INVESTIGATING THE RELATIONSHIP BETWEEN CHEMISTRY ACHIEVEMENT AND SELF-REGULATORY LEARNING STRATEGIES AMONG HIGH SCHOOL STUDENTS

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

BY

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

JUNE 2022

Approval of the thesis:

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ABSTRACT

INVESTIGATING THE RELATIONSHIP BETWEEN CHEMISTRY ACHIEVEMENT AND SELF-REGULATORY LEARNING STRATEGIES AMONG HIGH SCHOOL STUDENTS

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June 2022, 108 pages

The purpose of this study is to investigate the relationship between chemistry achievement and self-regulatory learning strategies which are classified as motivational beliefs (intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, self-efficacy, and test anxiety) and learning strategies use (rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, regulation of effort, time and study environment, help-seeking and peer learning) among high school students.

In the study, Motivated Strategies for Learning Questionnaire, which is developed by Pintrich, Smith, Garcia, and McKeachie (1991,) and a Chemistry Achievement Test were used as instruments. The study was conducted in Ankara with 16 twelfth-grade high school students enrolled in mathematics and science groups in the spring 2021-2022 semester.

Collected data were analyzed by multiple regression analysis. Results of the statistical analysis revealed that task value had a significant relation with chemistry achievement ($p < .05$) while intrinsic goal orientation, extrinsic goal orientation, control of learning, and self-efficacy did not have significance ($p > .05$). Rehearsal strategy use, time and study environment, and chemistry achievement had significant

relation ($p < .05$). On the other hand, elaboration, organization, metacognitive self-regulation, help-seeking, and peer learning did not have a significant relationship with chemistry achievement.

Keywords: Chemistry Achievement, Self-Regulation, Self-Regulatory Learning Strategies, Motivational Beliefs.

ÖZ

LİSE ÖĞRENCİLERİNİN KİMYA BAŞARISI İLE ÖZDÜZENLEME STRATEJİLERİ ARASINDAKİ İLİŞKİNİN İNCELENMESİ

Urlu, Hülya Gizem
Yüksek Lisans, Fen Bilimleri Eğitimi, Matematik ve Fen Bilimleri Eğitimi
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Haziran 2022, 108 sayfa

Bu çalışmanın amacı lise öğrencileri arasında motivasyonel inançlar (içsel hedef yönelimi, dışsal hedef yönelimi, görev değeri, öğrenmenin kontrolü, öz-yeterlik ve sınav kaygısı) ve öğrenme stratejileri (anlatım, detaylandırma, organizasyon, eleştirel düşünme, üstbilişsel öz-düzenleme, çabanın düzenlenmesi, zaman ve çalışma ortamı, yardım arama ve akran öğrenmesi) olarak sınıflandırılan öz-düzenleyici öğrenme stratejileri ile kimya başarısı arasındaki ilişkiyi incelemektir.

Araştırmada ölçüm aracı olarak Pintrich, Smith, Garcia ve McKeachie tarafından geliştirilen Öğrenmede Güdüsel Stratejiler Anketi ve Kimya Başarı Testi kullanılmıştır. Araştırma, 2021 – 2022 bahar döneminde Ankara'da matematik ve fen bilimleri alanına kayıtlı 161, on ikinci sınıf lise son öğrencisi ile gerçekleştirilmiştir.

Toplanan veriler çoklu regresyon analizi ile analiz edilmiştir. Istatistiksel analizin sonuçları, görev değerinin kimya başarısı ile anlamlı bir ilişkisi olduğunu ($p < .05$) ortaya çıkarırken, içsel hedef yönelimi, dışsal hedef yönelimi, öğrenmenin kontrolü, öz-yeterlik ve sınav kaygısı ile kimya başarısı arasında bir ilişki bulunamamıştır. Ayrıca, Anlama stratejisi, zaman ve çalışma ortamı ile kimya

başarısı arasında anlamlı bir ilişki bulunurken, detaylandırma, organizasyon, eleştirel düşünme, üstbilişsel öz-düzenleme, çabanın düzenlenmesi, yardım arama ve akran öğrenmesinin kimya başarısı ile anlamlı bir ilişkisi bulunamamıştır.

Anahtar Kelimeler: Kimya Başarısı, Öz-düzenleme, Öz-düzenleyici Öğrenme Stratejileri, Motivasyonel İnançlar

To My Beloved Mom

(b. 1965 - d. 2021)

ACKNOWLEDGMENTS

To begin, I would want to express my gratitude to my advisor, Prof. Dr. Yezdan Boz. I am very glad to work with you, and I learned a lot from you. Thank you for your motivation, and support in this process.

I also thank my committee members, Prof. Dr. Jale Çakıroğlu, and Assoc. Dr. Ayla Çetin Dindar, for your positive attitude, constructive feedback, and comments.

Mom, you always wanted to see me as an academic, I am on my way and I would not be able to make it without your love, rest in peace.

My biggest appreciation is to my best friend, Cansu Yıldız. My academic journey started with your support. You are a very kind, humble, dedicated, and best co-worker ever. I cannot accomplish without you. We are going to be together in the academy.

Last but not least, my sisters, Şule İrem Urlu and Elif Deniz Urlu, and my dad, Murat Temraz Urlu are always patient and supportive in my writing process. My love and hugs to you.

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ABBREVIATIONS

MSLQ:	Motivated Strategies for Learning Questionnaire
CAT:	Chemistry Achievement Test
SRL:	Self-regulatory Learning
SCT:	Social Cognitive Theory
MCQ:	Multiple Choice Questions
SPE:	Standarized Patient Examination
EFL:	English as a Foreign Language
H_0:	Null Hypothesis
SD:	Standard Deviation
DV:	Dependent Variable
IV:	Independent Variable
df:	Degree of Freedom
VIF:	Variation Inflation Factor
p:	Significance Level
β:	Beta coefficient
GPA:	Grade Point Average
IGO:	Intrinsic Goal Orientation
EGO:	Extrinsic Goal Orientation
TV:	Task Value

CL:	Control of Learning
SELP:	Self-efficacy for Learning and Performance
TA:	Test Anxiety
R:	Rehearsal
E:	Elaboration
O:	Organization
CT:	Critical Thinking
MSR:	Metacognitive Self-regulation
TSE:	Time and Study Environment
RE:	Regulation of Effort
PL:	Peer Learning
HS:	Help Seeking
ACHIE:	Achievement
N:	Sample Size

CHAPTER 1

INTRODUCTION

The age of information and technology is characterized by rapid technological advancements and the impact of chemistry as a field of science on every part of our life. Chemistry education has great importance for the future of society. Due to this importance, primarily developed countries, and all communities, are trying to improve quality of the chemistry education and increasing the number of scientifically literate people (Saf, 2011). Chemistry has many daily life examples and relations with other science disciplines and concepts of chemistry are familiar to the students therefore, chemistry can be classified as a significant science. Chemistry courses have aims to teach the fundamental concepts which play an important role in students' further education in chemistry or other sciences like physics or biology in high schools. The other purpose of chemistry in high schools is to create a positive attitude toward chemistry. However, to understand the real meaning of education and science, students need to digest the meaning of chemistry, and what is going on in the real-life from the perspective of the chemistry since chemistry includes the food industry, pharmacy, automotive, environment, recycling or home (MEB, 2018).

