efficacy to achieve mathematics, another student may own lower self-efficacy to achieve it. That is, self-efficacy can change with respect to individual's characteristic or internal and external factors. As a property of own, self-

efficacy may also change from one individual to another and may differ between different genders.

Self-efficacy is also a subject-specific belief, which means that it can differ across academic domains (Lenon, 2010).Self-efficacy is considered to be highly context-specific, eliciting students' judgments for a rather narrow and domain-specific field of expertise (Rotgans & Schmidt, 2010).For Driscoll (2005), use of any general self-efficacy scale, therefore, may result inconsistent results.A general measure of self-efficacy is not a possible measurement to be obtained, so a specified measure of self-efficacy among individuals must be used while measuring it.

2.1.1.1. The Related Concepts with Self-Efficacy Construct

Up to now, the major framework of self-efficacy was described briefly by focusing on Bandura's social cognitive theory. Self-efficacy is defined to be a concept which helps determine what people decide to do. Self- efficacy is not a function of individual's ability levels; rather it is a product of owns judgments about what he/she can do due to his/her abilities. The other possibly related concepts with self-efficacy as self-esteem, outcome expectations, and self-conceptare defined below:

Self-esteem is the subjective evaluation on individual's sense of self-worth, which affects the quality of personal agency (Harter, 1999). Self-esteem generally considers about the evaluation on a specific task(Bandura, 2001). For Linnenbirk and Pintrich (2003), self-esteem is theindividual's prospection of accomplishing or not accomplishing a specific task.It is practically definedrather a generalized form of

self-efficacy, which is affected by both cultural and personal standards (Pintrich, 2002).Bandura (1986) distinguished self-efficacy from self-esteem is that self-efficacy is a more related concept with individual's task specific confidence. Bandura (1997) also emphasized this difference as stating that self-efficacy deals with individual's capabilities, whereas self-esteem with self-worthiness.

Outcome expectations are also another concept related to self-efficacy. For Bandura (1986) students' outcome expecatitons are constituted upon their beliefs in their own capabilites on accomplishing that task, which is termed as self-efficacy. That is self-efficacy beliefs control individuals' motivation through not only goals but also outcome expectations (Bandura, 2001). Bandura (1997) specified that outcome expectations are determined by self-efficacy beliefs, whether entirely or partially. Outcome expectations, which are the one of the major determinants of action with self-efficacy, majorly focus on the results of the determined action (Pintrich, 2002); whereas occupying an outcome expectation based on a specified task prerequisities obtaining a positive self-efficacy on that task (Bandura, 2001). For Bandura (1986) self-efficacy beliefs are judgments concerning with engaging in the behavior or not; whereas outcome expectations are judgments on the possible consequences of the act of interest. Self-efficacy beliefs emphasize the judgments on owns' whether accomplishing a task or not; whereas outcome expectations focus on the results of the actions of interest (Schunk, 2008).

Finally, self-concept is also related with individual's self-efficacy beliefs. It is a more general form of self-efficacy (Harter, 1990). Self-concepts are individual's domain specific perceptions on own ability, based on judgments of self-worthiness (Pintrich, 2002). For Schunk (1991), self-efficacy is a context-specific concept;

whereas self-concept is a more general, domain specific concept, including evaluations on competence and self-worthiness perceptions, too. Self-efficacy beliefs are individuals own perceptions on own specific capabilities; on the other hand self-concept is the cumulative resultant of whole perceptions constituted on own individual experiences. Self-concept judgments concern with judgments of comparisons on individual's own and with others, based on a specified criteria. These judgments are essential in constituting and improving task-specific self-efficacy beliefs (Bandura, 1986). According to the related literature academic achievement, self-concept and self-efficacy are found to be related with each other (Hattie, 1992).However, self-efficacy is consistently found to be the most related and predictive factor on students' academic achievement (Pajares & Miller, 1994).

2.1.1.2. The sources of self-efficacy beliefs

According to Bandura (1997), a student's sense of self efficacy is derived from four core sources, which namely are mastery (enactive) experiences, vicarious experiences (social modelling), social persuasion, and phsychologicaland emotionalstates.These sourcesare assumed to be affecting individual's self-efficacy judgments; therefore, his/her performance.

2.1.1.2.1.Mastery experiences (Enactive experiences)

According to the reciprocal model of social cognitive theory, consequences of previous behaviors serve as information and motivation sources for the future tasks (Bandura, 1986). Throughout this perspective, enactive or mastery experiences are described. Enactive or mastery experiences are defined as a learner's own past accomplishments at a specific task (Bandura, 1997). These are the specific information that individual gained after his/her own successful or unsuccessful activities. This successes or failures may affect individual's outcome expectations about the same or any other similar subject. Bandura (1997) stated that enactive mastery experiences are far most effective self-efficacy contributing source; especially when the task is challenging and prerequisite determination.

It is documented that mastery expectations that one possesses are raised by previous successes (Bandura, 1986; Britner & Pajares, 2006; Zimmerman, 1995), they are lowered by repeated failures (Staples, Hulland&Higgings, 1998; Bandura &Jourden, 1991; Schunk& Hanson, 1989). Based on this idea, it may be defended that engaging in a task results in interpreting and improving self-beliefs on own capabilities. Bandura (1986) stated that successful interpretations lead to the improvement of these self-efficacy beliefs; whereas unsuccessful ones give recession to these beliefs. It is additionally documented that multiple successes also increase self-efficacy againstfailures (Bandura, 1997). However, repeated failures at the beginning of the act, additionally if not interpreted as due to lack of effort or unfavorable circumstances, give the most negative effect on self-efficacy (Försterling, 1985). On the other hand, if the individual had already constituted a

strong self-efficacy by the help of previous successes, failures can be handled less destructively (Brunstein&Gollwitzer, 1996).These effects of past failures mentioned might be erased by if they were handled with determined effort (Bandura, 1997; Bandura &Jourden, 1991; Försterling, 1985).Successful enactive mastery experiences are the far most effective source of self-efficacacy beliefs (Bandura, 1997). But, this does not mean that improvement of self-efficacy beliefs are direct resultants of these experiences. The fact is, individuals not only gain successful experiences but also perform cognitively weighing and evaluating based on their own criteria to improve their self-efficacies (Stajkovic& Luthans, 1998).

2.1.1.2.2. Vicarious experience (Modelling)

Vicarious learning (modeling) is one of the major notions of social cognitive theory. Although mastery experiences are more influential on developing a sense of self-efficacy; vicarious experiences emerge powerfully when individual has uncertainity upon own abilities based on limited past experiences (Bandura, 1997). It is the learner's observation of a role-model attaining success at a task.This is a process of comparison between a person and someone else (Pajares,2002).Individual self-efficacy rises when one observes a model who obtains successful outcomes. Watching others accomplishing a specific task encourage the individual about own ability to do so (Bandura, 1997).

The effects of vicarious information on self-efficacy appraisals are dependent on the criteria by which the ability will be evaluated. Seeing a skilled person fail by his/her use of insufficient strategies can increase self-efficacy in observers who

believe they have more suitable strategies at theirselves. When people see someone succeeding at something, their self-efficacy will increase; and where they see people failing, their self-efficacy will decrease (Pajares,1996). Conversely, poor performance contributes to decrease self-efficacy because this lead to lower observer's encourage and motivation to attempt model (Schunk, 2008).

Schunk (1981, 1983,1987) revealed that vicarious experiences are significantly related to improvement in self-efficacy (Pajares, 2002).Seeing other people performing successfully at a task can raise self-efficacy in observers that they can be able to possess the capabilities to master comparable activities, too (Pajares,2002). Social comparisons along with vicarious experiences gained through models affect one's self-beliefs on competence (Schunk, 1983).The models in one's environment supply a major source of information for evaluating self-efficacy (Schunk, 2008).

Modeled person maybe a peer or instructor depending on the observers needs (Cassani, 2008). Models can be live, symbolic or nonhuman, electronic, or in print (Pintrich, 2002). Models, through which vicarious experiences were gained, should poses several properties such as similarity with the observer and expertize on task; whereas the task itself should be of significant difficulty (Cassani, 2008). Family is initial source of self-efficacy. Parents are mainly the essential model to provide self-efficacy (Schunk, 2008). Furthermore, observing other's success increase motivation because people believe that if others can achieve, we can achieve (Schunk, 2008). As children grew older, peers become increasingly crucial in their social lives. If a peer who is perceived to having the similar ability succeeds, this will practically increase an observer's self-efficacy (Schunk, 2008).

2.1.1.2.3. Social (Verbal) persuasion

Verbal persuasion is another source of self-efficacy. It is the perception of a specific capability gained by external persuasion (Bandura, 1997). Social persuasions relate to encouragements/discouragements one percept.Verbal persuasion provided by others, influence one's own self-efficacy judgments (Bandura, 1997). It causes individual to focus on his/her own capabilities rather than insufficiencies and past failures and encourages us, raises our outcome expectancies and increases our self-efficacy by the way. Positive persuasions increase self-efficacy, negative persuasions decrease it. But as a rule of thumb it is generally easier to decrease someone's self-efficacy than it is to increase it.

Although verbal persuasions are far less effective sources of self-efficacy compared to mastery or vicarious experiences; they affect self-efficacy by affecting individual's self-beliefs (Zeldin&Pajares, 1997). Self-beliefs on accomplishing a specific task are related to better performance (Jackson, 2002; Lane & Lane, 2001; Pajares, 1996; Pajares, 2003).The aim in persuading someone verbally is to guide him or her use own ability to succeed, without giving him or her unrealistic expectations, too (Bandura, 1997). An individual verbally persuaded believes in that s/he is able to accomplish a specific task (Bandura, 1986). Verbal persuasions must be positive, authentic and realistic; otherwise it would not be a proper persuasion reinforcing one's desired behavior. Persuading person also should possess considerable intelligence and credibility; so that s/he contributes to self-efficacy (Bandura, 1997).

2.1.1.2.4.Physiological and emotional states

The perceived physiological and emotional factors by individual's own affects the self-efficacy beliefs of an individual (Bandura, 1997). In unusual, stressful situations, people commonly exhibit signs of distress; shakes, aches and pains, fatigue, fear, nausea, etc. and this may cause a decrease in students' self-efficacy, therefore performance (Bandura, 1997). Additionally, Pajares and Miller(1994) specified that there is a cross relation between these variables and added that low self-efficacy also causes such kinds of physiological symptoms. People tend to impair physiological responses with actual performance; therefore, physiological states may give information about individual's self-efficacy (Pajares, 2002). Emotional symptoms such as fear, stress, sweating decrease one's self-efficacy; whereas positive feelings reinforce self-efficacy (Bandura, 1997). A person's perceptions of these responses can markedly alter a person's self-efficacy (Pajares, 2002). Bandura (1997) proposed that individuals possessing fears, anxiety, stress and negative thoughts about own capabilities have lower levels of self-efficacy. Stronger emotional reactions on a task give one clues about the prospective success or failure (Pajares, 2002).

2.1.1.3.The Relationship between Self-Efficacy and Science/BiologyAchievement

As well as factors such as attitudes and motivation, self-efficacy is also a frequently emphasized concept researched in science and biology education literature (Ekici, 2005; Baldwin, Ebert-May & Burns, 1999; Koksal, 2009; Yumusak, 2006; Yumusak, Sungur & Cakiroglu, 2007). That may be because considerable research has suggested that self-efficacy has a major role on students' academic achievement (Al-Harthy & Was, 2010; Bandura, 1997; Graham & Weiner, 1996; Kitsantas & Zimmerman, 2009;Landine & Stewart, 1998; Multon, Brown & Lent, 1991;Pajares, 1996, 2002, 2003;Pintrich & De Groot, 1990; Pintrich & Schunk, 1995, 1996, 2002;Schunk, 1989, 1991; Schunk & Hanson, 1989; Schunk & Zimmerman, 1994; Tas, 2008; Wigfield & Eccles, 1992; Zimmerman& Bandura, 1994).Research in various domains reveal that there is a significant, medium and positive relationship between students' self-efficacy and achievement between the values of .49 to .70 (Pajares, 2002).

Self-efficacy is an academic construct, which is reported to be a significant predictor of students' academic achievement, by the help of increasing their achievement motivation (Bandura, 1997; Schunk, 1991; Schunk & Zimmerman, 1994; Zimmerman, 2000). A body of research showed that self-efficacy is a powerful predictor of students' academic achievement and performance especially in high school students (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, 2001; Bandura & Cervone, 1983; Britner & Pajares, 2006; DeBacker & Nelson, 1999; Gist, 1989; Lapan, Adams, Turner, & Hinkelman, 2000; Lent, Brown & Larkin, 1987;Marie,

2006; Pintrich, 1999; Sadri & Robertson, 1993;Shell, Colvin, & Bruning, 1995; Stajkovic & Luthans, 1998;Zimmerman, Bandura,& Martinez-Pons, 1992).

One of these numerous empirical studies stating that self-efficacy is strongly related to student achievement is the study conducted by Al-Harthy and Was(2010) on 265 undergraduate students enrolled in educational psychology course. Study focused an examined the relations between students' self-efficacy, task value, goal orientations, metacognitive self-regulation, self-regulation and learning strategies. The study also investigates the contribution of these variables on students' total scores on 12 exams. In this study, MSLQ developed by Pintrich et al. (1991), achievement goal questionnaire developed by Elliot (1999), and students' semester grades were used in order to conduct a path analysis to determine relationships between task value, achievement goal orientations, metacognitive self-regulation, learning strategies, self-regulatory strategies, self-efficacy, and students' academic achievement. Of particular interest, the highest correlation between the variables is the one between students' self-efficacy and their academic achievement ($r=.45$, $p<.05$). Additionally, self-efficacy was reported to be the most significant predictor variable of interest of students' achievement ($\beta=.42$).

In another study Britner and Pajares (2006) focused on the relationship between middle school students' academic achievement and their sources of self-efficacy beliefs. Britner and Pajares (2006) predicted 319 fifth to eight grader middle school students'(164 girls, 155 boys) science self-efficacy sources by using the "Sources of Science Self-Efficacy Scale"; whereas their achievement were assesed directly through their GPAs. Results of the study indicated thatmastery experiences, vicarious experinces, social persuasions, and psychological arousal as sources of self-efficacy

are found to be related with students' science achievement. Another aim of the study was to confirm self-efficacy as a predicting factor of students' achievement. Regression analysis also indicated that self-efficacy was the most effective predictor variable on students' science achievement (β=.49).

In one of the meta-analysis studies, Multon, Brown, and Lent (1991) examined 36 former studies in the related literature between the years 1977 to 1988. The relationship between students' self efficacies and their academic achievement were found to be significant through elementary school (r=.21), high school (r=.41) and college (r=.35) students. Additionally, students' self-efficacies were found to be related with their grades (r=.36) and scores on standardized achievement tests (r=.13). According to the results of this meta-analysis self-efficacy was reported to be a significant predictor of students' academic achievements. Self-efficacy was found to be accounting for the 14% of the variance in students' academic achievement, with an overall effect size of .38.

Another meta-analysis conducted by Robbins, Lauver, Davis, Langley, and Carlstrom in 2004 on college students between the years 1981 and 2002 showed that self-efficacy is the strongest predictor of GPA. Pietsch et al. (2003), Bandura (1997), Schunk (1991), Schunk and Zimmerman (1994) explained this prediction mechanism as self-efficacy raises achievement motivation and therefore, is a powerful predictor of academic achievement.Pajares (1996) additionally stated that while the assesment of self-efficacy are not based on a specific criterion task, the predictive value is regressed. He then added that when self-efficacy assesed based on a specific task better predictions on specific academic performances can be drawn.

Singh et al. (2002) reported in their study on 8th graders that; academic self-concept, interest, motivation, and self-efficacy are strong predictors of students' science achievement. To investigate whether students' learning styles and motivational beliefs including self-efficacyhave an impact on their biology achievement, Ozkan (2003) also conducted a research study in Turkey. Ozkan (2003) conducted her study with 980 10th grade students in fall 2003 semester. By using the Turkish version of MSLQ, Learning Style Inventory (LSI), and Biology Achievement Test (BAT), she reported the results of the analyzes of covariance (ANCOVA) and bivariate correlations. Based on the bivariate correlation results it was reported that students' biology achievement and self-efficacies (r=.179) are reported to bestrongly correlated with each other significantly.

Sungur and Yerdelen (2011) conducted another study aiming to compare low and high achieving biology students in the mean of various self-regulated learning strategies. Based on this purpose they administered MSLQ developed by Pintrich et al. (1993), on 252 high school students (99 girls,121 boys, 32 missing). 25%of the students were classified as low achievers; whereas 75% of them are termed as high achievers. Results of the univariate ANOVA conducted revealed the significant mean differences between high-achieving (M=5.16, $p<.05$) and low-achieving (M=4.70, $p<.05$) students' self-efficacies; in which high-achieving students posses significantly higher self-efficacies than low-achieveing students.

Regarding gender differences while Cole et al. (2001) reported no gender differences in students' general self-efficacies,Concannon and Barrow (2009) on the other hand reported that self-efficacy beliefs of individuals may differ, but these differences are far away from statistical significance. Several research confirmed the

occurence of a far more significant relationship between students' self-efficacies, in boys than girls, throughout math and science domains (Pajares, 1996; Pintrich & DeGroot, 1990; Zimmerman & Martinez Pons, 1990). Several other researches have confirmed males' dominance in science self-efficacy (DeBacker & Nelson, 2000; Osborne, et al., 2003; Pajares, 2002; Weinburgh, 1995). Pajares and Miller (1995) reported the dominance of males, in the mean of their expressions of self-confidence in maths and science; although females' far more significant academic performances in these domains.

2.2. Task Value

As a factor affecting student achievement, motivation can be defined in various ways. No matter in what ways we define motivation, either an inborn ability or a transient change in mood, it must be stressed that it is a process rather than a temporary activity around (Long, 2000). This process starts with our activities can either be mental or physical (Schunk, 2008). Motivation is generally defined as a goal directed activity in which an activity is provoked, maintained and directed by individuals' goals (Pintrich&Schunk, 2004). There are different approaches explaining motivation, such as expectancy-value models of motivation. According to this model of motivation, Eccles and Wigfield (2000) specified the main sparkle which enlightens this process mentioned is majorly constituted by our expectancies and values we refer to that specific task. In the following section, the expectancy-value theory is presented.