Moreover, education is defined as a process of changing behavior based on an individual's own life and experiences (Erturk, 1972). The behavior-changing occurs in knowledge, skills, attitudes, and value acquired in the process of education. Education is evolving in response to changing global conditions. Therefore, continuously developed teaching programs, the creation of a new learning environment, and the selection of proper methods for effective learning are as remarkable as the determination of students' interests, attitudes, and needs. For this purpose, student-centered educational programs have been applied.

One of the student-centered frameworks is the constructivist approach. As a consequence of the research conducted with the understanding of developing programs based on the framework in the Turkish educational system, it was decided to gradually renew the programs based on constructivism implemented at the primary and later secondary levels. Starting from 9th grade, the chemistry curriculum has been changed in 2008. Students' interests in science and scientific activities, having scientific thinking ability, applying scientific methods in the solution of problems in daily life, gaining critical thinking ability, taking responsibilities in activities, being disposed to research, and gaining the habit of research and how to use it, making the relationship between chemistry and daily life situations are fundamental purposes of the new curriculum (Susam, 2006).

Besides effective curriculum, the qualification of students is closely related to meaningful and effective learning. In today's societies, where the access to information and the production of information has become the focus of education, the perspective of the individual, teacher, learning, and information is gradually changing since scientific and technological improvements have made learning not only a phenomenon that takes places at school but also a dynamic process that covers all of life. As a result, the notion that learning is a continual and dynamic phenomenon has altered an individual's responsibility and role in the learning process. An individual who has to keep up with the passage of time and change has primary responsibility for their learning process and plans, organizes, and analyses it with the obligation (Yamac, 2011).

The fact that an individual acquires an active and responsible role in the learning process and the phenomenon of learning and the birth of individual-centered learning theories ad approaches. Gardner (1963) stated that the ultimate goal of education should make the individual responsible for his/ her education. In this aspect, self-regulatory learning which is one of the approaches that emphasizes the influence and importance of the individual in learning is gradually increasing and influenced in the educational literature.

Self-regulatory skills are important not only for guidance in school learning but also for continuing learning after school. Since one of the main ideas of education is maintaining long-term learning skills, individuals should learn basic skills informally after their graduation (Boakerts, 1997). In this way, it will be easier for individuals to adapt to the innovations and changes brought by social, cultural, and economic developments and to keep up with the era.

Self-regulation contains not only situational factors but also, cognitive, metacognitive, behavioral, and motivational factors, too. Although it is considered a different concept in the literature, self-regulation can be defined as an effective and constructive process in which learners set goals, monitor their learning, and control motivation and cognition in their learning (Pintrich, 2000; Schunk, 2005; Zimmerman, 1986). Moreover, according to Zimmerman (1998), self-regulation is not a mental ability such as competence or reading. Rather, self-regulatory learning is a process of self-management in which students transform their mental abilities into academic skills. In this process, learners who have self-regulation use cognitive, metacognitive, and behavioral strategies. In addition, motivational factors are important for learners in this process (Kuo, 2010). Cognitive strategies make the process of processing information effective and systematic based on the individual's unique qualities. On the other hand, Pintrich (2004) stated that metacognitive strategies represent activities helping students plan, monitor, and organize their learning. These strategies help learners to know, control, and follow cognitive strategies while performing these strategies. The other dimension is behavioral strategies. It is defined as the effort of learners to control their behavior.

As a different factor, motivational beliefs are seen in self-regulation. Motivational variables interact with situational, behavioral, and cognitive factors, influencing self-regulation. Motivation has a direct effect on the cognitive process. Motivation leads to the use of strategies such as goal orientation, self-efficacy, elaboration, and effort management which are the sub-dimension of self-regulation (Pintrich & DeGroot, 1990). In this way, motivational beliefs are related to self-regulated learning strategies.

Literature supported that application of self-regulation into education helps to explain achievement differences among learners (Schunk, 2005). After, accomplishing a task, learners may have an emotional reflection on the consequences. In other words, they can be found by reflecting on the reasons for the results. The types of uploads that students make for their success or failure can lead to more complex experiences of emotions such as guilt, shame, resentment, and pride. Students reflect on the reasons for their performance in what they do, both the nature of the loading and the nature of the emotions experienced are important results of the process of self-regulation (Weiner, 1986). In this direction, it is thought that the attitudes of the students towards the lesson or the task will also be affected at the end of the self-regulation process. It is expected that the effective and systematic use of self-regulatory learning strategies by students will positively affect achievement, attitudes, and feelings toward academic tasks or courses in students.

Both chemistry and self-regulatory learning strategies are important concepts in the educational research area, therefore these concepts should be investigated on every side of the world to generalize the findings. This study investigates the relationship between self-regulatory learning strategies and chemistry achievement among Turkish high school students.

1.1 Definition of Terms

Achievement: Students' performance in general chemistry topic is pointer of achievement in the study (Academic Key Performance Indicators, 2018). Achievement is measured by Chemistry Achievement Test (CAT) developed by researcher.

Self-Regulation: Interaction of personal, behavioral and environmental triadic simultaneously in a cyclic process is a short definition of self-regulation. (Zimmerman, 2000). These triadic stages have three different dimensions which are forethought, performance or volitional control and self-reflection. Definitions and measurement ways of these terms will be defined in below.

Self-Regulatory Learning Strategies: According to Zimmerman (1986), SRL is defined as actions to reach knowledge by self- perception. Moreover, Schraw et al. (2006) explained self-regulatory learning as ability to control environment and understand it. Cognitive, metacognitive and motivational beliefs. Learning strategies may be measured by Motivated Strategies for Learning Questionnaire (MSLQ).

Forethought Phase: It is the first process of Zimmerman's cyclic phases and be categorized by two; task analysis and motivational beliefs. Basically, task analysis includes goal setting and strategic planning. Motivational beliefs can be called as self-motivatio and it is beliefs about learning, such as self-efficacy, outcome expectations. (Bandura, 1997)

Goal orientation: It is the main part of task analysis. Anderman and Maehr (1994) stated that goal orientation explains how and why learners attempt to achieve various objectives.

Motivation: Pintrich (2002) explained motivation as a process rather than a certain product that cannot be directly observable but understandable from learners' behavior.

Performance or Volitional Control Phase: This phase which is the second part of cyclic process are about motoric efforts which are control and observation (Zimmerman, 2000). Mainly, self-control is classification of specific strategies such as attention focusing, instruction which were selected in forethought phase (Zimmerman, 2002). Moreover, observation means that recording of event or experimentation to detect the cause of the events (Zimmerman, 2002).

Self-Reflection Phase: In self-reflection part which is the last process, learners' self-evaluation, satisfaction are important (Zimmerman, 2000). Evaluation (self-judgement) includes causal attribution. On the other hand, satisfaction is generally about self-reaction. Adaptive or defensive responses is also a form of self-reaction.

1.2 Statement of the Problem

This study focuses on the following questions;

- What is the predictive relationship between motivational beliefs and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between using learning strategies and chemistry achivement among 12th grade Turkish high school students?

1.2.1 The Null Hypothesis

$H_0$1: There is no significant relationship between motivational beliefs and chemistry achievement among 12th grade Turkish high school students.

$H_0$2: There is no significant relationship between learning strategies and chemistry achievement among 12th grade Turkish high school students.

1.2.2 Statement of Sub-Problem

- What is the predictive relationship between intrinsic goal orientation and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between extrinsic goal orientation and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between task value and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between control of learning beliefs and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between self-efficacy learning and performance and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between test anxiety and chemistry achievement among 12th grade Turkish high school students?

- What is the predictive relationship between help seeking strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between peer learning strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between regulation of effort strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between time and study environment and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between metacognitive self-regulation and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between rehearsal strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between elaboration strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between organization strategy and chemistry achievement among 12th grade Turkish high school students?
- What is the predictive relationship between critical thinking strategy and chemistry achievement among 12th grade Turkish high school students?

1.2.3 Sub-hypothesis

$H_0$1.1: There is no significant relationship between intrinsic goal orientation and chemistry achievement among 12th grade Turkish high school students.

$H_0$1.2: There is no significant relationship between extrinsic goal orientation and chemistry achievement among 12th grade Turkish high school students.

$H_0$1.3: There is no significant relationship between task value and chemistry achievement among 12th grade Turkish high school students.

$H_0$1.4: There is no significant relationship between control of learning beliefs and chemistry achievement among 12th grade Turkish high school students.

$H_0$1.5: There is no significant relationship between self-efficacy learning and performance and chemistry achievement among 12th grade Turkish high school students.

$H_0$1.6: There is no significant relationship between test anxiety and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.1: There is no significant relationship between help seeking and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.2: There is no significant relationship between peer learning strategy and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.3: There is no significant relationship between regulation of effort strategy and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.4: There is no significant relationship between time and study environment and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.5: There is no significant relationship between metacognitive self-regulation and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.6: There is no significant relationship between rehearsal strategy and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.7: There is no significant relationship between elaboration and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.8: There is no significant relationship between organization and chemistry achievement among 12th grade Turkish high school students.

$H_0$2.9: There is no significant relationship between critical thinking strategy and chemistry achievement among 12th grade Turkish high school students.

1.3 Significance of the Study

In the literature, there are several studies about defining the relationship between self-regulation and achievement. In studies of self-regulatory learning strategies and motivational beliefs of different educational levels and tried to find out the relationship between achievement in different courses, and self-regulatory skills such as writing an essay, it was determined that the developed learning strategies (Kitsansas, Sten & Huie, 2009; Garavalia & Gredler, 2002; Glaser & Brunstein, 2007; Haslaman, 2005; Canca, 2005; Ruban & Reis; 2006). Canca (2005) stated that there is no significant relationship between achievement and cognitive learning strategies and metacognitive strategies, separately. However, when strategies were combined, a significant relation was found in mathematics class at university. Haslaman (2005) examined the prediction of academic achievement with self-regulation skills in a programming course at the undergraduate level. The findings of the study stated that the higher rehearsal, the lesser achievement. Moreover, task value, extrinsic goal orientation, setting goals, rehearsal, self-reflection, self-efficacy, peer learning, and time management which are self-regulation skills predicted achievement in 71%. On the other hand, Yumusak at his colleagues (2007) stated that some of the self-regulatory learning strategies are related to achievement and some of them are not in the biology course. Kitsansan et al. (2009) conducted a study on primary school fifth-grade students and it was revealed that cognitive and metacognitive self-regulatory strategies significantly predict the achievement in social studies, science, mathematics, and language skill courses. In addition, Duncan and McKeachie (2005) mentioned that the motivation of students may vary in different courses, and learners may use different strategies with respect to the nature of the task. In other words, the self-regulation abilities that predict achievement may differ depending on the structural and functional aspects of the lessons as well as the mental, physical, and affective development characteristics of the students.

To sum up, self-regulation and self-regulated learning concepts were studied American students in a very detailed way. Fewer research was found on self-regulation and its implications for both theoretical and practical ways. (Kadioglu, 2014)**.** Furthermore, the usage of self-regulatory skills of students may differ in different courses (Duncan & McKeachie, 2005). Moreover, some of the findings of the self-regulation process stated that there was a significant relationship between metacognitive processes and achievement (Zimmerman & Martinez-Pons,1986). However, some of the others found that there was no significant relationship (Kitsansas, Steen & Huie, 2009; Puteh and Ibrahim, 2010; Demir & Budak, 2016). Many studies are about generally science but not specifically chemistry. The fundamental aim of the study is to decrease the gap between America and other countries and add the different courses in the literature, study's findings may help to generalize self-regulation and its concepts from Turkey's perspective. In order to fulfill the variety of findings, literature may need recent studies, so this study aims to reduce the gap between these variations. Investigation of self-regulation contribution to achievement among Turkish students would support new classroom material, environment, or suitable curriculum with respect to findings.