2.2.1. The Expectancy-Value Theory

Based on the initial model developed by Eccles, Adler, Futterman, Goff, Kaczala, Meece,& Midgley (1983) the expectancy-value model of achievement motivation described how students' beliefs and values affect their behaviors on achievement. Expectancy-value models of motivation (Eccles et al.,1989, 2006; Feather, 1992; Wigfield, 1994; Wigfield&Eccles 1992, 2000, 2001, 2002) describes being motivated generally in terms of our values we assign to specific task and the expectancies we constitute based on our desires and the ideas about the outcomes we attempt to reach. Based on a socio-cognitive view Wigfield and Ecless (2000) proposed the expectancy-value theory of motivation in order to define several constructs to clarify how motivation affects students' choices, persistence, and performances.

According to Wigfield and Eccles' model (2000) as a current expectancy-value model of achievement motivation; an individual's social environment (cultural milieu, own behaviors and past performances), cognitive processes (perceptions, interpretations and attributions on social environment) and motivational beliefs (affective memories, goals, perceptions on competence and task difficulty) are three major determinants of individual's task values and expectancies; which are assumed to affect individual's achievement behaviors such as choice, persistence, effort, cognitive engagement and actual performance. The model has important contributions to education by emphasizing individuals as active, social cognitive beings who can take their own decisions. Based on this expectancy-value theory, learners are viewed as both active and social components of the learning process

(Wigfield & Eccles, 2000).Learning, performance and achievement based on this theory is influenced by motivational processes (Lennon, 2010).Just because it is a social cognitive model of motivation, there are many variables that may affect the related constructs in the model. It is simply not so highly possible to take into account all the related factors. There will always be some points or factors we would be ignoring or have to be ignoring because of our focus on the related task. The major criticism of the model is while examining effects on one construct, one may highly possible take some variables as extraneous and that may cause the person to omit some kind of significant information he/she may catch up, maybe.

Expectancy-value theory of motivation assumes that human behavior depends on the quantity of values, expectancies, and outcomes (Schunk, 2008). Pintrich and Schunk (2002) detailed that, students' both expectancies and values on academic tasks generate from their motivational beliefs regulated by cognitive processes shaped up in individuals' social environment. On the basis of this theory, motivation that an individual possesses on a specific task is a result of individuals' expectancies and values on that task. Based on these two premising stakes of the theory, individual's motivation to accomplish a specific task is built.The expectancy-value theory explains achievement behavior and achievement motivation as a cumulative function of success expectancies and task-specific values (Eccles and Wigfield, 2002; Pintrich & Schunk, 2002).According to Wigfield and Eccles (2000) stated that both expectancies and values determined to a specific task are the two major indicators of students' achievement. According to expectancy-value theories sucess expectancies and task value perceptions are related with students' academic performance (Eccles & Wigfield, 2002; Wigfield, 1994).

Expectancies are the concrete beliefs on prosperous successes to be achieved (Pintrich & Schunk, 2002). Wigfield and Eccles (2000) specified expectancies as present beliefs on future successes. Expectancies are both task and context specific (Bandura, 1997). Expectancies are defined as individuals' willingness to take challenges based on the desire to accomplish an aimed success (Eccless et al., 1983). Expectancies for success are defined in terms of an individual's short or long-term beliefs in accomplishing a prosperous task (Britner & Pajares, 2006). Success expectancies are positively related with individual's achievement, choice and persistence (Eccles, 1983; Eccles et al., 1998; Wigfiled, 1994; Wigfiled & Eccles, 1992).Success expectancies are constituted upon personal beliefs such as self-concept, which are shaped by past events and perceptions on them (Eccless et al., 1983). These expectancies affect students' academic outcomes by influencing their effort and persistence (Lenon, 2010).

Values, on the other hand, are defined as the comparative attractiveness of such a state, concerning mostly about the perceptions of importance and the interestingness of the task (Wigfield, 1994). Values, refer to the perceived importance based on the reasons engaging the task (Britner & Pajares, 2006).Task values are also described as the intrinsic enjoy gained through accomplishing the task process (Eccless et al., 1983). Pintrich and Schunk (2002) stated that task values collaboratively with success expectancies influence students' achievement by influencing their choice, persistence, and performances. For Pintrich and Schunk (2002), task values are the most dominant influencing variables on students' motivation; on the other hand, expectancies hold their dominance on shaping expectancies. Task values can be used to predict students' prosperous effort and

persistence (Debacker & Nelson, 1999). Task values are constructed based not only on individuals' goals whether long-term or short-term, but also perceptions, attitudes and social context being lived (Eccless et al., 1983).

Expectancy-value theories of motivation describes how students' perception of their achievement values and expectancies, influences their actual achievement (DeBacker & Nelson, 1999). Additionally, the other achievement-related concepts such as students' achievement goals, perceptions of past performances, self-schemas and specific beliefs on tasks are determinants of these expectancy and values (Eccles et al., 1983). The theory mainly proposes that expectancies determine own beliefs of an individual; on the other hand, values constituted their importance for individual's own (Parsons, Hinson & Brown; 2001). According to several theories of expectancy and values (Wigfield,1994; Eccles & Wigfield, 1995; Wigfield & Eccles, 2000, 2002) the choices and persistence students' performed during achievement is strongly related with their socio-psychological environment.According to expectancy-value models of motivation, students' self-beliefs and values owing to the tasks determined affect their choices, persistence, and performance; therefore,achievement motivation (Wigfield, 1994; Wigfield & Eccles, 1992).Therefore, the model also assumes motivation as the resultant activity of these two major concepts and other possible related terms, such as social influences. Consequently, thetheory attempts to give more brief information on individual differences on student learning in a more detailed way.

2.2.1.2. Task value

According to the expectancy-value models of achievement students' achievement related behaviors are related with their success expectancies and task value perceptions (Eccles & Wigfield, 2002; Wigfield, 1994).Task values are one's detailed former evaluation constituted on a task, describing it in terms of worth learning or not. Therefore, it helps foreseeing tasks' possible advantages and disadvantages (Pintrich, 1999).Task values comprises of one's goals, beliefs, perception of importance, and interest on a task (Lennon, 2010).Wigfield (1994) stated that values are constituted upon the individual beliefs, stemming from individual needs and determines the way it can be satisfied by the task. Based on this perspective, task values are stated to be an individual's general understanding of a specific task as defining it in terms of being useful, joyful and satisfactory (Eccles&Wigfield,1995; Wigfield,1994; Wigfield& Eccles,1992).Task values based on this perspective can be defined as the cognitive and affective beliefs on a specific task (Schweinle et al., 2006).

For Fries, Schmid, Dietz and Hofer (2005) what task values majorly influence is one's judgments and decisions on a task. Eccles and Wigfield (2002) added that task specific values are the main reason why one engaged in an activity by being the source of expectancies about that task.Pintrich and Schunk (2002) also defined values as the concepts that are explaining the individual reasons about why a student engaged in a task or preferred not to.

Expectancy-value theorists(such as Atkinson, 1957; Eccles, Adler, Futterman, Goff, &Kaczala, 1983; Wigfield, 1994; Wigfield&Eccles, 1992) following this perspective mainly claim that individuals' choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity. Several researches had been conducted to confirm the relationships between task values and student behavior and motivation (Fries, Schmid, Dietz & Hofer, 2005; Hitlin&Piliavin, 2004; Seligman, Olson &Zanna, 1996; Smith & Schwartz, 1997). Feather (1988, 1992) found out that task specific values influence the choice behavior of individuals on deciding whether accomplishing a specific task or not; therefore indirectly their influence motivation.Based on Feather's research (1988, 1992) task values are found to be related with individual's perceptions of own ability. Pintrich and Schunk (2002) stated that task values collaboratively with success expectancies influence achievement related behaviors such as choice, persistence, and performance.Wigfield and Eccles (1992) also proposed that task values collaboratively with expectancies are significant predictors of individuals' performance, persistence and choice behaviors. Feather (1988, 1992) also revealed that task values are determined mostly by the features, probability and the value of prosperous success or failure rather than the difficulty of the task.Task values therefore may be used for predicting effort and persistence to be exerted and achievement level in science regardless of gender (Debacker & Nelson, 1999).

Wigfield and Eccles (2000) stated based on their expectancy-value model of achievement that task values are described as a concept diversified into four major components: attainment value, utility value, intrinsic value, and cost. The four types

of task values concern with the different needs of an individual and the task itself (Wigfield, 1994; Wigfield & Eccles, 1992). Each of them is of equal importance in this theorybecause it is assumed that relation and combination of each affects individuals' achievement by affecting their choices and persistence over a task. Gensicke (2002) stated the main property of contemporary students as possessing the ability to integrate different values with each other (as cited in Fries, Schidt, Dietz and Hofer, 2005). Wigfield and Eccles (2000) stated that these terms defined are closely related with the individuals' achievement, choices, effort, and persistence by affecting them while performing it. It has also been assumed that by determining these main constructs researchers may be able to predict individual's possibilities for patterns of behavior.

Attainment values are the personal importance of success at a specific task for individual's own (Wigfield & Eccles, 2000). Attainment value is the degree of importance perception on accomplishment of a task. Attainment value of a task is described as the perceived personal importance of the success planned to be received at a task (Wigfield, 1994; Battle, 1966 as cited in Eccles & Wigfield, 2002). For Eccles Parsons, Adler, Futterman, Goff, Kaczala, Meece and Midgley(1983), attainment values are the individual's own importance on accomplishing a task properly. Possessing attainment value on a task means that the individual gives significant importance to accomplishing that task (Pintrich & DeGroot, 1990). The attainment values on a task are closely related with one's relevance of engaging in a task (Feather, 1988; Rokeach, 1979). Attainment values may stem from inner or social needs to achieve a relatively higher level of power (Pintrich & DeGroot, 1990).

Intrinsic value is stated as the perceived inner satisfaction in the process of accomplishing a task (Wigfield, 1994). Eccles Parsons, Adler, Futterman, Goff, Kaczala,Meece and Midgley (1983) defined intrinsic value in terms of perceptioned pleasure one gained during accomplishment of a task process. Intrinsic values are joyfulness one gains from processing the task, stemming from own interest for Wigfield and Eccles (2000). The construct itself can be assumed to be a similar concept to Harter (1981); Deci and Ryan's (1985) intrinsic motivation; and also Csikszentmihalyi (1988), Renninger (1992) and Schiefele's (1999) interest and flow.

Utility value is the measure of individual's usefulness perception on a specific task based on the aim of reaching a specific goal (Deci& Ryan, 1985; as cited in Tassone, 2001). Utility values are assumed to be the pre-evaluations on the future usability of a task based on individual goals (Wigfield & Eccles, 2000). Eccles Parsons, Adler, Futterman, Goff, Kaczala,

Meece and Midgley (1983) described utility values as the relationship of reaching goals to the task itself. Utility value is also stated to be the prospective usefulness of a task; which can be a short term or long term based on the quality of the individual perception (Wigfield, 1994). Utility value on a task is closely related with one's present and future goals (Deci & Ryan, 1985; Harter, 1981; Eccles et al., 1983; Eccles, 1987). The more a task relates to an important goal, the more positive value it has for the individual.

Cost is defined as the task's personal worthiness to spend time or effort on it (Eccles Parsons, Adler, Futterman, Goff, Kaczala,Meece & Midgley, 1983). On the other hand cost is also proposed to be the cancelled other things relative importance or possible unwanted consequences faced, while accomplishing a task (Wigfield,

1994; Eccles et al., 1983; Eccles, 1987). Therefore cost is simply the measure of worthiness of accomplishing a task. Beliefs on cost concern with the possible disadvantages taken due to engaging the task or not (Wigfield&Eccles, 2000). It majorly affects one's choosing or not choosing an activity; therefore a main sub-construct affecting task value and motivation.

2.2.1.2.1. The Relationship between Task Value andBiology/Science Achievement

Results of research studies indicated that students' task specific interest correlated with their academic choices, performance, persistence, cognitive strategy use, and motivation (Pajares, 1996; Pintrich & DeGroot, 1990; Pintrich, Smith, Garcia & McKeachie, 1993; Wigfield & Eccles, 2000). According to Wigfield's (1994) more specific ideas, students with higher achievement hold more specific task values.

Fries, Scmid, Dietz, and Hofer (2005) conducted a qualitative study in orderto determine whether values had an impact on student learning on 184 sixth, eight, and tenth grade students in Germany. According to the results of this study,achievement values (M=3.49) were perceived to be more meaningful for learners; therefore, more frequently used in the mean of learning process than well-being values(M=2.91). It was also revealed that students whohad higher achievement values are found to be possesing higher grades than others, because these values are related with time investment($r=.37, p<.01$).

There are also studies confirming the predictive capability of students' task values and their academic achievement (e.g.,Garcia & Pintrich, 1995; Pintrich, 2000). Zusho,Pintrich, Arbor and Coppola (2003) investigated the relative and predictive capability of students' motivation, use of cognitive and self-regulatory strategies on students' chemistry achievement on 458 college students in Michigan, USA. According to the results of this study task values (α= .85-.88 over three subscales) were found to be the best predictors of students' chemistry performance (β= .22, p<0.001).

Task value has been studied in Turkey, too. For exampleSungur (2007) investigated the relationships of motivational beliefs, meacognitive strategies and regulation of effort. Data were collected from 58 university students (43 female, 15 male) using Approaches to Learning Inventory (α=0.79 to 0.87 among its scales) developed by Miller, Greene, Montalvo, Ravindran,and Nichols (1996) and Metacognitive Awareness Inventory (α=0.77 to 0.88 among its scales) developed by Schraw and Dennison(1994). Results of the study indicated that task value is a significant predictor of students' academic performance under non-consequential conditions (β=0.308, p<.05). In another study, Ozkan (2003) studied 980 tenth grade Turkish students' motivational beliefs and learning styles influencing students' biology achievement The measurement devices used in this study are motivated strategies for learning questionnaire (MSLQ) developed by Pintrich, Smith, Garcia and McKeachie (1993), learning style inventor (LSI) developed by Kolb (1985) and translated into Turkish by Askar and Akkoyunlu (1993) and biology achievement test (BAT) consisting of 20 multiple choice items, prepared by the researcher through selecting the university entrance examination questions between years 1981-2001.

The data obtained in the study were analyzed through analysis of covariance (ANCOVA) and bivariate correlations. According to the results of the study students' task values and biology achievement were reported to be moderately related with each other ($r=.143$, $p<.05$). Another study in Turkey conducted by Yumusak (2006) on 519 tenth grade high school students aimed to determine correlations of the self-regulatory learning processes withTurkish high school students' achievement in biology course. Through the use of the canonical corelational analysis, tenth grade students' task values was found to be a significant predictor of their biology achievement ($\beta=.16$, $p=.006$, $p<.05$).

2.3. Learning Strategies

In educational fields learning has various definitions. Graham and Robinson (1987) defined learning strategies as specific ways that can be used alone or together during learning process. It is defended that individual's control over cognition can be processed by the use of various learning strategies (Pintrich, 1995; Vrugt & Oort, 2008 as cited in Al-Harthy & Was, 2010).Learning strategy use is therefore stated to be stemming from owns' conscious, therefore, a cognitive act (Paris et al., 2001; Paris, Lipson & Wixton, 1983; Wade, Trathen & Schraw, 1990). Cognitive learning strategies do this by concerning with learner's cognitive attempts based on accomplishing a determined goal (Mayer, 1988; Paris, Byrnes & Paris, 2001; Schneider & Weinert, 1990). Strategy use contain individual's determining own short-term goals and also other goals for determining appropriately what to study, how to process, and what to do when unexpected obstacles occur (Hadwin & Winne,

1996). This cognitive regulation provides learners to gain control over their own learning by organizing their activities (Vrugt & Oort, 2008 as cited in Al-Harthy & Was, 2010).

Learning strategies, in other words, students' processing of information, are divided into two distinct classes; which namely are surface processing strategies and deep processing strategies (Entwistle & Marton, 1984 as cited in Garcia & Pintrich, 1992; Entwistle, 1988). Entwistle (2004) stated the difference between deep and surface learning strategies defining them in terms of intention to learn by cognitively analyzing the information and intention to reproduce by repetition of information, respectively. Deep and surface learning strategies are diversified in this study due to their conceptual and predictive utility reported (Elliot, McGregor, & Gable, 1999). Surface learning strategies are negatively, deep learning strategies are positively related with higher levels of student achievement (Al-Harthy & Was, 2010). Mainly, deeper learning strategies are related with students' choice behavior and perceived personal development, whereas surface learning strategies are concerned with extrinsic rewards (Lens et al., 2002 as cited in Berger & Karabenick, 2010); that may be the reason why different learning outcomes are related to these two different learning strategies.

Weinstein and Mayer (1986) specified surface learning strategies as the ones not requiring to engage the task in, rather they focus their attention on memorization. Surface learning strategies mainly concern with simple recall activities, therefore,it is assumed that, information gained through these strategies does not go beyond short-term memory (Parker, 2007). Surface learning strategies are rather involved in saving the day by rote memorization enough to accomplish the task (Entwistle, 2000). Elliot

et al. (1999) classified surface learning strategies as memorization, rehearsal, and rote learning. Surface learning strategies such as recalling information is not concerned with long-term memory and therefore meaningful learning (Parker, 2007).