CHAPTER 2

LITERATURE REVIEW

Social Cognitive Theory (SCT), self-regulation terms and definitions are mentioned in the present chapter. Moreover, Zimmerman's Self-regulation framework, self-regulated learning, and related studies explained in this chapter.

2.1 Social Cognitive Theory

Over the years, several theories have been offered to explain the complex nature of humanity, developmental changes of people, behavior and regulations (Skinner, 1953; Bandura, 1986). These theories showed that there are two different perspectives which are peripheral and cognitive. Peripheral perspective is about environmental effect on human behavior (Skinner, 1953). On the other hand, cognitive perspective is interested in processes (Deci & Ryan, 1984). Nevertheless, Bandura's (1986) SCT contains both cognitive and behavioral perspectives. Theory mainly supports that outcome of people's intentional cognitive contributions to motivation and beliefs can shape their own talent. As an example, improvement of science, technology, medicine might have positive impact on people's life in economic or social way, resulting in a gaining of motivation, or happiness. Besides of motivation, personal characteristics, Bandura (1989) believed that people are able to organize, reflect and regulate themselves. As a result of his beliefs, SCT favors a model which is called triadic reciprocal determinism. Figure 2.1 shows the reciprocal relationship between personal, behavioral and environmental factors. According to Bandura (1986) self-regulation can be seen as environmental, personal, and behavioral interaction processes with respect to social cognitive theory. Personal process is about metacognition, knowledge and how people setting goals. On the

other hand, behavioral contains self-observation, self-reaction, and judgement while environmental is verbal influence, modeling and outcomes (Yumusak et al., 2006).

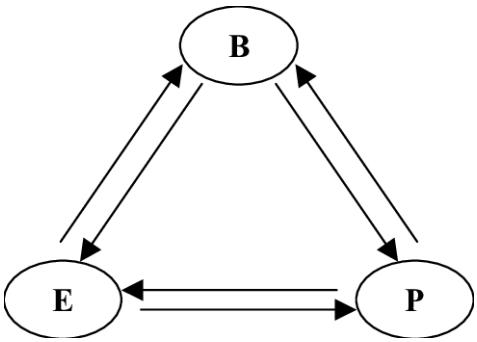

Figure 1 Bandura's Triadic Reciprocal Determinism

From "A social cognitive view of self-regulated academic learning" by Zimmerman pg. 330

Bandura defined three interactions as cyclic perspective. First of all, he explained that the relationship between personal and behavioral causal factors have two-way interaction with thoughts and actions (P↔B). This relationship illustrates how people's beliefs and thoughts influence their behavior, or how a person's beliefs and thoughts are influenced by the results of their acts (Bandura, 1986). As an example of personal – behavioral relationship, those who are verbally persuaded by someone who is important to them may show greater effort to complete the task successfully because they believe in their ability to accomplish the task (Bandura,1989). Learners who have strong self-efficacy beliefs choose difficult activities, employ a variety of cognitive techniques, and persevere in the face of failure (Pintrich, 2003). The P ↔E segment is concerned with expectations are affected by environment. Lerner (1982) stated that depending on the appearance such as age and race, the reaction from the social environment varies from person to person. Moreover, cultural effects, social status also can cause different reactions (Ates, 2021). To illustrate, a child known to be positive about the behavior of his peers has a different different relationship with peers than a child who is known as unassertive (Snyder, 1981). Finally, behavioral, and environmental relationship (B↔E) explains that behaviors are influenced by environment, and behavior also change environment, too (Bandura, 1986). The fact

is explained as our actions are continually changing as our environment changes. (Bandura, 1989). One of the good examples for this relationship is Covid-19 pandemic. In pandemic, staying at home, working online is preffered instead of moving, travelling (Ates, 2021). People required to adjust working settings which had an impact on factors such as motivation, flexibility in hours of workings, hence scheduling regulation (Kaharuddin, 2020).

2.2 Self-Regulation and Self-Regulatory Learning

Self-regulation and self-regulatory learning are not about only detailed knowledge of a matter. It concerns self-awareness, motivation, and behavioral skills to apply properly on the knowledge.

Social cognitive theory suggested that self-regulatory processes, personal, behavioral, environmental, are cyclic phases. Both Zimmerman (2000) and Pintrich (2004) developed self-regulatory frameworks.

Zimmerman's (2000) framework stated that self-regulation occurs in three different phases as forethought, performance (volitional control) and self- reflection in a cyclic manner. Forethought phase covers self- motivational beliefs. Performance phase is about self-observation and control, it means monitoring efforts. Finally, self-reflection phase contains self-reaction and judgement (Zimmerman, 2000).

Pintrich's (2004) framework is also developed based on social cognitive theory and includes four different phases. These are forethought, monitoring, control, and reflection. First phase is about setting goals, activating prior knowledge, managing time and effort. In monitoring phase, in a context or given task, metacognitive awareness plays fundamental role. Control phase concerns about motivation, learning strategies, thinking, and regulating effort in a given task. In final phase, judgements, reactions, decision making are important (Pintrich, 2004).

As a short definition, self-regulation can be explained as an active process by setting goals in learning, then checking the effort and regulating and judging tasks in

learning and environment (Wolters et al. 2003). Based on social cognitive theory and definitions, both Zimmerman and Pintrich frameworks defined that self-regulation is about setting targets.

As mentioned above, both models are based on SCT therefore, they have similarities. In social cognitive theory, learning is an active process, so pupils are active learner who want to know how learning is learned. Both Zimmerman and Pintrich frameworks accept students as active leaners who are setting goals, control themselves. In addition, both studied self-regulatory learning and achievement among students (Puustinen & Pulkinen, 2001).

Since there are two frameworks, like similarities, also differences exist. Pintrich focuses on goal orientation and framework underlines regulations of behavior, motivation, cognition in all phases. Nevertheless, Zimmerman stresses cyclic nature of phases. In this study, Zimmerman's framework is used to investigate self-regulation of students.

2.3 Zimmerman's Self-Regulatory Framework

Self-regulation and self-regulatory learning are cyclic processes and consist of three dimensions, forethought, performance (volitional control) and self-reflection. Figure 2.3 shows the cyclic phases of self-regulation and Table 1 shows subprocesses of self-regulation phases.