According to relevant studies, learning strategies and student achievement are related to each other (Entwistle, 1988; Weinstein & Mayer, 1986, Pintrich, Smith, Garcia & McKeachie, 1993). Whereas individuals adopting surface learning strategies show evidences of lower learning and achievement due to inadequate effort, unsuccessful management of time and environment, and loss of control over own cognitive processes (Al-Harthy & Was, 2010). Phan (2010) reported that for some reserachers deep learning strategies are predictors of higher achievement (Fenollar et al., 2007; Liem et al., 2008; Simmons et al., 2004; Sins et al., 2008); whereas others report that there is no significant relation (Dupeyrat & Marine, 2005; Senko & Miles, 2008). He also reported that some researchers stated that there is a negative relation between surface learning strategies and students' achievement (Liem et al., 2008; Simons et al., 2004); whereas others report that there is no significant relation (Dupeyrat & Mariné, 2005; Fenollar et al.,2007; Senko & Miles, 2008; Sins et al., 2008). Practically, it was generally reported that higher achievement is positively related with the use of deep learning strategies; whereas negatively related to the surface learning strategies (Al-Harthy & Was, 2010). It was also stated that surface learning strategies are related to less cognitive engagement; deep learning strategies are on the other hand related with higher levels of cognitive engagement (Garcia & Pintrich, 1992).

Piaget used the term schema for the connections between the old and new knowledge (Miller, 1993). Learning something for long-term requires linkage

between old information already set up and new information gained, which is an evidence of the use of deeper learning strategies (Parker, 2007). Pintrich and DeGroot (1990) defended that the use of deep learning strategies are main stakes of students' meaningful learning in academic situations. Processes involved in deep learning strategies may be exemplified such as retrieving relevant information, summarizing, and organizing it by linking old and new information by combining them into a new schema, infering and critical thinking on it (Elliot et al., 1999; Hadwin & Winne, 1996; Parker, 2007). Deep learning strategies, such as critical thinking, require replacing the new information gained through the meaningful schemata, which had already been formed (Hadwin & Winne, 1996). Deep learning strategies provides individual to develop own understanding by actively involving one to relate ideas and patterns already shaped with the new ones (Entwistle, McCune & Walker, 2000). Therefore, deep learning strategies are related with higher levels of cognitive engagement obtained by the individual (Weinstein & Mayer, 1986). Parker (2007) stated that student's effort put forth during challenges, deep cognitive learning strategy utility (e.g. linking old and new information, organizing, and critical thinking) and performances are measures of their learning. Deeper learning strategies are related with higher levels of task value, self-efficacy, and performance (Yumusak, 2006). Utilization of deeper level learning strategies are additionally positively correlated with higher academic performance and better learning (Bembenutty, 2007; Lan, 1996; Pintrich& De Groot, 1990; Pokay & Blumenfeld, 1990; Vrugt & Oort, 2008 as cited in Al-Harthy& Was, 2010; Weinstein & Mayer, 1986).

For Entwistle (2004), deep learning strategies concern with a dominant intention to understand; whereas, surface learning strategies focuses on the repeating the information on a similar, standardized form. Individuals adopting deep learning strategies throughout their learning integrate information so regulate their own comprehension by putting more effort forth to improve their comprehension (Garcia & Pintrich, 1991). It additionally has to be mentioned that utilizing deeper leaning strategies is not an automatic resultant of higher academic performance, interest and effort should still be possessed and exerted (Al-Harthy & Was, 2010). To minimize the possible misunderstandings, Volet (1997) stated that use of surface strategies does not mean minimizing effort while studying, whereas deep strategies are not requiring maximal effort (as cited in Entwistle,2004).

Al-Harty and Was (2010) defined rehearsal as a surface learning strategy requiring the repetition of information, for reproducing the material in some form, for encoding it into short-term memory by rote memorization.Rehearsal as a surface learning strategy does not involve the processes whereby old and new information is connected, rather concerns with the repetition of information to store it into short-term memory (Parker, 2007). Rehearsal strategies focus on reproducing the same information in the same form therefore maintaining it by repeating it (Zusho et al., 2003).Weinstein and Mayer (1986) exemplified rehearsal strategies as word repetition, information copying and textbook underlining. Elaboration is a deeper learning strategy requiring individual to constitute cognitive linkages between old and new knowledge by techniques such as paraphrasing or summarizing (Al-Harthy & Was, 2010). Elaboration strategies focus its attention on keeping the information in long term memory by the help of relating old information with the new one; by

extracting meaning, summarizing or paraphrasing (Weinstein & Mayer, 1986). Pintrich et al. (1993) explained the aim using elaboration strategies as encoding information for setting up new concepts as understandable ones in the cognitive structure. Research shows that elaboration is an effective learning strategy for better learning, higher performance and keeping the information in long term memory for a longer time (Johnsey, Morrison & Ross, 1992; Weinstein, 1982). Elaboration learning strategy is positively related with critical thinking learning strategies as well; whereas rehearsal strategies are not positively related with critical thinking (Garcia & Pintrich, 1992).

Organization is another deeper level cognitive learning strategy developing individual's schemas by techniques such as selection of main ideas, drawing graphs, tables, concept mapping or outlining (Zusho et al., 2003; Al-Harthy & Was, 2010). Student intended to use such a strategy is supposed to draw relations between information in the ways mentioned (Weinstein & Mayer, 1986). Learning strategies based on organization requires grouping, organizing and outlining information. It was stated that individuals using organizational strategies more frequently are tend to store new information faced in their memory more effectively and remember it later more accurately (Ormrod, 1998 as cited in Dembo and Eaton, 2000). According to Weinstein and Mayer (1986), individuals using organizational strategies are far better performing than the ones not using them, rather try to learn the information by reading it. The utilization of organizational learning strategies is also confirmed to be a powerful and significant predictor of higher biology achievement levels among students (Yumusak, 2006).

2.3.1. The Relationship between Learning Strategies andBiology/Science Achievement

The use of various learning strategies help learners to guide their own learning processes in order to achieve efficiently on academic tasks (Pintrich & Schunk, 1996). According to several relevant studies (Paris et al., 2001; Pintrich & DeGroot, 1990; Pintrich & Garcia, 1991) the use of appropriate cognitive learning strategies are reported to be positively related with individual's academic performance. A body of research defended that students' use of learning strategies are also one of the major determinants of their successful achievement by affecting student achievement in a significant positive way (Entwistle, 1988; Garcia & Pintrich, 1996; Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992; Pintrich, Smith, Garcia & McKeachie, 1991, 1993;Weinstein & Mayer, 1986; Zimmerman & Martinez-Pons, 1990). Sternberg and Grigorenko (2001, as cited in Stoffa, 2009) proposed the mechanism that the proper use of effective learning strategies improves student motivation, therefore, achievement due to letting them taking the responsibility of their own learning processes. Thus, it may be defended that students have the initiative to attain the proper learning strategies when needed depending on the context (Marton & Saljo, 1984).

Zusho and Pintrich (2003) conducted a study by using MSLQ three times in a semester.In their study,the sample was consisting of458 college students (243 female, and 215 male) with the ages ranging from 17 to 25.It was reported that rehearsal as a learning strategy is a significant positive relative of students' chemistry

achievement (r=.13, p<.05).Weinstein and Mayer (1986) also added that utility of elaboration and organization strategies are both relatives and predictors of students' higher achievement. These two learning strategies, which are also termed as deeper learning strategies in this study are additionally stated to be essential concepts in students' academic achievement (Pintrich & De Groot, 1990; Pintrich, Brown & Weinstein, 1990; Pressley & McCormick, 1995).

Based on the experimental research conducted by Sungur and Tekkaya (2006) to define the influence of different learning strategies on students' motivation, students' task values in science and learning strategies were also revealed to be related with each other. The study used MSLQ as a learning strategy determining instrument was used and problem based learning strategies are adopted to teach students science better.The students' achievement were found to be significantly related with elaboration (r = .740) and organization (r = .574) (p<.01). Learning strategies and students' self-efficacies were revealed to be significant for elaboration (r = .571) and organization (r = .445) (p<.01).

Studying Turkish high school students Yumusak (2006) focused on the self-regulatory learning processes. This study confirmed the predictive utility of various learning strategies adopted during learning process in biology lessons. The study of interest applied a canonical corelational analysis to the data obtained from the sample mentioned by using two measuring instruments. The first measuring instrument was biology achievement test (BAT) prepared by the researchers in a 20 item multiple choice test format. The second instrument was the motivated strategies for learning questionairre (MSLQ) developed by Pintrich, Garcia, Smith & McKeachie in 1993. This study revealed that rehearsal (p=0.00, β=-0.22) and organization (p=0.047,

β=0.13) strategies are both significant predictors of students' biology achievement; whereas elaboration (p= 0.25, β=0.13) gives insignificant results based on this purpose ($p < 0.05$). It was concluded that organization is a significant predictor variable; whereas rehearsal as a learning strategy made the strongest contribution on explaining students' biology achievement. Therefore, results of this study reveal that as students use organization strategies more they tend to have higher achievement in chemistry; on the other hand as they use rehearsal strategies more this tendency is reversed.

2.3.2. Gender Difference in Achievement

Students' achievement is influenced by various cognitiveand affective variables, as well as by their genders (Parker, 2007). According to the related research, there are gender differences in students' perceptions on science-related experiences (Greenfield, 1996). The variations based on students' science and mathematics achievement may be due to the individual's differing perceptions on cognitive abilities stemming from gender differences (Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007).Meece and Jones (1996) argued that the reason of the gender differences in science learning may be due to females' more frequent complaints on lack of self-confidence or motivational traits. Different genders possessed influences the way students utilize various cognitive strategies, by this way their achievement.

Greenfield (1995) proposed based on NAEP (National Assesment of Educational Progress) data obtained between 1976 and 1990 that male students

possesed an overall advantage in science compared to females. Based on standardized test results such as SAT (Scholastic Aptitude Test) and GRE (Graduate Record Examination), males generally outperform in science and mathematics. Additionally, it was reported that females are in a seek for exam questions closely parallel to class lessons. Any question irrelevant to lessons gives the result of lower performance in female students in science and mathematics domains (Willingham & Cole, 1997). Dweck (1986) stated that in science and mathematics lessons at higher grade levels, male students tend to improve their motivational propositions more easily. Therefore, female students lack the occurrence of motivational properties as a need to show greater achievement in science and mathematics lessons (Meece & Jones, 1996).However, according to Lee and Burkham (1996), female students tend to achieve higher in science. Lee and Burkham (1996) specified that males posses higher achievement in physical sciences whereas females have higher achievement in life sciences. Similarly, Lee, and Burkham (1996) and Yenilmez, Sungur, and Tekkaya (2006) revealed that female students are more prone to achieve higher in life sciences such as biology.

As a study considering Biology lesson, Sungur and Tekkaya (2003) had revealed no significant gender differences in the mean of 47 tenth grade students' achievement and attitudes towards human circulatory system topic. Another research conducted by Yenilmez, Sungur, and Tekkaya (2006)showed significant gender differences in the mean of students' biology achievementin their experimental study aimed to find the significant predictors of students' achievement inphotosynthesis and respiration of plants topicand to determine possible gender differences.A total of 117 eight grade students were taught based on conceptual change strategies, in four

class hours, then a covariant analysis was conducted. The study examined the relations of students' past knowledge, reasoning ability, gender and achievement. According to the results of the study the main predictors of students' biology achievement are reported to be their reasoning ability, past knowledge and gender. Results of this study revealed that students' gender as well as their prior knowledge and reasoning ability accounted for 41% of the variance in the students' science achievement. Even if there was a reported significant gender difference accounted for female students on test, this difference was not too high.On another study, Ozkan (2003)revealed in her study by the help of ANCOVA conductedthat gender was a major determinant of students' biology achievement ($F(1, 969) = 4.5$, $p = .034$). It was also found in her studythat female students posess higher biology achievement than males (r=-.77).

According to TIMSS reports generally boys are reported to be more advantageous, whereas PISA reports reveal the disadvantage of boys in science achievement. Based on TIMSS 1995 report there revealed to be no significant gender differences in the first four years of students' science achievement in Ireland, Greece, Cyprus, Potugal, United Kingdom and Norway; whereas in Czech Republic, Hungary, Netherlands, Austria and Island boys have a significant advantage. However, these insignficant gender differences gains a significance at the eight year of school. In the last year of secondary school females signficantly outperform better than males in life sciences and environmental education, as a field including Biology lessons as well (Mulis et al., 2000). Based on TIMSS 1999 data the Flemish Coomunity of Belgium, Bulgaria, Italy, Cyprus, Romania, Finland and Turkey had reported to have no signficant gender differences in eight graders' science

achievement. However in Czech Republic, Latvia, Lithuania, Hungary, Netherlands, Slovenia, Slovakia and United Kingdom males have an overall science achievement advantage (Martin et al., 2000). TIMSS 2003 data confirms the insignificant gender differences in science achievement of in the first four graders in Flemish Community of Belgium, Italy, Latvia, Hungary, Slovenia and United Kingdom (Martin et al., 2004). Also the TIMSS 2007 data reported the abscence of gender differences in the first four year of schooling in the mean of science achievement of the students in Denmark, Latvia, Lithuania, Hungary, Sweden, United Kingdom and Norway. However the same data on TIMSS 2007 stated that males have a significant advantage in science in Czech Republic, Germany, Italy, Netherlands, Austria and Slovakia (Martin et al., 2008).

The PISA 2000 report confirmed the occurence of an advantage in males science achievement in Denmark and Austria. But in the same report Latvian female students are reported to be outperforming in science (OECD, 2001). Another PISA report considering the year 2006 also reported that female students in Bulgaria, Greece, Latvia, Lithuania, Slovenia and Turkey have higher science achievement levels. However in Denmark, Luxembourg, Netherlands and United Kingdom this situation is contrary, meaning that males outperform in science compared to the females (OECD, 2007).

2.4. Summary of Literature Review

Determining factors affecting student achievement is not an easy task to accomplish. Because it requires not only taking cognitive factors into account, but

also the affective ones should also be considered. As Gabel (1994) stated students' values, motivation, attitudes, and beliefs on learning may affect the way they learn and their overall achievement. Therefore, both the cognitive and affective factors influencing student achievement should also be considered in a study aiming to determine such factors, especially as predictors.

One of these factors assumed to be influencing student achievement is students' self-efficacy beliefs, which is introduced to literature by Bandura in 1970s. It was proposed in the related literature that self-efficacy is a reportedly strong predictor of students' higher achievement (Britner & Pajares, 2006; Pajares, 2003; Pintrich & DeGroot, 1990; Pintrich & Schunk, 1995;Robbins, Lauer, Davis, Langley & Carlstrom, 2004).

A second factor influencing students' achievement is their task values. For Pintrich and Schunk (2002), task values majorly determine why one started to do a task; therefore, they are also initiative sparkling point of the learning processes. Pintrich and DeGroot (1990) described the process as that higher task value is related with higher self–efficacy therefore higher student achievement. Wigfield and Eccles (1992) also defined task values as strong predictors of students' achievement. Indeed, in the related literature, several studies revelaed the relationship between task value and achievement (DeBacker & Nelson, 1999; Fries, Schmidt, Dietz, & Hofer, 2005; Pintrich & Schunk, 2002; Pintrich, Simith, Garcia, & McKeachie, 1993; Yumusak, 2006).

The third factor affecting student achievement is the use of learning strategies which is assumed by Pintrich (1995) to be influencing the individuals' own control over own cognition. To make a more clear investigation on them, Entwistle (1988)

classified these learning strategies into two major classes by terming them as surface and deep learning strategies. Surface learning strategies mainly concern with simple recall activities (Parker, 2007). Elliot et al. (1999) defined surface learning strategies by exemplifying them as memorization, rehearsal and rote learning. Whereas deep learning strategies may be exemplified such as retrieving relevant information, summarizing, elaborating, organizing and critical thinking on it (Elliot et al., 1999; Hadwin & Winne, 1996; Parker, 2007). Al-Harthy and Was (2010) generalized that surface learning strategies are negatively and deep learning strategies are positively related to higher student achievement. Other studies also supported the association between deeper learning strategies use and achievement (e.g., Bembenutty,2007; Parker, 2007; Pintrich, 1999; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991; Vrugt&Oort,2008; Weinstein & Mayer, 1986).

The last factor defined in the present study to be affecting student achievement is their gender. For Lenon (2010), female students tend to have no significant differences in the mean of science achievement; whereas Lee and Burkham (1996) proposed that females posses higher levels of achievement. On the other hand, Steinkamp and Maehr (1983) reported the advantage of males on science achievement. Stark and Gray (1999) specified that Biology as a science domain is one of the major area of interest in female students' perceptions. Schibeci (1984) added that female students posses more positive attitudes towards biology. Therefore, females tend to achieve higher in this domain (Lee & Burkham, 1996; Yenilmez, Sungur & Tekkaya, 2006).

In the light of this literature review, the present study investigated the role of self-efficacy beliefs, task value, learning strategies, and gender difference on 11th grade students' biology achievement.

CHAPTER III

PROBLEMS AND HYPOTHESES

3.1. Purpose of the Study

The purpose of this study was to investigate whether self-efficacy beliefs, task value, learning strategies, and gender difference can be used to predict 11th grade students' Biology achievement.

3.2. The Main Problem: Predictors of Students Biology Achievement

The main problem of the study is that:

How well do the students learning strategies, task value, self-efficacy beliefs, and genderspredict 11th grade students'Biology achievement?

3.3. The Sub-problems

The sub-problems of this study are listed below:

1. How well do self-efficacy beliefs predict 11th grade students' Biology achievement?
2. How well do task values predict 11th grade students' Biology achievement?

3. How well does the use of rehearsal strategy predict 11th grade students' Biology achievement?
4. How well does the use of organization strategy predict 11th grade students' Biology achievement?
5. How well does the use of elaboration strategy predict 11th grade students' Biology achievement?
6. How well does the gender difference predict 11th grade students' Biology achievement?

3.4. Hypotheses

The problems stated based on the aim of the present research study were tested with the following hypotheses.

Null Hypothesis 1: There will be no significant contribution of students' self-efficacy beliefs to their biology achievement test scores.

Null Hypothesis 2: There will be no significant contribution of students' task values to their biology achievement test scores.

Null Hypothesis 3: There will be no significant contribution of students' use of rehearsal as a learning strategy to their biology achievement test scores.

Null Hypothesis 4: There will be no significant contribution of students' use of elaboration as a learning strategy to their biology achievement test scores.

Null Hypothesis 5: There will be no significant contribution of students' use of organization as a learning strategy to their biology achievement test scores.

Null Hypothesis 6: There will be no significant contribution of students' genders to their biology achievement test scores.

CHAPTER IV

METHOD OF THE STUDY

This chapter gives brief information about the methodology used in the present study. In the chapter below; the overall design and the variables of the study, the population and the sample for the study, the data collection instruments, the way how the analysis of data was conducted and the possible limitations of the study are described.

4.1. Design of the Study

The study possessed a correlational research design. Correlational research designs may intend to explain or predict the relations of the variables, based on the general aim of the research conducted (Fraenkel & Wallen, 2006). The present study aimed to determine the main predictors of 11th grade students' biology achievement concerning their self-efficacy, task value, learning strategies, and gender. Therefore, by the help of determining the existence of a significant relationship between variables of interest, the value of a criterion variable is investigated considering the scores of predictor variables (Fraenkel & Wallen, 2006). To fulfill this aim, the data of the study were analyzed using simultaneous regression analysis.

4.2. Participants

The target population of this study was all 11th grade students in Ankara. According to the information obtained from Statistics Department of Ministry of Education, approximate total number of target population was 56.495. The accessible population of this study was all 11th graders in Çankaya and Yenimahalle districts in Ankara(approximately 32.709 students based on ministry of national education report in 2010). Based on this, the sample of the study, which was shaped through utilizing convenience sampling method,consisted of 1035 11th grade high school students in Yenimahalle and Cankaya regions of Ankara.

Table 4.1.shows demographic information gained from the participants. According to the data, 52% of the participants were female and 48% of them were male.

Table 4.1. Demographic Characteristics of the Students

Variable	Frequency (n)	Percent (%)
Gender		
Male	497	48
Female	538	52
Total	1035	100

4.3. Data Collection Instruments

There were two main data collection instruments used in the study. One of them was the Turkish version of the Motivated Strategies for the Learning Questionnaire (MSLQ) measuring students' learning strategies and their motivationalorientations. The second one was the Biology Achievement Test (BAT) used for determining students' Biology achievement.

4.3.1. The Motivated Strategies for Learning Questionnaire (MSLQ)

The Motivated Strategies for Learning Questionnaire (MSLQ) is a self-report 7 point rating scale consisting of 81 items; developed by Pintrich, Smith, Garcia, and McKeachie (1991) and adapted into Turkish by Sungur (2004). This questionnaire consisted of two main parts; which namely were motivation with 6 sub-scales (31 items) and learning strategies with 9 subscales (50 items). The sub-scales in motivation part namely were intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. The sub-scales in learning strategies part were rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation. These sub-scales MSLQ has can either be used altogether or separately; based on the research studies' purpose as suggested by the developers.

In the present study, five subscales ofthe questionnaire were used as rehearsal (REH), organization (ORG), elaboration (ELA), self-efficacy beliefs (SE) and task value beliefs (TV). Definitions and sample items in the questionnaire are presented in Table 4.2.(See Appendix A for the items in English version and Appendix B for the Turkish version).

Table 4.2. Definitions, item numbers and example items for MSLQ subscales

Subscale	**Number of items in the subscale**	**Definition**	**Sample item**
REH	4	Learning strategy generally associated with repetition.	I memorize key words to remind me of important concepts in this class.
ORG	4	Learning strategy generally associated with grouping the information into meaningful clusters.	I make simple charts, diagrams, or tables to help me organize course material.
ELA	6	Learning strategy generally associated with integrating the prior information with the new one.	When reading for this class, I try to relate the material to what I already know.
SE	8	Individual's belief in own ability to accomplish a task on Biology lesson.	I'm confident I can do an excellent job on the assignments and tests in this course.
TV	6	Individual's emphasis on valuing a Biology task.	Understanding the subject matter of this course is vey important to me.

A high score on REH subscale reveals that the student is using learning strategies necessitating repeating of information such as memorization by multiple repetition of the same information. A high score in ORG subscale means that the

student is using learning strategies requiring the classifying the information into a new form such as graphs or figures. A high score on ELA scale indicates that student is using learning strategies such as paraphrasing in order to keep it into own long term memory. A high score on SE subscale means that student proficiently perceives his/her ability to achieve high in Biology. A high score in TV subscale indicates that student perceives Biology as a valuable learning task to be completed. Pintrich et al. (1991) found Cronbach's alpha coefficients as .69 for REH, .64 for ORG, .76 for ELA, .93 for SE, and .90 for TV.

4.3.1.1. Confirmatory Factor Analysis

Based on theMSLQ data obtained from the study, confirmatory factor analysis was conducted on the MSLQ sub-scales of interest for checking the validity of the five factor model of the questionnaire suggested by Pintrich et al. (1991). The statistical analyses were run through Analysis of Moment Structures (AMOS) 7 program (Arbuckle & Wothke, 2006). The output is presented in Appendix D.Figure 4.1. shows parameter estimates and fit statistics. All the factor loadings were significant since they were higher than .30.

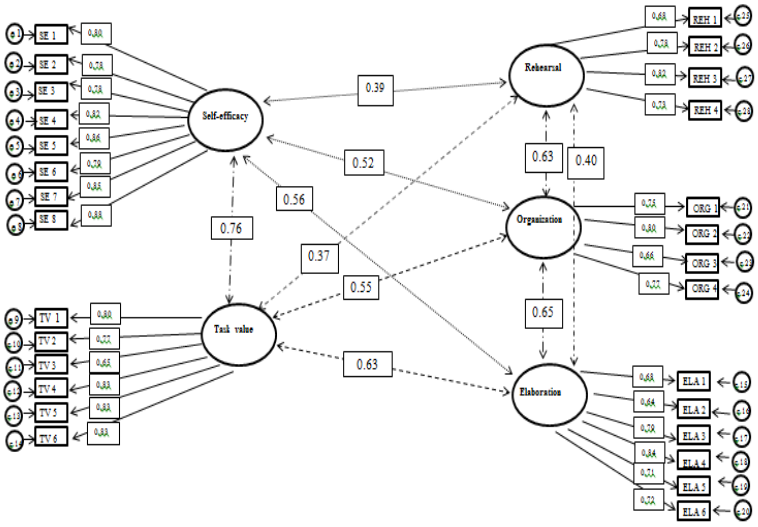

Figure 4.1. Confirmatoy factor analysis of MSLQ

Note: All coefficients were significant at $\rho < .05$. $\chi 2 = 1618.4$, d$f = 340$. CFI = .92, TLI = .91 RMSEA = .068 (CI= .065-.071, 90%)

Using AMOS enabled researcher to specify the factorial relationship between the variables of interest in MSLQ (SE, TV, REH, ELA and ORG), and to determine the goodness-of-fit of the specified model with the observed data. Alternative goodness-of-fit indexes such as the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA) are used as an alternative to Chi-square statistics in order to cope up with the limitations of Chi-square statistics, while testing the overall fit of the model was considered. In the present study, RMSEA, CFI, TLI and χ^2/ df indexes were used to test the validity of the hypothesized model and the data for reassuring construct validation of MSLQalong with is 90% confidence intervals.

According to Hu and Bentler, 1999, as cited in Tabachnick and Fidell, 2007, as the significance of the model increases, the Tucker-Lewis Index(TLI) and Comparative Fit Index (CFI)indexes closens to the value of 1.0. Additionaly, Bentler

(1992) stated that a CFI value greater than .90 also reveals a good fit of the data examined. Additionally, Root Mean Square Error of Approximation (RMSEA) values lower than .08 it may be assumed that model is congruent, if this value is lower than .05 this reveals a good fit of the data (Browne and Cudeck, 1993; Byrne, 2001). Finally, a χ^2/ df ratio lower than 5 is an indicator of the goodness of fit of the related data (Byrne, 2001). Results of the analysis in this study yielded the following fit indices: χ^2 (340) =1618.4, χ^2/ df= 4.76, TLI = .91, CFI = .92; RMSEA = .068 (CI= .065-.071, 90%), which means that the values of indices were acceptable. Therefore, it can be said that the model fit the data. These findings provided an evidence for the factorial validitiy of MSLQ scores with this sample of 11th grade Turkish high school students.

4.3.1.2. Reliability

Cronbach alpha coefficient is one of the most commonly used indicator of internal consistency. Cronbach alpha coefficient of a scale should be above .7 ideally (Hinkle, Wiersma & Jurs, 2003). In the present study, the value of Cronbach's alpha for task value was found to be .91 and for self-efficacy .94. In terms of the learning strategies scale, the values of Cronbach's alpha for rehearsal, elaboration and organization were found to be .84, .87, and .83, respectively. Therefore, it can be concluded that there was high internal consistency among the items of the scales. The reliability coefficients obtained from the MSLQ subscales of the original English version, Turkish version and present study were presented in Table 4.3.

Table 4.3. The reliability coefficient values of the MSLQ subscales belonging to the English version (Pintrich et al., 1991), Turkish version (Sungur, 2004) and the present study.

	Pintrich et al. (1991)	Sungur (2004)	Present study
Motivation Scale			
Task Value	.90	.87	.91
Self-efficacy	.93	.89	.94
Learning Strategies Scale			
Rehearsal	.69	.73	.84
Elaboration	.76	.78	.87
Organization	.64	.71	.83

4.3.2. Biology Achievement Test (BAT)

The study assessed the biology achievement of students by the help of a multiple choice test named Biology Achievement Test (BAT), which can be seen in Appendix C. This test aimed to asses 11^{th} grade students' understandings of basic concepts in biology.The test was consisting of 20 multiple choice questions chosen from the previous University Entrance Examinations (ÖSS) between the years 1999-2006 and their semblances were modified without changing their fundamental patternsIt was assumed by the researcher that answering these questions required using higher order thinking strategies. Each question in BAT hadone correct answer and four distracters. The reason why researcher preffered to use a multiple choice

questioned test is its ease in administration and providing objectivity in scoring students.One class hour (40 minutes) were given to each student to complete the test. In order to determine the students' score on the test, a correct answer was coded as "5" and an incorrect response as "0". The total score obtained on the test was used as a measure of students' biology achievement; in which a higher score gained indicated a higher, whereas a lower score indicated a lower understanding of the topics in the test.

The BAT includes seven major topics that were selected from 11th grade Biology curriculum proposed by Ministry of Education. Related topics and the number of questions belonging to them in BAT can be examined at Table 4.4. below.

Table 4.4. Table of specifications based on the topics in BAT

Title of the Chapters	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Tissues	1 (5%)	1 (5%)	1 (5%)				3 (15%)
Endocrine and Nervous Systems	1 (5%)		1 (5%)	2 (10%)			4 (20%)
Support and Movement Systems	1 (5%)		1 (5%)				2 (10%)
Digestion Systems		1 (5%)	2 (10%)				3 (15%)
Transportation and Circulatory Systems	1 (5%)		1 (5%)		1 (5%)		3 (15%)
Respiratory Systems	1 (5%)		1 (5%)				2 (10%)
Excretion Systems	2 (10%)					1 (5%)	3 (15%)
Total	7 (35%)	2 (10%)	7 (35%)	2 (10%)	1 (5%)	1 (5%)	20 (100%)

Among these 20 questions classified based on Bloom's Taxonomy of educational objectives; 7 of them were knowledge level, 2 of them were

comprehension level, 7 of them were application level, 2 of them were analysis level, 1 of them was synthesis level and 1 of them was evaluation level.

While developing BAT, firstly the 11th grade curriculum content was searched. Then, the seven main units that were included by 11th grade Biology curriculum were listed. After that, the web site of ÖSYM was searched for the questions which were asked in the University Entrance Examinations related with the 11th grade biology curriculum. All of the related questions were collected and a multiple-choice question pool was formed. To establish a required level of content validity an expert biology teacher was consulted for the appropriateness of the questions selected for the pool to the content and grade level. Based on the possible time limitations to be faced on administration process of BAT, the expert teacher suggested researcher to prepare a test with maximum 20 questions. The expert teacher also added thatto have a representative test prepared based on 11th grade biology curriculum, each unit in the curriculum should have equal numbers of questions. Considering these suggestions, by attempting to emphasize as required and as equal number of questions as possible for each unit, BAT was formed. While deciding on which questions from which units to be included in the test, it was concluded that each of the units in the curriculum should be represented with one or more questions, to poses a considerable degree of content validity in BAT.Additionally, while selecting from the question pool an expert in the biology education domain, a biology teacher and the advisors were consulted and the test was controlled for its face content validity. Then the format of the test was modified by these consultants and the researcher.The suggested changes were applied on the test

due to providing the content and face validity of the test. After that, the selected questions were modified into different semblances. Not only the body of original questions, but also their distracters were not modified. Lastly, the final format of the questions was investigated by the experts. All of the experts agreed on the appropriateness of the test based on the criterion set for them.

4.3.2.1. Pilot Study

The pilot study aimed to reveal that the BAT was a uniformly processing instrument for 11th grade students. Based on this purpose, BAT was applied to 163 students (85 males and 78 females) from five schools in both Çankaya and Yenimahalle districts of Ankara. Item analysis (ITEMAN) was conducted for analyzing the test items in terms of their contributions they make to the reliability of the test as well as the functioning of response alternatives for each test item (Crocker & Algina, 1986).

4.3.2.1.1. ITEMAN Analysis (Item Analysis) for BAT

Item discrimination indexes and item difficulty levels of the questions of the BAT were estimated by the help of ITEMAN programme.According to the scale statistics, the mean was 14.890 and standard deviation was found to be 3.345. Skewness and Kurtosis values were between +1 and -1 indicating normal distribution. Item difficulty of the items ranged between .564 and .828; the item

discriminating indiceswere ranging between .252 and .857; since all these indexes were higher than .20, all items might be used in the BAT (Crocker & Algina, 1986). The Kuder Richardson Formula 20 reliability coefficient was found to be .70, which were accepted as satisfactory (Hinkle, Wiersma & Jurs; 2003). Appendix Epresents ITEMAN statistics of the test.

4.4. Variables

There were two types of variables in this study; dependent variable and independent variables.

The dependent variable of this study was the 11^{th} grade students' Biology achievement scores gained from the BAT. Achievement was assumed to be continuous variable and was measured by an interval scale.

The independent (predictor) variables of the study were rehearsal, organization, and elaboration strategies of learning, task value, self-efficacy beliefs, and genders of the 11^{th} grade students. Gender was assumed to be a discrete variable measured by a nominal scale; whereas other independent variables were assumed as continuous variables measured by an interval scale.

4.5. Data Analysis Procedure

After the data collection procedures; the data were analyzed through descriptive and inferential analyzes. Analysis was conducted by using the PASW

(Predictive Analytics SoftWare) Statistics 18 and the significance level for all the research questions was defined as α=.05. The results were summarized in tables and figures; where available. Throughout descriptive analyzes mean, standard deviation, range, skewness and kurtosis values were calculated for variables used in the study. For inferential analyzes, a simultaneous regression analysis was conducted to show that the biology achievement levels of the 11th grade students can be predicted by the help of several predictor variables.

4.5.1. Simultaneous Linear Regression Analysis

Simultaneous linear regression is a statistical analysis used in predicting a dependent variable, by the help of a linear combination of a set of multiple independent variables (Hinkle, Wiersma & Jurs; 2003). In this study, simultaneous regression analysis was used to investigate the predictive power of independent variables on the dependent variable. The dependent variable of the study was Biology achievement level of the 11^{th} grader high school students; whereas the independent variables are rehearsal, organization and elaboration learning strategies; self-efficacy and task value beliefs; and gender of the students.

4.6. Assumptions of the Study

Several assumptions of the study were listed below:

- The researcher did not influence the responses of the participants.

- All participants completed the questionnaire under the same and standard conditions.
- The researcher was not biased during the administration and evaluation of the study.
- All participants completed the questionnaire sincerely and their answers reflect their real ideas on their selves.

4.7. Limitations of the Study

The study had some limitations:

- The study was limited Çankaya and Yenimahalle region of Ankara.
- The study was limited to 1035 11^{th} grade students taking Biology course.
- The BAT used in the study was limited to multiple choice question style.
- Biology achievement of the students' was limited to their scores on the BAT.
- As measured by a self-report measurement device students' self-efficacy and task value data might be questioned in the mean of their validities. Because the data obtained through this device may not be completed by the students entirely truthfully or honestly.
- Students' varying characteristics such as socio-economic and family characteristics and also classroom teachers' educational (e.g. learning approach embraced) and non-educational (e.g. demographic variables) characteristics were not taken into account.

CHAPTER V

RESULTS OF THE STUDY

This chapter gives information about the results of the overall study. Descriptive statistics of the study, assumptions of simultaneous regression analysis, results of simultaneous regression analysis, and summary of findings are described in this chapter.

5.1. Descriptive Statistics of the Study

Descriptive statistics such as mean, median, mode, standard deviation, range, minimum, maximum, skewness, kurtosis, and histograms of 11^{th} grade students' scores on thebiology achievement test(BAT) were presented in Table 5.1.

Table 5.1. Descriptive Statistics based on the BAT scores

Achievement Score	
Mean	59.99
Std. Deviation	19.87
Skewness	-.08
Kurtosis	-.49
Range	90.00
Minimum	10.00
Maximum	100.00

According to Table 5.1.shown above, the BAT scores of the students have a mean of 59.99; additionally are ranging from 10 to 100, in which higher scores mean greater biology achievement. Therefore, it can be said that the students in this study showed moderate achievement level. Moreover, the descriptive statistics based on the BAT scores were categorizes according to students' gender and are presented in Table 5.2.

Table 5.2. Descriptive Statistics based on the BAT scores of students in different genders

Achievement Score							
Gender	Mean	N	Standard Deviation	Range	Median	Skewness	Kurtosis
Male	63.72	497	19.06	90.00	65.00	-.17	-.53
Female	56.54	538	20.01	90.00	55.00	.03	-.40
Total	59.99	1035	19.87	90.00	60.00	-.08	-.49

Table 5.2.shows that the mean scores of male students are slightly higher than the female students. In addition, skewness and kurtosis values of each gender presented in Table 5.2.; Male and female students in the study showed a normally distributed population sample; because these values are between -1 and +1 (Tabachnick & Fidell, 2007).