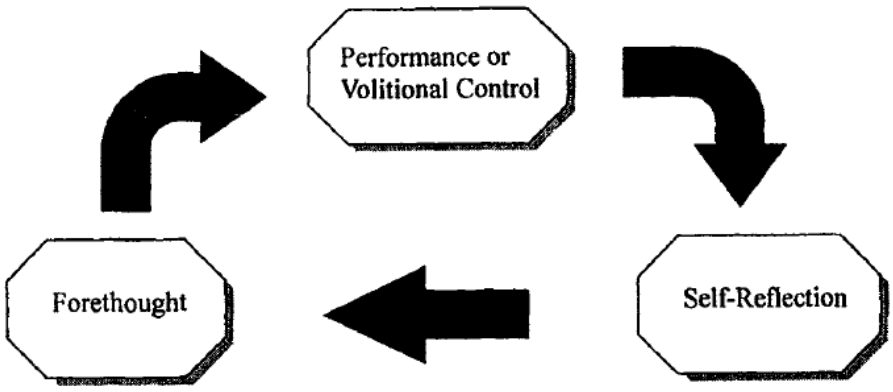

Figure 2 Cyclic Phases of Self-Regulation

From, Self-Regulated Learning: From Teching to Self-reflective Practice, Zimmerman & Schunk, 1998, p.3

Table 1 Subprocess of Self-Regulation

From, Attaining Self-regulation: a social cognitive perspective, Zimmerman, p.16

Cyclic Self-Regulatory Phases		
Forethought	Performance/ Volitional Control	Self-reflection
Task Analysis	Self-Control	Self-Judgement
Goal Setting *Strategic Planning*	*Self-instruction* *Imagery* *Attention Focusing* *Task Strategies*	*Self-evaluation* *Causal attribution*
Self-Motivation Beliefs	Self-Observation	Self-Reaction
Self-efficacy *Outcome expectations* *Intrinsic value* *Goal orientation*	*Self-recording* *Self-experimentation*	*Self-satisfaction/affect* *Adaptive-defensive*

Influential processes that precede and set the stage for action are referred to as forethought. Process that occurs during motoric attempts and effecting attention and action are called as performance or volitional control. Finally, processes that occur following performance efforts and impact some's response to that event are referred to as self-reflection.

2.3.1 Forethought Phase

Forethought is the first phase in which students examine the assiginment, analyze it, assess their ability to perform it successfully, and set goals and plans on how to complete it. This phase includes two different parts that task analysis and self-motivation beliefs. One of the main features of task analysis is *goal setting*. Goal setting is the process of deciding on certain learning or performance outcomes (Locke & Latham, 1990). According to Bandura and Schunk (1981) students acquired improved self-efficacy and intrinsic interest in mathematics after pursuing and achieving proximal goals. Other one is the *strategic planning*. Learners require strategies which are suitable for task and goal. The selected suitable strategies facilitate cognition, directing motoric execution, and controlling effect all of which improve performance (Pressley & Woloshyn, 1995). Both setting goals and strategy selection need a cyclic adjustment due to fluctuation of personal, behavioral, and environmental features.

Second part is self-motivation beliefs which are self-efficacy, expectations, intrinsic value, and goal orientation. In short, personal ideas about one's ability to learn or perform effectively are referred to as *self-efficacy*. Moreover, the conviction in the ultimate goals of performance is referred to as result *expectations* (Bandura, 1997). Since self-efficacy beliefs influence the setting goals, as a final, leaners need to see outcome success and they develop an *intrinsic value* to see that outcome (Deci, 1975; Lepper & Hodell, 1989). As a result of developing intrinsic value, learners more tend to become *goal orientated*. Detailed and structured explanation of forethought phase is shown in the Figure 3 (Panadero &Alonso-Tapia, 2014).

Task Analysis

Self-regulatory cycle begins with a task analysis where is broken up into smaller parts and individual performance strategies are chosen based on prior knowledge or/and experience (Winne, 2001; Zimmerman & Moylan, 2009). Goals

and strategic planning which are necessary for self-regulation to occur are formed during this phase.

Winne and Hadwin (1998) stated that learners appraise two important variables when setting up their goals: performance level and assessment criteria. The assessment criterias are the benchmarks against which the performance is going to be measured (e.g., a summary should include the key opinion from the text being summarized as one of its criteria). The issue arises when students are unaware of these criteria; this occurs frequently since teachers do not always specify plainly how projects will be graded. Students have more difficulty setting acceptable goals when this occurs.