Descriptive statistics for all students concerning task value, self-efficacy, elaboration, organization, and rehearsal are presented in Table 5.3.

Table 5.3. Descriptive statistics ofachievement score, task value, self-efficacy,elaboration, organization, and rehearsal

	Rehearsal	Organization	Elaboration	Self-Efficacy	TaskValue
Mean	4.47	4.33	4.14	4.68	4.67
Standard Deviation	1.47	1.45	1.38	1.39	1.46
Skewness	-.114	-.185	-.182	-.502	-.394
Kurtosis	-.668	-.611	-.514	-.294	-.607

As seen Table 5.3., rehearsal strategy use with a mean of 4.47 appeared to be the most frequently used strategy in biology learning among students. Looking at the skewness and kurtosis values in Table 5.3.about the variables of the present studies interest, it can be revealed that these variables have shown a normal distribution among the population.

Table 5.4. Descriptive statistics indicating the gender differences on task value, self-efficacy,elaboration, organization, and rehearsal

	Rehearsal		Organization		Elaboration		Self Efficacy		Task Value	
	male	female	male	female	male	female	male	female	male	female
Mean	4.67	4.29	4.61	4.08	4.39	3.91	4.68	4.69	4.91	4.45
Standard Deviation	1.43	1.49	1.37	1.48	1.37	1.36	1.36	1.42	1.41	1.47
Skewness	-.14	-.07	-.36	-.01	-.33	-.06	-.56	-.46	-.55	-.26
Kurtosis	-.73	-.64	-.33	-.69	-.35	-.54	-.11	-.44	-.39	-.70

Table 5.4. above gives the descriptive statistics on 11th grade students' use of rehearsal, organization and elaboration learning strategies, self-efficacy and task value scores. According to the table, it can be concluded that in all fields except self-

efficacy male students have slightly higher mean values than the females. It may additionally be concluded based on the skewness and kurtosis values obtained around zero (Tabachnick & Fidell, 2007) that in both of the genders the study represented a normally distributed population sample. As indicated in the table by the help of means, it can also be concluded that, both male (M= 4.67) and female (M= 4.29) students prefer to use rehearsal as a learning strategy to learn biology. On the other hand, the means of task value and self-efficacy beliefs also indicated that female students are prone to have higher self-efficacy beliefs (M=4.69), whereas males posses higher task values (M=4.91) on biology.

5.2. Simultaneous Linear Regression Analysis

In this study, simultaneous linear regression analysis was used to investigate the predictive power of independent variables on the dependent variable.

5.2.1. Assumption of Simultaneous Linear Regression Analysis

According to Tabachnick and Fidell (2007) multiple linear regression has five major assumptions, that namely are normality, multicollinearity, linearity, independence of residuals, and homoscedasticity. Each assumption was checked in order to clarify the appropriateness of the analysis.

5.2.1.1.Normality

Multiple linear regression analysis assumes that the variables of interest are normally distributed. An abnormal distribution might violate the relationships and the significance of the variables (Tabachnick & Fidell, 2007). Normality assumption states that the cases represent a random sample from the population and the errors in the data are independently distributed (Hinkle, Wiersma & Jurs; 2003).

Normality can be inspected by the help of Kolmogorov-Smirnov or Shapiro-Wilk test. Insignificant test results ($p > .05$) reveal that there is a normal distribution (Field, 2005). In this study, Kolmogorov-Smirnov test yielded $\alpha=.067$, $p< .05$ and Shapiro-Wilk test $\alpha=.986$, $p < .05$; therefore, the data of the study were verified to be normally distributed. In addition, normality assumption can be checked by the help of a histogram that is represented not to be too much peaked nor flat (Tabachnick & Fidell, 2007). Normal probabilistic curve on histogram shows that there is a normal distribution among data. Figure 5.1.indicates that normality was met in this study. Lastly, as reported in the descriptive statistics section, skewness and kurtosis values are in appropriate range, between -1 and +1, (Hinkle, Wiersma & Jurs; 2003) indicates that normality assumption was met.

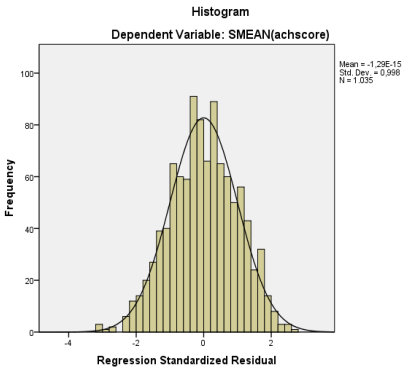

Figure 5.1. Histogram showing normality of the data

5.2.1.2. Multicollinearity

For accurately determining the relationships between dependent and independent variables multiple linear regression analysis prerequisities assuming that there is no multicollinearity in the data (Tabachnick & Fidell, 2007). Multicollinearity occurs when the independent variables are not independent within their selves. Thus, there should be no correlation among independent variables (Hinkle, Wiersma, & Jurs, 2003). Multicollinearity is defined as having too high correlation values among independent variables (Tabachnick & Fidell, 2007).

Multicollinearity can be investigated by checking the condition index (CI), variance inflation factor (VIF) and tolerance values or investigating the Pearson correlations among independent variables. According to Tabachnick and Fidell (2007) to meet this assumption as required, CI values must be lower than 30, VIF values must be lower than 10, whereas the tolerance values are higher than .20. As

seen in the Table 5.5., all variables had a value of VIF lower than 3 and tolerance higher than .20. In addition, there are no pearson correlation values higher than .90 (see Table 5.5.). Therefore, multicollinearity assumption was met in the study.

Table 5.5. Tolerance, VIF and CI values of the data

	Tolerance	VIF	Condition Index
Gender	.919	1.088	6.460
Task Value	.446	2.242	9.204
Self Efficacy	.472	2.118	11.454
Elabortaion	.553	1.809	13.222
Organization	.531	1.882	15.491
Rehearsal	.707	1.414	17.183

Table 5.6. Intercorrelations among independent variables

	Gender	Task Value	Self Efficacy	Elaboration	Organization	Rehearsal
Gender	1.00	-.16	.01	-.17	-.18	-.13
Task Value	-.16	1.00	.69	.57	.48	.35
Self Efficacy	.01	.69	1.00	.52	.46	-.35
Elaboration	-.17	.57	.52	1.00	.56	.34
Organization	-.18	.48	.46	.56	1.00	.53
Rehearsal	-.13	.33	.35	.34	.53	1.00

5.2.1.3. Linearity

Another assumption to be satisfied is the linearity assumption, which can be revealed by a scatterplot showing the linear relationship between the dependent and independent variables, instead of a curvilinear one. Linearity is present when the

scatterplot shows the shape of a rectangular, not a curved shape (Tabachnick & Fidell, 2007). To check the linearity assumption, the bivariate scatterplot of the variables of interest was used. Based on the scatterplot, which is not curved rather rectangular on Figure 5.2.it can be claimed that the linearity assumption was met.

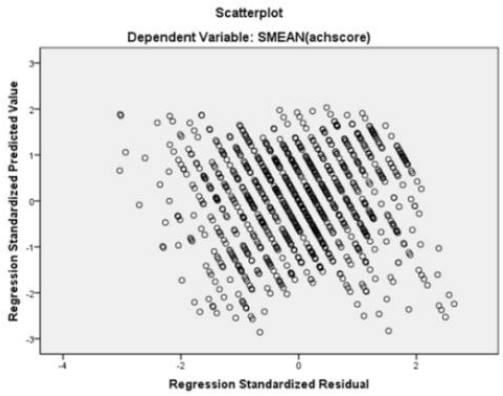

Figure 5.2. Scatterplot on linearity

5.2.1.4. Independence of Residuals

Another assumption to be checked in multiple linear regression analyzes is the independence of residuals assumption, which defines that the errors of variables are not related with each other (Tabachnick & Fidell, 2007). To check this assumption is met or not Durbin-Watson values are used as a criterion. A Durbin-Watson value between 1 and 3 shows that this assumption was met (Field, 2005). For Tabachnick and Fidell (2007) this vale must be close to 2. The result gained on Durbin-Watson value of 1.01 shows that this assumption was satisfied, too.

5.2.1.5. Homoscedasticity

Tabachnick and Fidell (2007) defined the homoscedasticity (homogeneity of variance) assumption as the equality of the standard deviations of error scores of independent variables on dependent variable. Homoscedasticity assumption is checked throughout a scatterplot showing the standardized residuals between the regression standardized predicted values. To interpret this assumption by the help of a scatterplot is done by inspecting whether the spread vertical axis more or less. Field (2005) stated that the more spread on vertical axis means that the data is heteroscedastic rather than homoscedastic. Figure 5.2.reveals that this assumption was met.

Additonally sample size and outliers were checked before conducting the simultaneous linear regression analysis, as prerequisities. According to Tabachnick and Fidell (2007), the appropriate sample size can be calculated by the help of the formula N > 50 + 8m (m, symbolizes the number of independent variables). There are six independent variables used in this study. Thus, applying the formula as; N>50+8.(6); N should be greater than 98. This study had a sample size of 1035. Therefore, sample size of this analysis is assumed to be appropriate for the analysis.

The outliers in the data were also checked by the help of the Mahalanobis distances. Mahalanobis distances measure the chi-square distribution based on degrees of freedom equal to the predictor variables; therefore compute the distance of a specific score to the cluster of other scores (Tabachnick & Fidell, 2007). Multivariate outliers criterion is $p<.001$. The critical chi-square at $\alpha=.001$ for df=6 is

22.457 (Hinkle, Wiersma & Jurs, 2003). The Mahalanobis distances range between .97 and 21.95. There are no cases exceeding the critical value.

Due to satisfying all the assumptions and pre-requisities, these independent variables specified have been examined on their contributions on dependent variable.

5.2.2. Results of Simultaneous Regression Analysis

A simultaneous regression analysis was conducted to predict the Biology achievement of 11th grade students from their task value, self-efficacy beliefs, and also learning strategies as rehearsal, organization, and elaborations. Findings of the analysis are presented in Table 5.7.

Table 5.7. Summary of the simultaneous regression analysis

Independent variables	B	SE	Beta (β)	t
Gender	-5.100	1,182	-.128	-4.316*
Rehearsal	-.486	,458	-.036	-1.061
Organization	.113	,536	.008	.210
Elaboration	1.442	,550	.100	2.620*
Self-efficacy	1.244	,594	.087	2.095*
Task value	1.282	,581	.241	5.650*

Note: Dependent Variable: BAT, SE =18.2118, R = .406, R^2 =.165, Adjusted R^2=.160 , $^{*}p < .05$, $^{**}p < .01$.

According to the results obtained from the data, it was primarily found that 11th grade students' gender (t= -4.316), elaboration learning strategy (t=2.62), self-

efficacy (t=2.095) and task values (t=5.65) are significant correlates of their biology achievement; whereas rehearsal (t=-1.061) and organization (t=.210)learning strategies are not ($\rho < .05$). Based on the semi-partial coreelations obtained from the data being a male student, using elaboration learning strategies and possessing higher task values and self-efficacies are related with achieving higher in 11^{th} grade biology lessons. Additionally, rehearsal and organization learning strategies are found not to be significantly related with 11^{th} grade students' biology achievement.

Results also revealed that, the independent variables significantly explained the %16.5 of the variation in students' Biology achievement ($R = .406$, $F (6, 1028) = 9.95$, $p < .05$). Results also showed that gender ($\beta = -.128$), elaboration ($\beta = .100$), self-efficacy ($\beta = .087$) and task value ($\beta = .241$) significantly contributed to 11^{th} grade students' Biology achievement ($\rho < .05$). On the other hand, organization ($\beta = .008$) and rehearsal ($\beta = -.036$) learning strategies did not make statistically significant contributions ($\rho < .05$). Therefore, first, second, fourth and sixth hypotheses stating that there will be no significant contribution of students' genders, self-efficacies, task values and elaboration as a learning strategy to their biology achievement test scores has been rejected. Based on the beta coefficients, task value is found to be the strongest predictor of 11th grade students' Biology achievement, while all other variables are controlled ($\beta = .241$).

5.2.3. Summary of the Findings

In this section, the findings of the study were summarized. According to the simultaneous regression results, it was revealed that:

- 11^{th} grade students who values Biology lessons more are more likely to achieve higher than others in Biology. Task value beliefs are found to be the most effective predictor of 11^{th} grade students' Biology achievement levels.
- 11^{th} grade students who posseses higher self-efficacy beliefs on Biology are more likely to achieve higher than others in Biology. Self-efficacy beliefs are revealed to be the second influent predictor variable on 11^{th} grade students' Biology achievement levels.
- 11^{th} grade students who use their elaboration strategies while learning Biology, as a higher order thinking skill, are more likely to achieve higher than others in Biology. The use of elaboration as a learning strategy is a significant predictor of 11^{th} grade students' Biology achievement.
- There are also gender differences in terms of 11^{th} grade students' Biology achievement levels. According to the results obtained, 11^{th} grade male students tend to achieve higher than the females in Biology.
- Rehearsal and organization learning strategies give non-significant results among prediction of 11^{th} grade students' Biology achievement levels.

CHAPTER VI

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter aims to give information about discussion of the present study's results, implications of the study, the possible threats to internal and external validity and several recommendations for further research.

6.1. Discussion

This study aimed at investigating the predcitors of 11th grade students' biology achievement. The study was conducted with 1035 eleventh grade high school students, on which the Turkish version of the MSLQ and the BAT were administered in 2009-2010 spring semester in Ankara. According to the descriptive statistics implemented through the data obtained in the study, the participating students were confirmed to be showing moderate biology achievement with a mean of 59.99 over 100 points in the BAT. Male students (M=63.72) showed higher achievement than females (M=56.54) in the mean of the BAT scores obtained in this study. Irrespective of their genders students in this study were reported to be possesing higher self-efficacy beliefs (M=4.68) than task value beliefs (M = 4.67) on biology lessons. Based on genders, their levels of beliefs are different. The results of the study indicated that female students tended to posess higher self-efficacies;

whereas males had higher task values. The most frequently used learning strategy through biology lesssons were also found out in the study. Results showed that rehearsal (M=4.47), organization (M=4.33), and elaboration (M=4.14) are the most frequently used learning strategies in biology learning, respectively. Each of all learning strategies reported to be frequently used in biology learning are showing a significant dominance in male students' biology learning, rather than females.

According to the self-regulated learning literature three major cognitive strategies are heavily emphasized, which are rehearsal, elaboration, and organization (Pintrich & DeGroot, 1990; Weinstein & Mayer, 1986). These strategies are reported to be influencing students' cognitive engagement in the learning process, therefore, provide learner to achieve relatively higher (Tassone, 2001).Results of the multiple regression analysis revealed that students' gender, use of elaboration as a deep learning strategy, task values, and self-efficacy beliefs were major predictors of their biology achievement. These findings are consistent with the previous studies in the related literature (e.g. Cakıcı, Arıcak, & Ilgaz,2011; Fries, Schmid, Dietz, & Hofer, 2005; Pintrich & DeGroot, 1990; Pintrich & Schunk, 2002; Senay, 2010; Sungur, 2007; Wigfield, 1994; Wigfield & Eccles, 2000, Yumuşak, 2006).In addition, results are in line with Eccles and Wigfield (1995) which stated that if individuals perceive a task as a joyful, useful or satisfactory task, they achieve higher on that task.

According to recent educational research, in order to explain students' higher academic achievement better, both the cognitive and affective variables were considerably took quite important focus (Pintrich & DeGroot, 1990). Based on this main idea, Pintrich and Schunk (2002) stated that task value beliefs are the strongest predictors of students' achievement. Results of the present study proved that 11th

grade students who valued Biology lessons more are more likely to achieve higher than others in Biology. This practically means that, students who tend to like, attach importance and are interested in biology as a subject matter, believe in the usefulness of the course and own capabilities to learn efficiently are the ones prosperously showing higher biology achievement than others in the classroom. This result is consistent with the findings of the related literature (Al-Harthy & Was, 2010; DeBacker & Nelson, 1999; Eccless & Wigfield, 2002; Fries, Schmid, Dietz & Hofer, 2005; Wigfield, 1994; Yumusak, 2006).

Findings of the study also revealed that students' task values were far the strongestpredictor of their achievement in Biology.Pintrich et al. (1991) also supported this conclusion by reporting the same findings on a study administered to American students. Also Fries, Schmid, Dietz and Hofer (2005) concluded on their study that task specific values are significantly and positively correlated with students' learning and performance at a pre-determined task. For Yumusak (2006), as students value a task more, their academic achievement scores based on this task increases. McCoach and Siegle (2003) explained the reason why valuing a task results in better outcomes for student, as showing maximal effort on the specific task because of being more motivated. Yumusak (2006) added that higher task value was also positively related with higher levels of learning strategy use, which is additionally related with better achievement outcomes. According to Pintrich and Schunk (2002), the reason why task values posses a close relationship with student achievement is its relationship with achievement related behaviors such as self-regulative abilities, motivation, achievement goals, choice, persistence and performance. Pintrich (1999) explained the cause of the dominance of this

relationship as task values being the main determinant of judging a task is worth learning or not by helping to see its possible advantages or disadvantages, formerly.Due to all these reasons task values dominantly explained the majority of the variance in students' biology achievement in the present study.