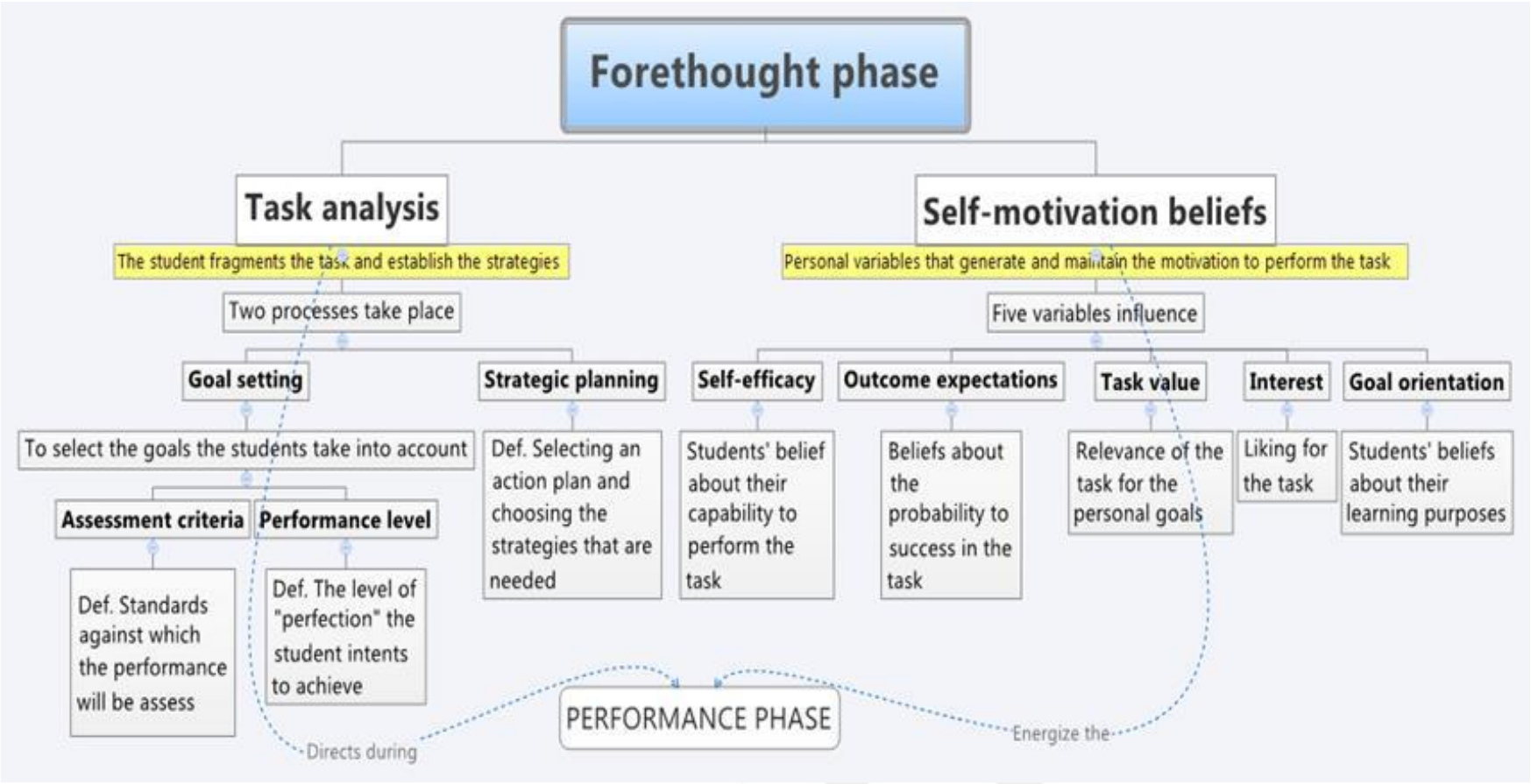

Figure 3 Forethought Phase

Moreover, research found a positive effect on learning when assessment criteria are stated explicitly (Andrade & Valtcheva, 2009; Panadero & Jonsson, 2013).

The other factor that affects goal setting is learners' level of performance which interrelates with the assessment criteria (Pintrich & DeGroot, 1990). In order to make more meaningful, Panadero and Alonso-Tapia (2014) gave a clear example for level of performance and assessment criteria. A student understands that in order to receive high level of performance on a specific task, s/he must put up a significant amount of effort. Nevertheless, the students are uninterested in the assignment, and achieveing a high grade is not a target. Even if the teacher conveys the evaluation criteria, the learner does not place a high enugh value on the activity to put up the effort required to achieve a good grade, so s/he will perform averagely.

Planning is important for self-regulation and reliable predictor of achievement (Zimmermann, 2008). Moreover, it is also one of the key differenes between masters and beginners with the latter, consuming time for planning which has found to be critical for achievement (Zimmerman & Kitsantas, 2005; Ericsson, Charness, Feltovich, & Hoffman, 2006).

Self-Motivation Beliefs

Self-motivation beliefs can be expressed as beliefs, values, goals and interest which are individual variables that produce and preserve the motivation to perform a task. The interaction of these elements produces motivation to accomplish a task.

First one is self-efficacy expectation. It can be defined as someone's own capacity to complete a task. Pajares (2008) stated that self-efficacy expectations are essential for learners' motivation. For instance, if a learner does not believe her/him own capacity, motivation will decline, and s/he is not going to want to put out any effort since s/he anticipates failing. In contrast, the learners are more motivated and employ necessary strategies to deal with challenges during the performance because self-eficacy expectations of learners are high.

Second one is outcome expectations. It can be defined as opinions about how well a particular endeavor will turn out (Zimmerman, 2011). Students who have low outcome expectations will not put out necessary effort to succeed, much as students who lack self-efficacy. Though, outcome expectations and self-efficacy may appear to be same construct, they are different as Pajares (1997, 2008) noted, this s a widespread misunderstanding. To illustrate, a researcher can think that s/he can conduct outstanding research (self-efficacy) while also being aware that s/he can come up with false hypotheses and that success depends on outside judgements that do not always focus on the research quality. Because of this, researcher can have low outcome expectation even if s/he has high self-efficacy (Panadero & Alonso-Tapia, 2014). In spite of that, both self-efficacy and outcome expectations are highly correlated with each other. In fact, the higher self-efficacy, the higher outcome expectations lean to be.

The other variables are task value and interest. Both enliven the learners' first attempt to the task. Task value is important for learners' individual goals for the task. If the learners believe tat the work is beneficial, they are more motivated to finish, learn from that task and apply more strategies (Wigfield, Hoa, & Lutz Klauda, 2008). On the other side, interest to perform a task is another variable. Interest can be individual and improved by meaning of the task with respect to the individual perception (Renninger, Hidi & Krapp, 1992). Although interest and task value share some characteristics, Zimmerman does not explicitly distinguish between two in the cyclic model.

The last part for the motivational beliefs is goal orientation. It can be explained as learners' beliefs about target of their learning. Even though this is a general judgement of their learning based on prior experiences, it is well accepted that goal orientations have an impact on self-regulation. There is scientific evidence that students who have learning goals select and apply learning strategies that encourage deeper learning, more sophisticated reflection processes, quicker academic failure recovery, and greater intrinsic motivation for the activities (Grant & Dweck, 2003; Harackiewicz, Barron, & Elliot, 1998).

2.3.2 Volitional or Performance Phase

Zimmerman's second phase is performance. In this phase, self-control and observation were examined. *Self-controlling* enables students and performers to concentrate on the subject at hand and maximize their effort. Self-instruction which is a part of self-control can be explained as how someone can continue while performing a task (Schunk, 1982). Other than self-instruction, imagery (creating pictures in mind) is also a well-used way to control technique to supports performance. The goal of attention focusing is to strengthen concentration while filtering out other hidden processes or external events. Ignoring distractions and avoiding thinking about past and mistakes were found to be effective to increase attention focusing (Kuhl, 1985). Task strategies supports to learning and performance by eliminating unnecessary part of the task and reorganizing left parts meaningfully.

Second section of volitional phase is *self-observation*. It is about keeping notes of certain parts of someone's own performance and the circumstances that occurs it (Zimmerman & Paulsen, 1995). In the course of forethought phase, setting stratified goals supports self-observation since goals concentrated on certain events. Self-feedback is crucial for observation. It facilitates someone to taking actions in a correct time. Moreover, informativeness of performance is also another feedback type which is about practicing a skill in structured context. In that way, results can be more informative (Ericsson & Lehman, 1996). Learners who misinterpret their actions could not make themselves actions right properly is called as accuracy of observation. Final observation feature is valence of behavior. Observing someone's negative aspects may reduce motivation to self-regulate (Kirschenbaum & Karoly, 1977). Self-recording is an observational strategy to enhance self-feedback, informativeness, valence and accuracy (Zimmerman & Kitsantas, 1996). Personal information can be captured at the place of occurrence, structured in the most useful way, preserved without the need for intrusive rehearsal, and provided with a larger data base for deciphering proof of improvement. Self-experimentation is leaded to

cycle of self-observation. People can engage in personal experimentation by systematically modifying the components of their functioning that are in issue when self-observation of natural fluctuations in behavior does not provide conclusive diagnostic evidence. As a result, higher meaningful understanding and better performance or volitional control can be provided by systematic self-observation. Figure 4 shows performance phase summary (Panadero &Alonso-Tapia, 2014).

In this phase, for two reasons, it is crucial that learners maintain their focus and employ proper learning strategies. The first reason is that learners' motivation should not decrease and second one is that monitoring learnig progress of their own towards goals. Zimmerman and Moylan (2009) stated that there are two fundamental processes in the performance phase which are self-observation and self-control like mentioned above.

Self-Observation

Learners should clearly comprehend the appropriateness and quality of their work in order to control the task process. If their work is suitable, they can proceed with doing task; if not, they can make changes. There are two different types of observants that students can use. First one is self-monitoring which is called as metacognitive monitoring. What is being done in the light of standards that judge how well a process is being followed is evaluated by self-monitoring (Winne & Hadwin, 1998). Self-monitoring process is alike self-assessment. However, self-assessment is done after completing the task whereas self-monitoring is done during the performance (Samuelstuen & Bråten, 2007). In this way, possibility of evaluation of learning process and evalution of product have some standards to assess.

The second one is self-recording which involves coding the performance's actions. Unnoticed things may have been identified by using self-records. To illustrate, learners would become aware of how much time it actually takes if they kept track of the time spend reading a text. It is crucial to keep in mind that during the performance, an excessive amount of cognitive processing may occur, preventing

the brain from fully recognizing all the activities taken (Kostons, van Gog, & Paas, 2009).

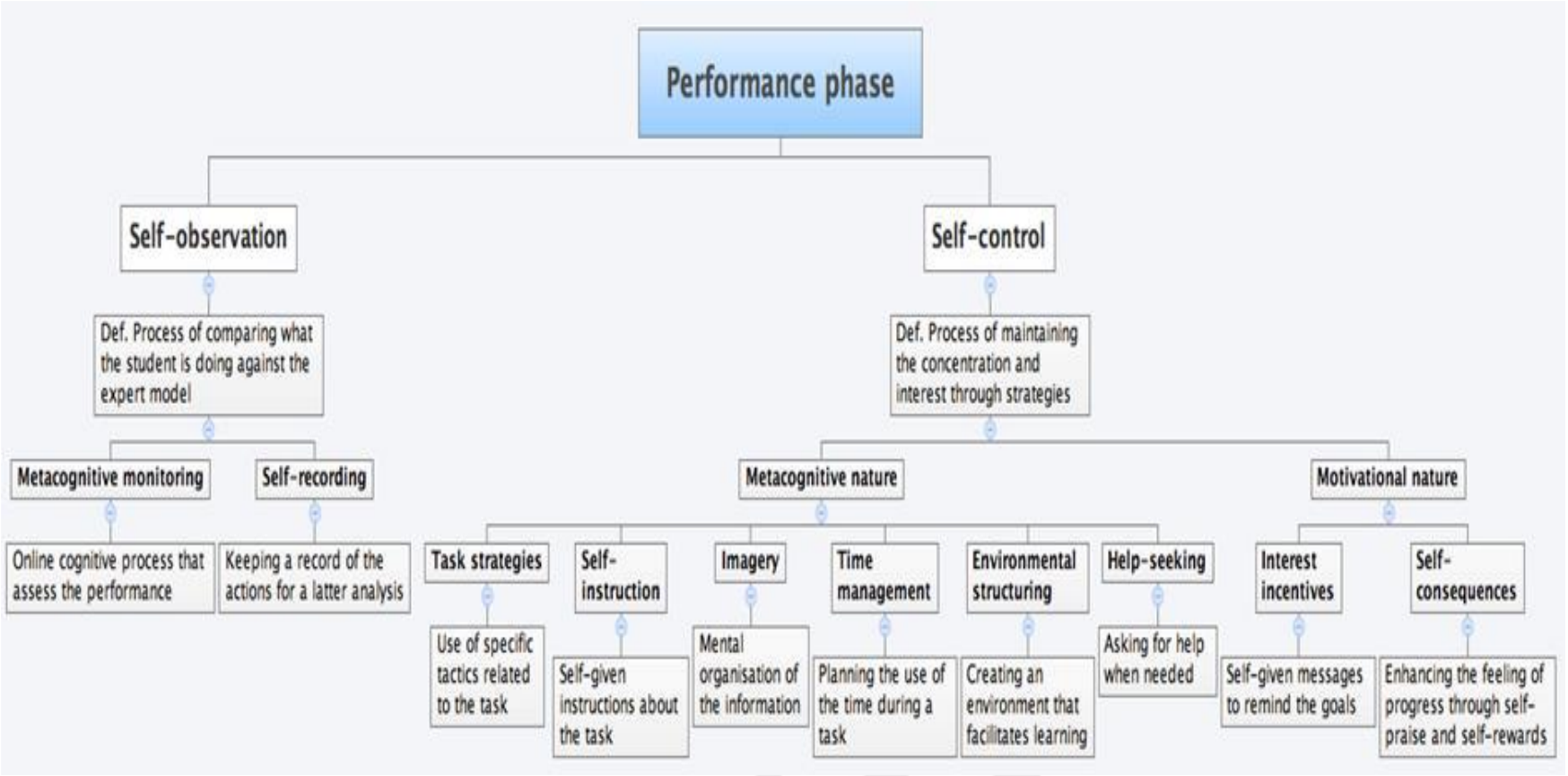

Figure 4 Performance Phase

Self-Control

Self-control has two different categories which are motivational and metacognitive nature. The aim of motivational nature maintains motivation and interest, on the other hand, metacognitive ones maintain concentration. The metacognitive ones are also evaluated as resource management in this chapter.