A huge body of research also concluded that not only task values but also self-efficacy is a major factor explaining student achievemet (Al-Harthy & Was, 2010; Bandura, 1993, 1997; Britner & Pajares, 2006, Graham & Weiner, 1996; Ozkan, 2003; Pajares, 2003; Pintrich, 1999; Pintrich & DeGroot, 1990; Pintrich & Schunk, 1995, 2002; Schunk, 1991; Schunk & Zimmerman, 1994; Singh et al., 2002; Robbins, Lauver, Davis, Langley & Carlstrom, 2004; Yumusak, 2006; Zimmerman, Bandura, and Martinez-Pons, 1992).Results of the present study also indicated that 11^{th} grade students who posses more self-efficacy beliefs in Biology lessons are more likely to achieve higher than others in Biology. Self-efficacious students are described as being seeking for challenges, persisting on them and using effective learning strategies to achieve higher in the related literature (Al-Harthy & Was, 2010; Bandura, 1997; Britner & Pajares, 2001, 2006; Eccles et al., 1998; Lau & Roeser, 2002;Ozkan, 2003; Pajares, 2002; Pintrich & DeGroot, 1990; Schunk, 1989, 1991, 1996; Schunk & Zimmerman, 1994; Wigfield, 1994; Zeldin & Pajares, 1997).For Pintrich and Schunk (2002), students with high efficacy are the ones to achieve higher, with more cognitive engagement, by trying harder and longer. Pajares (1996) explained the reason that why self-efficacy influences students' achievement as due to its affect on students'patterns of thoughts and their affective responses. Other researchers also tried to explain why self-efficacous students achieve higher than others. For instance, Eggen and Kauchak (1999) described the

mechanism as; higher self-efficacy is related to positive beliefs, which lead to more sincere intention, that causes more effort exerted, conclusively higher achievement.According to Zimmerman and Martinez-Pons (1992) this is due to its improving influence on students' motivation. In addition, self-efficacy improves students' participation, autonomy and attendance; therefore, their achievement (Schunk & Pajares, 2001). These reasons might be valid for the present study to explain why students who beleived in their capability to successfully complete biology tasks were more successful in Biology than the students who did not believe in their ability to succeed.

Research also supported the idea that the effective use of learning strategies is another predictor of student better achievement levels (Berger & Karabenick, 2010; Garcia & Pintrich, 1996; Pintrich & De Groot, 1990; Pintrich, Smith, Garcia & McKeachie, 1991;Yumusak, 2006; Zimmerman & Martinez-Pons, 1990). Pintrich and Schunk (2002) stated that the factors explaining students' deeper understanding is not only his or her more effort that was exerted but also the deeper processing during learning. According to the results of this study, 11th grade students who use their elaboration strategies while learning Biology, as a higher order thinking skill, were more likely to achieve higher than others in Biology. This result is consistent with the related literature (Johnsey, Morrison & Ross, 1992; Parker, 2007; Weinstein, 1982). As a result, as students study by puting all the information together, relating the concepts to each other and their previous knowledge, and applying ideas in different classes and discussions, their Biology achievement increase.Because elaboration as a deep learning strategy requires students to constitute cognitive linkages between old and new knowledge (Al-Harthy & Was,

2010), elaboration provides learners to keeping the information in long term memory (Johnsey, Morrison & Ross, 1992; Weinstein & Mayer, 1986).

The present study also found out that 11th grade male students tended to achieve higher than the females in biology. This result is consistent with the findings of Greenfield(1995), Lee and Burkham (1996), Martin et al., (2008), Steinkamp and Maehr (1983), Tekkaya, Ozkan and Sungur (2001), Willingham and Cole(1997). In the related literature, there are mixed results for the relationship between gender difference and science achievement. For example the study conducted with primary students by Cavas (2011) in Turkey found gender differences in the mean of students' science achievement favoring for females but this result fail to achieve significance ($p=.78$, $p<.05$).It was generally found that males outperform better than females in science; but the major factor causing this difference has still not clearly stated (Garcia & Pintrich, 1995). This may be due to females' tendency of posessing lower science self-efficacy than males, as reported by Calıskan (2004). Tekkaya, Ozkan and Sungur (2001) explained the reason why males outperform in science as, male students' perception of biology as an easier science topic to be studied. This difference was attempted to be explained by males' higher interest and self-efficacy in science, as dominantly and significantly affecting factors on students' academic achievement (DeBacker & Nelson, 2000; Pajares, 2002). In the present study, males possessed slightly higher task values than the females, which was also found be the strongest predictor of students' biology achievement. Therefore, one of the possible reasons of this gender difference may be due to their higher task values obtained for this lesson. However, more research is needed to explore gender difference in achievement. On the other hand, other findings in the literature indicated a

significant difference between males and females in science (Lee & Burkham, 1996) and biology (Ozkan, 2003) achievement in favor of females, which contradicts with results of the current study. Lastly, there are also studies in the related literature finding no gender differences in learning and performance different from the findings of thepresent study (e.g., Meece et al.,2006; Rusillo & Arias, 2004; Sungur & Tekkaya, 2003).

As well as significant variables, there are also non-significant results obtained in the present study. Rehearsal and organization learning strategies found to be non-significant to predict 11th grade students' Biology achievement. However, the findings are inconsistent with the research studies stating that rehearsal (Tassone, 2001; Yumusak, 2006) and organization (Parker, 2007; Weinstein & Mayer, 1986; Yumusak, 2006) are related to students' higher achievement. The finding on rehearsal is consistent with research conducted by Parker (2007), in which rehearsal is assumed to be a surface learning strategy, therefore, found to be unrelated to meaningful learning. In other words, students who utilize rehearsal strategy read class notes over and over again without any connection among concepts and memorize important terms; therefore, they might not be successful in biology.The finding on organization is also inconsistent with several other studies (Parker, 2007; Pintrich & DeGroot, 1990; Sungur & Tekkaya, 2006; Van-Zile & Tamsen, 2001; Yumusak, 2006).One of the possible reasonsof why organization was not found be a predictor variable in the present study may be its being more relative to storing information into memory effectively to remember(Ormrod, 1998 as cited in Dembo and Eaton, 2000), rather than affecting achievement directly. This reason may also be due to the contradictory definition proposed by Schiefele (1991) as assuming

organization as a surface learning strategy rather than a deep learning strategy defined by Entwistle (1988). According to Al-Harthy and Was (2010), surface learning strategies are the ones that are negatively related with students achievement. Therefore, such like the German sample analyzed in Shiefele's (1991) study, the sample adopted in this study may perceive organization as a surface, rather than a deep learning strategy. For that reason, inconsistent result with the related literature might be gained through this scale.

The current study showed the significant contributing factors to the students' Biology achievement. Further research is also necessaryto explore new predictors. Implications and recommendations for further prospective research were additionally given below.

6.2. Implications for Practice

Results of this study would lead several implications or suggestions for teachers.

- Teachers should be aware of thatthere are individual differences in students' learnings. Teachers should use different methods (lectures, analogies, projects, laboratory experiments, and simulations) to stimulate different students' in the classroom. Classrooms should also be designed to develop students' different ways of learning.Teachers should especially encourage their students to use elaboration learning strategies to be successful in biology, such as creating linkages between old and new information through

teaching, allowing students to extract meaning from the lesson, using more summarizing and paraphrasing exercises on homeworks etc.

- Students' task values and self-efficacy beliefs should also be taken into account to enchance their Biology achievement. Teachers should design their instruction to improve their students' task value and self-efficacy beliefs, such as stressing the importance of biology in daily life, encouraging students' self-improvementfor providing them an inner satisfaction towards biology during instruction.
- Gender differences in learning should also be taken into account. Teachers should investigate effective ways to promote female students' achievement in biology.

6.3. Recommendations for Future Research

The suggestions of the present studyfor the prospective reserch are given as follows:

- The role of demographic variables such as socioeconomic status, school type, family background etc. can also be investigated.
- The study may be conducted on different grade levels to examine the grade level changes in variables of interest.
- The study can be conducted for different disciplines like chemistry or physics.

- The effects of different instructional strategies which emphasize the development of task value and self-efficacy beliefs on biology achievement can be examined.
- The effects of other various learning strategies on student achievement can also be examined.
- Random sampling may be used for gaining more generalizable results in further studies.

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APPENDIX A

THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

(MSLQ)

A.1. Motivation

The following questions ask about your motivation for and attitudes about this class. Remember there are no right or wrong answers, just answer as accurately as possible. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

12 3 4 5 6 7
Not at all true of me *Very true of me*

1. In a class like this, I prefer course material that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I will be able to learn the material in this course.
3. When I take a test I think about how poorly I am doing compared with other students.
4. I think I will be able to use what I learn in this course in other courses.
5. I believe I will receive an excellent grade in this class.
6. I'm certain I can understand the most difficult material presented in the readings for this course.
7. Getting a good grade in this class is the most satisfying thing for me right now.
8. When I take a test I think about items on other parts of the test I can't answer.
9. It is my own fault if I don't learn the material in this course.
10. It is important for me to learn the course material in this class.
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
12. I'm confident I can learn the basic concepts taught in this course.
13. If I can, I want to get better grades in this class than most of the other students.
14. When I take tests I think of the consequences of failing.
15. I'm confident I can understand the most complex material presented by the instructor in this course.
16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.
17. I am very interested in the content area of this course.
18. If I try hard enough, then I will understand the course material.
19. I have an uneasy, upset feeling when I take an exam.
20. I'm confident I can do an excellent job on the assignments and tests in this course.
21. I expect to do well in this class.

22. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
23. I think the course material in this class is useful for me to learn.
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.
25. If I don't understand the course material, it is because I didn't try hard enough.
26. I like the subject matter of this course.
27. Understanding the subject matter of this course is very important to me.
28. I feel my heart beating fast when I take an exam.
29. I'm certain I can master the skills being taught in this class. Review of the MSLQ
30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.
31. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.

A.2. Learning Strategies

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

1	2	3	4	5	6	7
Not at all true of me						*Very true of me*

32. When I study the readings for this course, I outline the material to help me organize my thoughts.
33. During class time I often miss important points because I'm thinking of other things. (reverse coded)
34. When studying for this course, I often try to explain the material to a classmate or friend.
35. I usually study in a place where I can concentrate on my course work.
36. When reading for this course, I make up questions to help focus my reading.
37. I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do. (reverse coded)
38. I often find myself questioning things I hear or read in this course to decide if I find them convincing.
39. When I study for this class, I practice saying the material to myself over and over.
40. Even if I have trouble learning the material in this class, I try to do the work on my own, without help from anyone. (reverse coded)
41. When I become confused about something I'm reading for this class, I go back and try to figure it out.
42. When I study for this course, I go through the readings and my class notes and try to find the most important ideas.
43. I make good use of my study time for this course.
44. If course readings are difficult to understand, I change the way I read the material.
45. I try to work with other students from this class to complete the course assignments.

46. When studying for this course, I read my class notes and the course readings over and over again.
47. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.
48. I work hard to do well in this class even if I don't like what we are doing.
49. I make simple charts, diagrams, or tables to help me organize course material.
50. When studying for this course, I often set aside time to discuss course material with a group of students from the class.
51. I treat the course material as a starting point and try to develop my own ideas about it.
52. I find it hard to stick to a study schedule. (reverse coded)
53. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.
54. Before I study new course material thoroughly, I often skim it to see how it is organized.
55. I ask myself questions to make sure I understand the material I have been studying in this class.
56. I try to change the way I study in order to fit the course requirements and the instructor's teaching style.
57. I often find that I have been reading for this class but don't know what it was all about. (reverse coded)
58. I ask the instructor to clarify concepts I don't understand well.
59. I memorize key words to remind me of important concepts in this class.
60. When course work is difficult, I either give up or only study the easy parts. (reverse coded)
61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course.
62. I try to relate ideas in this subject to those in other courses whenever possible.
63. When I study for this course, I go over my class notes and make an outline of important concepts.
64. When reading for this class, I try to relate the material to what I already know.
65. I have a regular place set aside for studying.
66. I try to play around with ideas of my own related to what I am learning in this course.
67. When I study for this course, I write brief summaries of the main ideas from the readings and my class notes.
68. When I can't understand the material in this course, I ask another student in this class for help.
69. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.
70. I make sure that I keep up with the weekly readings and assignments for this course.
71. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.
72. I make lists of important items for this course and memorize the lists.
73. I attend this class regularly.
74. Even when course materials are dull and uninteresting, I manage to keep working until I finish.
75. I try to identify students in this class whom I can ask for help if necessary.

76. When studying for this course I try to determine which concepts I don't understand well.
77. I often find that I don't spend very much time on this course because of other activities. (reverse coded)
78. When I study for this class, I set goals for myself in order to direct my activities in each study period.
79. If I get confused taking notes in class, I make sure I sort it out afterwards.
80. I rarely find time to review my notes or readings before an exam. (reverse coded)
81. I try to apply ideas from course readings in other class activities such as lecture and discussion.

APPENDIX B

THE TURKISH VERSION OF THE MOTIVATED STRATEGIES OF LEARNING QUESTIONNAIRE (MSLQ-TR)

Ad, Soyad: **Biyoloji Dersi Not Ortalaması:**

Sınıf: **Yaş:**

ÖĞRENMEDE GÜDÜSEL STRATEJİLER ANKETİ

Bu anket iki kısımdan oluşmaktadır. İlk kısımda biyoloji dersine karşı tutumunuzu, motivasyonunuzu, ikinci kısımda ise biyoloji 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

B.1. Motivasyon (Güdülenme)

	beni hiç yansıtmıyor						**beni tam olarak yansıtıyor**
1. Biyoloji dersinde yeni bilgiler öğrenebilmek için, büyük bir çaba gerektiren sınıf çalışmalarını tercih ederim.	1	2	3	4	5	6	7
2. Eğer uygun şekilde çalışırsam, biyoloji dersindeki konuları öğrenebilirim.	1	2	3	4	5	6	7
3. Biyoloji sınavları sırasında, diğer arkadaşlarıma göre soruları ne kadar iyi yanıtlayıp yanıtlayamadığımı düşünürüm	1	2	3	4	5	6	7
4. Biyoloji dersinde öğrendiklerimi başka derslerde de kullanabileceğimi düşünüyorum.	1	2	3	4	5	6	7

5. Biyoloji dersinden çok iyi bir not alacağımı düşünüyorum.	1	2	3	4	5	6	7
6. Biyoloji dersi ile ilgili okumalarda yer alan en zor konuyu bile anlayabileceğimden eminim.	1	2	3	4	5	6	7
7. Benim için şu an biyoloji dersi ile ilgili en tatmin edici şey iyi bir not getirmektir	1	2	3	4	5	6	7
8. Biyoloji sınavları sırasında bir soru üzerinde uğraşırken, aklım sınavın diğer kısımlarında yer alan cevaplayamadığım sorularda olur	1	2	3	4	5	6	7
9. Biyoloji dersindeki konuları **öğrenemezsem** bu benim hatamdır.	1	2	3	4	5	6	7
10.Biyoloji dersindeki konuları öğrenmek benim için önemlidir	1	2	3	4	5	6	7
11. Genel not ortalamamı yükseltmek şu an benim için en önemli şeydir, bu nedenle biyoloji dersindeki temel amacım iyi bir not getirmektir.	1	2	3	4	5	6	7
12. Biyoloji dersinde öğretilen temel kavramları öğrenebileceğimden eminim.	1	2	3	4	5	6	7
13. Eğer başarabilirsem, biyoloji dersinde sınıftaki pek çok öğrenciden daha iyi bir not getirmek isterim	1	2	3	4	5	6	7
14. Biyoloji sınavları sırasında bu dersten başarısız olmanın sonuçlarını aklımdan geçiririm	1	2	3	4	5	6	7
15. Biyoloji dersinde, öğretmenin anlattığı en karmaşık konuyu anlayabileceğimden eminim.	1	2	3	4	5	6	7
16. Biyoloji derslerinde öğrenmesi zor olsa bile, bende merak uyandıran sınıf çalışmalarını tercih ederim.	1	2	3	4	5	6	7
17. Biyoloji dersinin kapsamında yer alan konular çok ilgimi çekiyor.	1	2	3	4	5	6	7
18. Yeterince sıkı çalışırsam biyoloji dersinde başarılı olurum.	1	2	3	4	5	6	7
19. Biyoloji sınavlarında kendimi mutsuz ve huzursuz hissederim.	1	2	3	4	5	6	7
20. Biyoloji dersinde verilen sınav ve ödevleri en iyi şekilde yapabileceğimden eminim.	1	2	3	4	5	6	7
21. Biyoloji dersinde çok başarılı olacağımı umuyorum	1	2	3	4	5	6	7
22. Biyoloji dersinde beni en çok tatmin eden şey, konuları mümkün olduğunca iyi öğrenmeye çalışmaktır.	1	2	3	4	5	6	7
23. Biyoloji dersinde öğrendiklerimin benim için faydalı olduğunu düşünüyorum.	1	2	3	4	5	6	7
24. Biyoloji dersinde, iyi bir not getireceğimden emin **olmasam** bile öğrenmeme olanak sağlayacak ödevleri seçerim.	1	2	3	4	5	6	7
25. Biyoloji dersinde bir konuyu **anlayamazsam** bu yeterince sıkı çalışmadığım içindir.	1	2	3	4	5	6	7
26. Biyoloji dersindeki konulardan hoşlanıyorum.	1	2	3	4	5	6	7

27. Biyoloji dersindeki konuları anlamak benim için önemlidir.	1	2	3	4	5	6	7
28. Biyoloji sınavlarında kalbimin hızla attığını hissederim.	1	2	3	4	5	6	7
29. Biyoloji dersinde öğretilen becerileri iyice öğrenebileceğimden eminim.	1	2	3	4	5	6	7
30. Biyoloji dersinde başarılı olmak istiyorum çünkü yeteneğimi aileme, arkadaşlarıma göstermek benim için önemlidir.	1	2	3	4	5	6	7
31. Dersin zorluğu, öğretmen ve benim becerilerim göz önüne alındığında, biyoloji dersinde başarılı olacağımı düşünüyorum	1	2	3	4	5	6	7

B.2. Öğrenme Stratejileri

	beni hiç yansıtmıyor						**beni tam olarak yansıtıyor**
32. Biyoloji dersi ile ilgili bir şeyler okurken, düşüncelerimi organize etmek için konuların ana başlıklarını çıkarırım.	1	2	3	4	5	6	7
33. Biyoloji dersi sırasında başka şeyler düşündüğüm için önemli kısımları sıklıkla kaçırırım.	1	2	3	4	5	6	7
34. Biyoloji dersine çalışırken çoğu kez arkadaşlarıma konuları açıklamaya çalışırım	1	2	3	4	5	6	7
35. Genelde, ödevlerime rahat konsantre olabileceğim bir yerde çalışırım.	1	2	3	4	5	6	7
36. Biyoloji dersi ile ilgili bir şeyler okurken, okuduklarıma odaklanabilmek için sorular oluştururum.	1	2	3	4	5	6	7
37. Biyoloji dersine çalışırken kendimi çoğu zaman o kadar isteksiz ya da o kadar sıkılmış hissederim ki, planladıklarımı **tamamlamadan** çalışmaktan vazgeçerim.	1	2	3	4	5	6	7
38. Biyoloji dersiyle ilgili duyduklarımı ya da okuduklarımı ne kadar gerçekçi olduklarına karar vermek için sıklıkla sorgularım.	1	2	3	4	5	6	7
39. Biyoloji dersine çalışırken, önemli bilgileri içimden defalarca tekrar ederim	1	2	3	4	5	6	7
40. Biyoloji dersinde bir konuyu anlamakta zorluk çeksem bile hiç kimseden yardım almaksızın kendi kendime çalışırım.	1	2	3	4	5	6	7
41. Biyoloji dersi ile ilgili bir şeyler okurken bir konuda kafam karışırsa, başa döner ve anlamak için çaba gösteririm.	1	2	3	4	5	6	7
42. Biyoloji dersine çalışırken, daha önce okuduklarımı ve aldığım notları gözden geçirir ve en önemli noktaları belirlemeye çalışırım.	1	2	3	4	5	6	7
43. Biyoloji dersine çalışmak için ayırdığım zamanı iyi değerlendirebiliyorum.	1	2	3	4	5	6	7
44.Eğer biyoloji dersi ile ilgili okumam gereken konuları anlamakta zorlanıyorsam, okuma stratejimi değiştiririm.	1	2	3	4	5	6	7

45. Biyoloji dersinde verilen ödevleri tamamlamak için sınıftaki diğer öğrencilerle çalışırım.	1	2	3	4	5	6	7
46. Biyoloji dersine çalışırken, dersle ilgili okumaları ve ders sırasında aldığım notları defalarca okurum	1	2	3	4	5	6	7
47. 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
48. Biyoloji dersinde yaptıklarımızdan **hoşlanmasam bile** başarılı olabilmek için sıkı çalışırım.	1	2	3	4	5	6	7
49. Dersle ilgili konuları organize etmek için basit grafik, şema ya da tablolar hazırlarım.	1	2	3	4	5	6	7
50. Biyoloji dersine çalışırken konuları sınıftaki arkadaşlarımla tartışmak için sıklıkla zaman ayırırım	1	2	3	4	5	6	7
51. Biyoloji dersinde işlenen konuları bir başlangıç noktası olarak görür ve ilgili konular üzerinde kendi fikirlerimi oluşturmaya çalışırım.	1	2	3	4	5	6	7
52. Çalışma planına bağlı kalmak benim için zordur.	1	2	3	4	5	6	7
53. Biyoloji dersine çalışırken, dersten, okuduklarımdan, sınıf içi tartışmalardan ve diğer kaynaklardan edindiğim bilgileri bir araya getiririm.	1	2	3	4	5	6	7
54. 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
55. Biyoloji dersinde işlenen konuları anladığımdan emin olabilmek için kendi kendime sorular sorarım.	1	2	3	4	5	6	7
56. Çalışma tarzımı, dersin gereklilikleri ve öğretmenin öğretme stiline uygun olacak tarzda değiştirmeye çalışırım.	1	2	3	4	5	6	7
57. Genelde derse gelmeden önce konuyla ilgili bir şeyler okurum fakat okuduklarımı çoğunlukla **anlamam**	1	2	3	4	5	6	7
58. İyi anlamadığım bir konuyu öğretmenimden açıklamasını isterim.	1	2	3	4	5	6	7
59. Biyoloji dersindeki önemli kavramları hatırlamak için anahtar kelimeleri ezberlerim.	1	2	3	4	5	6	7
60. Eğer bir konu zorsa ya çalışmaktan vazgeçerim ya da yalnızca kolay kısımlarını çalışırım	1	2	3	4	5	6	7
61. Biyoloji dersine çalışırken, konuları sadece okuyup geçmek yerine ne öğrenmem gerektiği konusunda düşünmeye çalışırım.	1	2	3	4	5	6	7
62. Mümkün olduğunca biyoloji dersinde öğrendiklerimle diğer derslerde öğrendiklerim arasında bağlantı kurmaya çalışırım.	1	2	3	4	5	6	7
63. Biyoloji dersine çalışırken notlarımı gözden geçirir ve önemli kavramların bir listesini çıkarırım.	1	2	3	4	5	6	7
64. Biyoloji dersi için bir şeyler okurken, o anda okuduklarımla daha önceki bilgilerim arasında bağlantı kurmaya çalışırım.	1	2	3	4	5	6	7
65. Ders çalışmak için devamlı kullandığım bir yer (oda vs.) vardır	1	2	3	4	5	6	7
66. Biyoloji dersinde öğrendiklerimle ilgili ortaya çıkan fikirlerimi sürekli olarak gözden geçiremeye çalışırım.	1	2	3	4	5	6	7

67. Biyoloji dersine çalışırken, dersle ilgili okuduklarımı ve derste aldığım notları inceleyerek önemli noktaların özetini çıkarırım.	1	2	3	4	5	6	7
68. Biyoloji dersinde bir konuyu anlayamazsam sınıftaki başka bir öğrenciden yardım isterim.	1	2	3	4	5	6	7
69. Biyoloji dersiyle ilgili konuları, ders sırasında öğrendiklerim ve okuduklarım arasında bağlantılar kurarak anlamaya çalışırım.	1	2	3	4	5	6	7
70. Biyoloji derslerinde verilen ödevleri ve derse ilgili okumaları zamanında yaparım.	1	2	3	4	5	6	7
71. Biyoloji 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
72. Biyoloji dersinde önemli kavramların listesini çıkarır ve bu listeyi ezberlerim.	1	2	3	4	5	6	7
73. Biyoloji derslerini düzenli olarak takip ederim	1	2	3	4	5	6	7
74. Konu çok sıkıcı olsa da, ilgimi **çekmese** de konuyu bitirene kadar çalışmaya devam ederim.	1	2	3	4	5	6	7
75. Gerektiğinde yardım isteyebileceğim arkadaşlarımı belirlemeye çalışırım.	1	2	3	4	5	6	7
76. Biyoloji dersine çalışırken iyi anlamadığım kavramları belirlemeye çalışırım.	1	2	3	4	5	6	7
77. Başka faaliyetlerle uğraştığım için çoğu zaman biyoloji dersine yeterince zaman ayıramıyorum	1	2	3	4	5	6	7
78. Biyoloji dersine çalışırken, çalışmalarımı yönlendirebilmek için kendime hedefler belirlerim.	1	2	3	4	5	6	7
79. Ders sırasında not alırken kafam karışırsa, notlarımı dersten sonra düzenlerim.	1	2	3	4	5	6	7
80. Biyoloji sınavından önce notlarımı ya da okuduklarımı gözden geçirmek için fazla zaman **bulamam**.	1	2	3	4	5	6	7
81. Biyoloji dersinde, okuduklarımdan edindiğim fikirleri sınıf içi tartışma gibi çeşitli faaliyetlerde kullanmaya çalışırım.	1	2	3	4	5	6	7

APPENDIX C

THE BIOLOGY ACHIEVEMENT TEST(BAT)

Biyoloji Dersi Başarı Testi

Değerli öğrenciler;

Çoktan seçmeli sorulardan oluşan aşağıdaki test sizlerin Biyoloji dersi başarınızı ölçmek amacıyla düzenlenmiştir. Teste katılım gönüllülük esasına dayalıdır. Teste vereceğiniz cevaplar ve kişisel bilgileriniz tamamiyle gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir; elde edilecek bilgiler bilimsel yayımlarda kullanılacaktır.Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakıp çıkmakta serbestsiniz.Böyle bir durumda testi uygulayan kişiye, testi tamamlamadığınızı söylemek yeterli olacaktır. Test sonunda, ilgili sorularınız için cevap anahtarı ayrıca dağıtılacaktır.

Çalışmaya katılımınızdan dolayı size şimdiden teşekkür ederiz.

Adınız:

Yaşınız:

Cinsiyetiniz:

☐ Erkek

☐ Kız

Okul tipi:

Anadolu Lisesi ☐

Özel Okul (Kolej) ☐

Düz Lise ☐

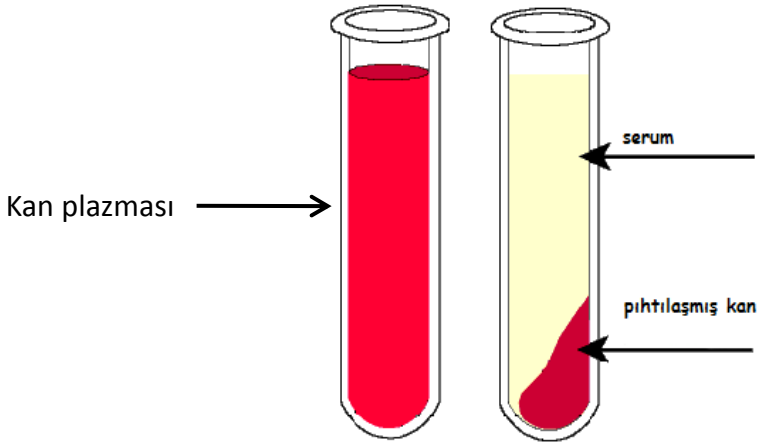
Biyoloji Dersi Not Ortalamanız:

1.

Ökseotu, değişik ağaçlar üzerinde yarı parazit olarak yaşayan yeşil yapraklı bir bitkidir.Bu bitki yaşamını sürdürebilmek için emeçlerini üzerinde yaşadığı bitkinin hangi yapılarına doğrudan ulaştırmalıdır?

A) Epidermis B)Odun Boruları C)Soymuk Boruları D)Kambiyum E) Emici Tüyler

2.



Kan plazması, kanın madde taşımasını sağlayan ara maddesidir. Kanın pıhtılaşmasından sonra hücrelerinden ayrılmış açık sarı renkli kısmına da kan serumu denir. Aşağıdakilerden hangisi kan serumundan farklı olarak sadece kan plazmasında bulunur?

A) Vitamin B)Fibrinojen C)Hormon D)Amino asit E)Antikor

3. Aşağıdakilerden hangisi Soymuk borularının (Floem) özelliklerinden değildir?

A) Canlı hücrelerden oluşmuşlardır
B) Besin yapıtaşlarını taşır

C) Çevresi destek doku hücreleri ve bu hücrelerin salgıladığı Süberin, Lignin gibi su geçirmeyen maddelerle çevrilidir.

D) Ara çeperleri yer yer erimiştir.

E) İletim kökten yapraklara ve topraklardan köklere doğru 2 yönlüdür.

4.Aşağıdaki tabloda belirli bir zaman aralığı içerisinde bir hormonun miktarındaki değişime bağlı olarak insan vücudunda gözlemlenen değişiklikler gösterilmiştir.

DURUM	DEĞİŞİKLİK
Hücrelerdeki glikoz alımı	Azalma
Karaciğerdeki glikoz miktarı	Azalma
Kandaki glikoz miktarı	Artış

Tabloda verilen durum aşağıda verilen seçeneklerden hangisi sonucunda oluşur?

A) Aldosteron miktarındaki artış
B) Kortizol miktarındaki azalma
C) Parathormon miktarında azalma
D) İnsülin miktarındaki azalma
E) Kalsitonin miktarındaki artış

5. Memeli bir hayvanın henüz fark ettiği düşmanından kaçabilmesi için vücudundaki;

I.Hormon Bezleri II. Kas Sistemi III. Sinir Sistemi IV. Duyu Organları

Aşağıda verilen hangi sıraya göre etkinlik göstermelidir?

A) IV- I- II- III
B) II- III- IV- I
C) IV- III- I- II
D) III- II- IV- I
E) II- I- III- IV

6. **I. MSH- Deri Hücresi**
II. Tiroksin- Tüm hücreler
III. Progesteron- Uterus
IV. FSH-Gonadlar
V. Somatotropin- Tüm hücreler

Yukarıdaki hormonlardan hangileri birlikte eşleştirildikleri dokuları hedef organ olarak etkilerler?

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

7. Eşik şiddetini aşan bir uyartının şiddeti daha da arttırılacak olursa aşağıdaki değişiklerden hangisinin gözlemlenmesi beklenir?

A) İmpuls sayısı artar
B) Tepki süresi kısalır
C) İmpulsun yapısı değişir
D) Tepkinin şiddeti azalır
E) İmpulsun hızı artar

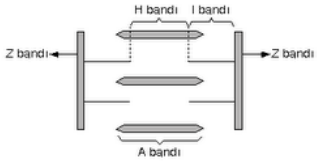
8.

Aşağıda verilen seçeneklerden hangisi turgor basıncı yüksek bir bitkinin turgor basıncının azalmasına yol açar?

A) Bitkinin izotonik bir ortama konması
B) Bitkinin bünyesindeki çözünmüş maddeleri dış ortama atması
C) Bitkinin hipotonik bir ortama konması

D) Bitkinin osmotik basıncı yüksek bir ortama konması
E) Bitkinin ATP kullanarak suyu içine alması

9. Aşağıdaki şekilde gevşemiş haldeki bir çizgili kasın yapısı gösterilmiştir.



Şekle göre, kasılma anında çizgili bir kasta aşağıdaki yapılardan hangilerinin boylarında değişiklik görülmesi beklenir?
I.A bandı II.H bandı III.I bandı IV. Z bandı

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

10. Biri böcekçil, diğeri böcekçil olmayan iki bitkide aşağıdaki özelliklerden hangileri ortaktır?

I. Hücre dışı protein sindiriminin gerçekleşmesi
II. Fotosentez için karbonu işaretlenmiş karbondioksit verildiğinde, işaretli karbonun hücrede sentezlenen proteinlerdeki aminoasitlerin tümünde bulunması
III. Hücrelerinde proteinlerin aminoasitlere parçalanması

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

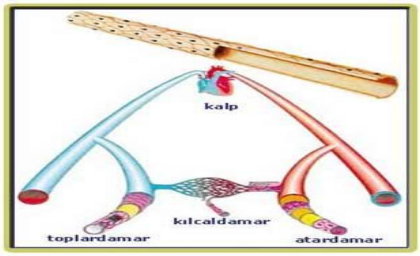
11. Sindirim olayları sırasında alınan besinin yapıtaşlarına parçalanma süresi aşağıdakilerden hangisine bağlı <u>değildir</u>?

A) Alınan besinin sıcaklığına
B) Salgılanan sindirim enzimlerinin miktarına
C) Alınan besin yüzeyinin büyüklüğüne
D) İnce bağırsakta emilme yüzeyinin büyüklüğüne
E) Pankreastan salgılanan HCO^-_3 miktarına

12.Memelilerde midenin kendi kendisini sindirmemesinin sebebi aşağıdakilerden hangisi değildir?

A) Midenin iç yüzeyinin mukus kaplı olması
B) Pepsin enziminin aktif olarak salgılanması
C) HCl ve pepsinojen miktarının besin miktarına bağlı olarak Gastrin hormonu ile kontrol edilmesi
D) Besinlerin asit yoğunluğunu azaltması
E) Mide bezlerinden inaktif pepsinojen salgılanması

13. Memelilerde, atardamarları toplardamarlara bağlayan kılcal damarlar boyunca <u>kan basıncı</u> azalmayıp <u>sabit kalsaydı</u> aşağıdakilerden hangilerinin gerçekleşmesi beklenir?



I. Çözünen maddelerin kılcal damardan doku sıvısına daha kolay geçmesi
II. Metabolizma atıklarının kılcal damarlara daha kolay geçmesi
III. Doku sıvısının kılcal damarlara daha kolay geçmesi
IV. Doku sıvısı miktarının azalması

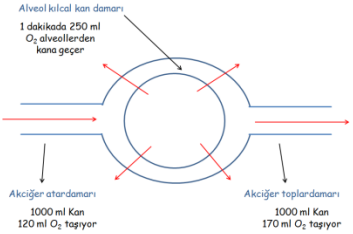
A) Yalnız I B)Yalnız II C)Yalnız III D)III ve IV E)II, III ve IV

14.Bitkilerde terleme aşağıdaki işlevlerden hangisini veya hangilerini gerçekleştirir?

I. Madensel tuzların taşınmasına yardımcı olma
II. Bitkinin aşırı ısınmasını önleme
III. Fotosentez ürünlerinin köklere taşınmasına yardımcı olma

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

15.Bir insanın damarından 1 dakikada geçen kanın miktarı; o damardan geçen O_2'nin dokularda kullanım miktarının, damardan geçen O_2 miktarına oranlanmasıyla bulunabilir.



Yukarıdaki şekilde bir insan akciğerindeki atardamar, kılcal damar ve toplardamarlar arasındaki O_2 alışverişi açıklanmaktadır. Şekle ve öncesinde verilen bilgiye göre; insan kalbinin 1 dakikada pompaladığı kan miktarı kaç litredir?

A) 25 litre/dakika
B) 12 litre/dakika
C) 5 litre/dakika
D) 10 litre/dakika
E) 2 litre/dakika

16.İnsanda;

I. Oksijenin hemoglobinden ayrılması
II. Bazı yıkım ürünlerinin dış ortama atılması
III. Karbondioksidin hemoglobine bağlanması

Olaylarından hangileri akciğerlerin görevidir?

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

17. Bir koşucunun koşmaya başlamasından sonra gelişen olayların sırası aşağıdaki seçeneklerden hangisinde doğru olarak verilmiştir?

I. Soluk alıp- verme merkezlerinin uyarılması
II. Dokularda karbondioksit miktarının artması
III. Kanda karbondioksit miktarının artması

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

18. Aşağıdakilerden hangileri <u>tatlı su balıklarının</u> özelliklerindendir?

I. Vücut sıvısı konsantrasyonu ile dış ortam konsantrasyonunu eşitlemeye çalışma
II. Enerji kullanarak tuzu dışarıdan alma
III. Seyreltik idrar oluşturma
IV. Su içmeme

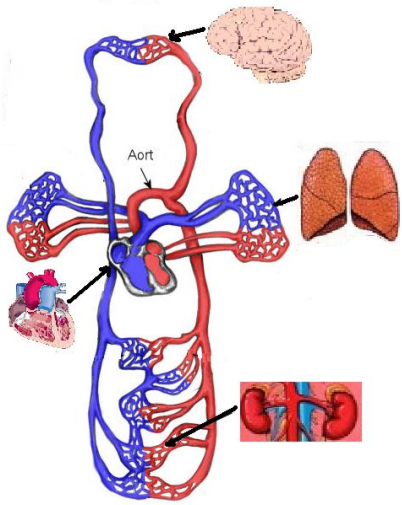
A) I ve II B) II ve IV C) I, II ve III D) I, III ve IV E) II, III ve IV

19.Bir insanın belirli bir süre içinde vücuduna aldığı sıvı miktarından <u>daha fazla</u> miktar idrar çıkarmasına aşağıdakilerden hangileri sebep olabilir?

I. Böbrek atardamarının kan basıncının azalması
II. Böbrek kanallarından suyun geri emilimini sağlayan hormonun normalden az salgılanması
III. Böbreklerden geçen kan akım hızının azalması

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

20.



Böbrek fonksiyonları normal seyreden sağlıklı bir insanda aşağıda sıralanan yapılardan hangisinde kandaki <u>boşaltım maddelerinin derişimi</u> en azdır?

A) Böbrek atardamarı
B) Aort
C) Akciğer atardamarı
D) Böbrek toplardamarı
E) Akciğer toplardamarı

APPENDIX D

PARAMETER ESTIMATES AND FIT STATISTICS ON AMOS OUTPUT

The model is recursive.

Sample size = 1035

Your model contains the following variables

Observed, endogenous variables:

selfefficacy1
selfefficacy2
selfefficacy3
selfefficacy4
selfefficacy5
selfefficacy6
selfefficacy7
selfefficacy8
taskvalue1
taskvalue2
taskvalue3
taskvalue4
taskvalue5
taskvalue6
elaboration1
elaboration2
elaboration3
elaboration4
elaboration5
elaboration6
organization1
organization2
organization3

organization4
rehearsal1
rehearsal2
rehearsal3
rehearsal4

Unobserved, exogenous variables:
SelfEfficacy
e1
e2
e3
e4
e5
e6
e7
e8
TaskValue
e9
e10
e11
e12
e13
e14
Elaboration
e15
e16
e17
e18
e19
e20
Organization
e21
e22

e23
e24
Rehearsal
e25
e26
e27
e28

Variable counts

Number of variables in your model:	61
Number of observed variables:	28
Number of unobserved variables:	33
Number of exogenous variables:	33
Number of endogenous variables:	28

Parameter Summary

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	33	0	0	0	0	33
Labeled	0	0	0	0	0	0
Unlabeled	23	10	33	0	0	66
Total	56	10	33	0	0	99

Notes for Model

Number of distinct sample moments:	406
Number of distinct parameters to be estimated:	66
Degrees of freedom (406 - 66):	340

Result

Minimum was achieved
Chi-square = 1618.4
Degrees of freedom = 340
Probability level = ,000
Maximum Likelihood Estimates

Regression Weights

			Estimate	S.E.	C.R.	PLabel
selfefficacy1	<---	SelfEfficacy	1,000			
selfefficacy2	<---	SelfEfficacy	1,011	,036	28,474	***
selfefficacy3	<---	SelfEfficacy	,997	,035	28,577	***
selfefficacy4	<---	SelfEfficacy	1,115	,037	30,173	***
selfefficacy5	<---	SelfEfficacy	1,130	,035	32,384	***
selfefficacy6	<---	SelfEfficacy	1,099	,038	28,966	***
selfefficacy7	<---	SelfEfficacy	1,130	,035	31,954	***
selfefficacy8	<---	SelfEfficacy	1,116	,033	33,706	***
taskvalue1	<---	TV	1,000			
taskvalue2	<---	TV	,941	,035	26,985	***
taskvalue3	<---	TV	,818	,037	21,823	***
taskvalue4	<---	TV	,994	,033	29,956	***
taskvalue5	<---	TV	1,034	,035	29,922	***
taskvalue6	<---	TV	1,012	,034	29,899	***
elaboration1	<---	Elaboration	1,000			
elaboration2	<---	Elaboration	,803	,043	18,752	***
elaboration3	<---	Elaboration	,982	,044	22,480	***
elaboration4	<---	Elaboration	1,098	,047	23,595	***
elaboration5	<---	Elaboration	,940	,046	20,376	***
elaboration6	<---	Elaboration	,937	,045	20,613	***

organization1	<---	Organization	1,000			
organization2	<---	Organization	1,041	,043	24,153	***
organization3	<---	Organization	,937	,047	19,978	***
organization4	<---	Organization	1,022	,044	23,278	***
rehearsal1	<---	Rehearsal	1,000			
rehearsal2	<---	Rehearsal	1,179	,056	21,079	***
rehearsal3	<---	Rehearsal	1,255	,057	21,898	***
rehearsal4	<---	Rehearsal	1,126	,056	20,066	***

Standardized Regression Weights

			Estimate
selfefficacy1	<---	SelfEfficacy	,800
selfefficacy2	<---	SelfEfficacy	,782
selfefficacy3	<---	SelfEfficacy	,784
selfefficacy4	<---	SelfEfficacy	,815
selfefficacy5	<---	SelfEfficacy	,857
selfefficacy6	<---	SelfEfficacy	,792
selfefficacy7	<---	SelfEfficacy	,849
selfefficacy8	<---	SelfEfficacy	,881
taskvalue1	<---	TV	,799
taskvalue2	<---	TV	,765
taskvalue3	<---	TV	,645
taskvalue4	<---	TV	,828
taskvalue5	<---	TV	,827
taskvalue6	<---	TV	,827
elaboration1	<---	Elaboration	,679
elaboration2	<---	Elaboration	,644

elaboration3	<---	Elaboration	,791
elaboration4	<---	Elaboration	,840
elaboration5	<---	Elaboration	,706
elaboration6	<---	Elaboration	,716
organization1	<---	Organization	,746
organization2	<---	Organization	,796
organization3	<---	Organization	,657
organization4	<---	Organization	,765
rehearsal1	<---	Rehearsal	,676
rehearsal2	<---	Rehearsal	,776
rehearsal3	<---	Rehearsal	,822
rehearsal4	<---	Rehearsal	,729

Covariances

			Estimate	S.E.	C.R.	PLabel
SelfEfficacy	<-->	TV	1,360	,086	15,906	***
SelfEfficacy	<-->	Elaboration	,952	,075	12,619	***
SelfEfficacy	<-->	Organization	,864	,071	12,238	***
SelfEfficacy	<-->	Rehearsal	,570	,059	9,612	***
TV	<-->	Elaboration	1,211	,091	13,262	***
TV	<-->	Organization	1,035	,083	12,464	***
TV	<-->	Rehearsal	,626	,068	9,181	***
Elaboration	<-->	Organization	1,155	,089	12,969	***
Elaboration	<-->	Rehearsal	,634	,068	9,335	***
Organization	<-->	Rehearsal	,974	,078	12,505	***

Correlations

			Estimate
SelfEfficacy	<-->	TV	,757
SelfEfficacy	<-->	Elaboration	,563
SelfEfficacy	<-->	Organization	,524
SelfEfficacy	<-->	Rehearsal	,385
TV	<-->	Elaboration	,626
TV	<-->	Organization	,547
TV	<-->	Rehearsal	,369
Elaboration	<-->	Organization	,650
Elaboration	<-->	Rehearsal	,398
Organization	<-->	Rehearsal	,626

Variances

	Estimate	S.E.	C.R.	PLabel
SelfEfficacy	1,569	,102	15,359	***
TV	2,059	,136	15,143	***
Elaboration	1,818	,153	11,893	***
Organization	1,736	,131	13,227	***
Rehearsal	1,395	,121	11,542	***
e1	,880	,043	20,553	***
e2	1,022	,049	20,816	***
e3	,979	,047	20,789	***
e4	,982	,048	20,306	***
e5	,723	,037	19,334	***

e6	1,130	,055	20,684	***
e7	,774	,040	19,560	***
e8	,563	,030	18,469	***
e9	1,165	,060	19,326	***
e10	1,292	,065	20,023	***
e11	1,937	,091	21,375	***
e12	,933	,050	18,520	***
e13	1,016	,055	18,543	***
e14	,976	,053	18,559	***
e15	2,122	,104	20,456	***
e16	1,652	,079	20,853	***
e17	1,049	,058	18,240	***
e18	,918	,056	16,312	***
e19	1,614	,080	20,080	***
e20	1,520	,076	19,934	***
e21	1,383	,076	18,145	***
e22	1,085	,066	16,366	***
e23	2,014	,101	19,998	***
e24	1,284	,073	17,562	***
e25	1,657	,085	19,513	***
e26	1,279	,076	16,792	***
e27	1,051	,072	14,596	***
e28	1,559	,085	18,348	***

Squared Multiple Correlations

	Estimate
rehearsal4	,531
rehearsal3	,676
rehearsal2	,603
rehearsal1	,457
organization4	,585
organization3	,431
organization2	,634
organization1	,557
elaboration6	,512
elaboration5	,499
elaboration4	,705
elaboration3	,626
elaboration2	,415
elaboration1	,461
taskvalue6	,684
taskvalue5	,684
taskvalue4	,685
taskvalue3	,416
taskvalue2	,585
taskvalue1	,639
selfefficacy8	,776
selfefficacy7	,721

selfefficacy6	,627
selfefficacy5	,735
selfefficacy4	,665
selfefficacy3	,614
selfefficacy2	,611
selfefficacy1	,641

Minimization History

Iteration	Negative eigenvalues	Condition #	Smallest eigenvalue	Diameter	F	NTries	Ratio
0e	14		-1,380	9999,000	19092,451	0	9999,000
1e	15		-,151	4,956	9876,176	20	,182
2e*	4		-,105	1,769	6018,301	5	,661
3e*	1		-,055	1,561	3434,382	5	,763
4e	0	2052,171		,664	2378,083	5	1,040
5e	0	252,261		1,268	2209,738	2	,000
6e	0	230,863		,393	2000,419	1	1,190
7e	0	257,590		,237	1962,998	1	1,162
8e	0	253,046		,090	1959,091	1	1,094
9e	0	242,774		,018	1958,986	1	1,025
10e	0	250,579		,001	1958,986	1	1,001

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	66	1618.434	0,000		4,762
Saturated model	406	,000	0		
Independence model	28	19680,230	378,000		52,064

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,133	,877	,854	,735
Saturated model	,000	1,000		
Independence model	1,182	,181	,120	,168

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,900	,889	,916	,907	,916
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	,899	,810	,824
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Default model	1618,986	1483,529	1761,902
Saturated model	,000	,000	,000
Independence model	19302,230	18846,116	19764,662

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1,895	1,566	1,435	1,704
Saturated model	,000	,000	,000	,000
Independence model	19,033	18,668	18,226	19,115

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,068	,065	,071	,000
Independence model	,222	,220	,225	,000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	2090,986	2094,795	2417,168	2483,168
Saturated model	812,000	835,431	2818,516	3224,516
Independence model	19736,230	19737,846	19874,610	19902,610

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	2,022	1,891	2,160	2,026
Saturated model	,785	,785	,785	,808
Independence model	19,087	18,646	19,534	19,089

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	203	214
Independence model	23	24

Execution time summary

Minimization:	,029
Miscellaneous:	2,535
Bootstrap:	,000
Total:	2,564

APPENDIX E

ITEMAN STATISTICS

		Item Statistics				Alternative Statistics			
Seq.No.	Scale-Item	Prop. Correct	Biser.	Point Biser.	Alt.	Prop. Endorsing	Biser.	Point Biser.	Key
1	1-1	0,718	0,857	0,643	A	0,018	-0,718	-0,241	
					B	0,718	0,857	0,643	*
					C	0,153	-0,746	-0,490	
					D	0,098	-0,416	-0,242	
					E	0,012	-0,275	-0,080	
					Other	0,000	-9,000	-9,000	
2	1-2	0,798	0,789	0,554	A	0,055	-0,707	-0,345	
					B	0,798	0,789	0,554	*
					C	0,061	-0,604	-0,305	
					D	0,018	-0,515	-0,173	
					E	0,067	-0,362	-0,189	
					Other	0,000	-9,000	-9,000	
3	1-3	0,779	0,779	0,557	A	0,031	-0,382	-0,154	
					B	0,037	-0,509	-0,218	
					C	0,779	0,779	0,557	*
					D	0,092	-0,493	-0,281	
					E	0,061	-0,679	-0,343	
					Other	0,000	-9,000	-9,000	
4	1-4	0,767	0,436	0,316	A	0,049	-0,345	-0,162	
					B	0,135	-0,343	-0,218	
					C	0,037	-0,304	-0,130	
					D	0,767	0,436	0,316	*
					E	0,012	0,013	0,004	
					Other	0,000	-9,000	-9,000	
5	1-5	0,742	0,252	0,186	A	0,202	-0,243	-0,170	
					B	0,025	-0,145	-0,054	
					C	0,742	0,252	0,186	*
					D	0,031	-0,065	-0,026	
					E	0,000	-9,000	-9,000	
					Other	0,000	-9,000	-9,000	
6	1-6	0,669	0,521	0,401	A	0,006	0,012	0,003	
					B	0,147	-0,457	-0,297	
					C	0,166	-0,258	-0,173	
					D	0,012	-0,621	-0,180	
					E	0,669	0,521	0,401	*

					Other	0,000	-9,000	-9,000	
7	1-7	0,644	0,475	0,370	A	0,644	0,475	0,370	*
					B	0,141	-0,225	-0,145	
					C	0,049	-0,219	-0,103	
					D	0,080	-0,230	-0,126	
					E	0,086	-0,450	-0,252	
					Other	0,000	-9,000	-9,000	
8	1-8	0,798	0,627	0,440	A	0,006	-0,940	-0,209	
					B	0,012	-0,333	-0,096	
					C	0,147	-0,417	-0,271	
					D	0,798	0,627	0,440	*
					E	0,037	-0,668	-0,286	
					Other	0,000	-9,000	-9,000	
9	1-9	0,828	0,438	0,296	A	0,006	-1,000	-0,232	
					B	0,018	-0,230	-0,077	
					C	0,025	-0,528	-0,196	
					D	0,828	0,438	0,296	*
					E	0,123	-0,260	-0,161	
					Other	0,000	-9,000	-9,000	
10	1-10	0,810	0,355	0,246	A	0,000	-9,000	-9,000	
					B	0,074	-0,206	-0,110	
					C	0,810	0,355	0,246	*
					D	0,025	-0,623	-0,232	
					E	0,092	-0,193	-0,110	
					Other	0,000	-9,000	-9,000	
11	1-11	0,656	0,423	0,328	A	0,656	0,423	0,328	*
					B	0,012	0,013	0,004	
					C	0,031	-0,303	-0,122	
					D	0,080	-0,378	-0,207	
					E	0,221	-0,266	-0,190	
					Other	0,000	-9,000	-9,000	
12	1-12	0,724	0,455	0,341	A	0,153	-0,149	-0,098	
					B	0,724	0,455	0,341	*
					C	0,025	-0,177	-0,066	
					D	0,055	-0,427	-0,209	
					E	0,043	-0,647	-0,292	
					Other	0,000	-9,000	-9,000	
13	1-13	0,828	0,518	0,350	A	0,828	0,518	0,350	*
					B	0,031	-0,329	-0,132	
					C	0,031	-0,171	-0,069	
					D	0,055	-0,608	-0,297	
					E	0,055	-0,263	-0,129	
					Other	0,000	-9,000	-9,000	
14	1-14	0,669	0,354	0,273	A	0,025	-0,400	-0,149	
					B	0,209	-0,117	-0,082	

					C	0,006	-0,411	-0,091	
					D	0,669	0,354	0,273	*
					E	0,092	-0,393	-0,224	
					Other	0,000	-9,000	-9,000	
15	1-15	0,730	0,561	0,418	A	0,025	-0,464	-0,173	
					B	0,092	-0,548	-0,313	
					C	0,730	0,561	0,418	*
					D	0,025	0,205	0,076	
					E	0,129	-0,381	-0,239	
					Other	0,000	-9,000	-9,000	
16	1-16	0,798	0,562	0,394	A	0,006	-0,306	-0,068	
					B	0,798	0,562	0,394	*
					C	0,006	-1,000	-0,232	
					D	0,098	-0,299	-0,174	
					E	0,092	-0,504	-0,288	
					Other	0,000	-9,000	-9,000	
17	1-17	0,742	0,581	0,429	A	0,049	-0,525	-0,247	
					B	0,117	-0,186	-0,114	
					C	0,742	0,581	0,429	*
					D	0,018	-0,515	-0,173	
					E	0,074	-0,535	-0,286	
					Other	0,000	-9,000	-9,000	
18	1-18	0,816	0,577	0,396	A	0,025	-0,687	-0,256	
					B	0,110	-0,292	-0,176	
					C	0,018	-0,921	-0,309	
					D	0,031	-0,250	-0,100	
					E	0,816	0,577	0,396	*
					Other	0,000	-9,000	-9,000	
19	1-19	0,810	0,544	0,377	A	0,012	-0,448	-0,130	
					B	0,810	0,544	0,377	*
					C	0,025	-0,145	-0,054	
					D	0,074	-0,548	-0,293	
					E	0,080	-0,328	-0,180	
					Other	0,000	-9,000	-9,000	
20	1-20	0,564	0,597	0,474	A	0,043	-0,165	-0,074	
					B	0,288	-0,547	-0,412	
					C	0,074	-0,075	-0,040	
					D	0,564	0,597	0,474	*
					E	0,031	-0,329	-0,132	
					Other	0,000	-9,000	-9,000	