First of all, using *specific strategies* which is a metacognitive nature in order to accomplish a task makes learners have a meaningful comprehension. To illustrate, while reading, highlighting a text might help readers remember its most crucial passages.

The other metacognitive nature, *self-instruction* which consists of self-directed instructions or explanations of tasks that being conducted can be employed by learners. For instance, students may be asked during a solving problem whether their solving steps to take true or not. These articulations develop learning and self-regulation (Schunk, 1982).

Imagery is another metacognitive term which is about using mental images to organize knowledge and strengthen learning (Zimmerman, 2011). Moreover, creating images raise interest to the given task since it helps to learners to visualize what they think.

Moreover, students must *manage time* effectively. It is crucial that they need to know and manage time to complete a task. Since lack of timing for finishing a task can cause decreasing of outcome expectations and learners feel that they are not capable to complete a task. Dembo and Seli (2008) stated that time management is a good strategy to monitor performance and complete it in given time interval. In addition, *learning environment* is also important in performance phase. Corno (2001) stated that creating less distrative environment for learning is needed. For example, not sitting a friend who talks during the class is an example of avoiding distractive environment. Other experience in the learning during performance phase is called as *help seeking*. It is basically about asking teacher or expert how to solve a problem or

question. Help seeking can be appeared as a poor sign to finish a task and can be evaluated lack of self-regulation. Nevertheless, it can be reverse if the circumstances are given (Newman, 2008). Karabenick (1998) gave an example that a learner who has low grades are unwilling to ask help when they face a situation. Moreover, some of the learners may use help-seeking as a short-cut way to complete a task. Their behaviour is not suitable for self-regulatory learning, and it is inefficient. It must be used as a learning strategy; learners should have volunteer to learn from the answers and finish the task by themselves (Newman, 2008).

Another subtitle is *enhancing interest* during the task which can be classified as motivational strategy. This is accomplished by sending them self-directing signals that serve to remind them of the task at hand or the problem they are attempting to address. To illustrate, this problem has a solution, and I can find it (Corno, 2001). Finally, learners may give up a task if they are not making progress. Nevertheless, *self-consequences* are utilized, they can solve this strain. By praising and rewarding oneself, self-consequences increase sentiments of progress. When utilized after a goal is accomplished, these techniques maintain interest and effort levels, increasing the likelihood that further techniques will be used to advance the work (Corno, 2001).

2.3.3 Self-Reflection Phase

According to Bandura's (1986) definition, two reflection part (self-judgment and self-reaction) is used to explain reflective phase of regulation. Self-judgment includes assessing one's own performance and assigning causal meaning to the outcomes. In addition, self-evaluation is the process of comparing self-monitored data to a benchmark or aim. Zimmerman and Paulsen (1995) stated that sensitivity of someone's self-judgments determines the adaptive quality of one's self-reactions.

Causal attributions concerning the results are linked to self-evaluative assessments. These attributions are critical in self-reflection since attributions of

errors to a fixed ability drive learner to respond negatively and inhibit efforts to improve (Weiner, 1979). Since these phases are cyclic processes, forethought phase also has an impact on attributional judgements. Learners who plan to use a certain technique throughout forethought and apply it in performance phase are more likely to blame chosen technique than on a lack of talent which can be annihilating personally. In Figure 5, detailed demonstration of self-reflection phase is given (Panadero &Alonso-Tapia, 2014).

In the course of self-reflection phase, judging the work and composing reasons for the conclusions are done by learners. Positive and negative emotions are detected based on learners' attributions while they justify their failure and success. Learners' motivation and self-regulation are influenced by these emotions.

Self-Judgement

This process is basically based on the assessment of the performance. It consists of self-evaluation and causal attribution.

Self-evaluation can be defined as assessment of performance based on some criteria and level of goal (Panadero, 2011). In order to make accurate and reliable assessment for performance, learners may ask assessment criteria from their teacher before the task. In that way, students can understand better and correct mistakes easier (Dochy, Segers, & Sluijsmans, 1999). Moreover, assessment criteria are not only method to evaluate performance. Setting goals in forethoght phase, performance level of reaching that wanted are also way to assess (Winne, 2011). In both manners, all students can judge their score with same criteria and similar quality. The desired performance level can be reached in three ways; first one is based on a review of the competencies that the learner will soon acquire which is also known as objective criterion, second one, based on foregoing performances which is called as progress criterion and last one is based on the comparison levels with others which is comparison criterion (Winne & Hadwin, 1998).

The reasons that students assign themselves for their success or failure on a task are known as causal attributions. In this process, questioning the result is seen whether expected result is positive or negative. This implies that attribution based on different factors in the result like, luck, effort, support, ability (Weiner, 1986).

Self-Reaction

Expectations and feelings both have an impact on future motivation and method of approach. As a result, the students' responses to their own attributions are both emotional and cognitive, which is why this process of self-regulation is known as self-reaction. Students can modify their attribution style to make it more adaptive and, as a result, better control their emotions if they learn to view their successes and failures as opportunities to learn and grow (Schunk, 2008).

Self-satisfaction/affect and adaptive/defensive decisions are two processes that need to be considered when it comes to self-reaction, according to Zimmerman and Moylan (2009). Self-satisfaction is explained as reactions which can be affective and cognitive that learners experience when they evaluate themselves (Zimmerman & Moylan, 2009). Positive affect activities result in higher levels of desire for future performance, whilst negative affect activities are carried out to escape the task (Bandura, 1991).

The other one is called as *adaptive/defensive* decisions. When learner decide to make adaptive judgments, they are more likely to complete the work again, whether utilizing the same strategies or trying out new ones in order to get better outcomes. On the contrary, when making defensive choices, pupils attempt to avoid completing the task once more in order to prevent failing again (Wolters, 2003).

To sum up, it can be concluded that self-regulation is a cyclic process; for their upcoming performance, the pupils consider and are inspired by their prior one (Zimmerman, 2011). Motivational variables which are in performance phase are directly affected by attributions and experienced emotions to become more successful in the future. For example, if learners "failed" and made defensive

choices, he or she would be less interested in the task at hand and would have lower expectations for the results. Instead, the student would be more inclined to perform well or steer clear of goals. On the other hand, if learners "failed" and made adaptive decisions seeking feedback to remedy the errors in the future or when attributing they did so based on adaptable factors and within their power, they would maintain their learning goals and motivation would be higher (Alonso-Tapia, 2005).

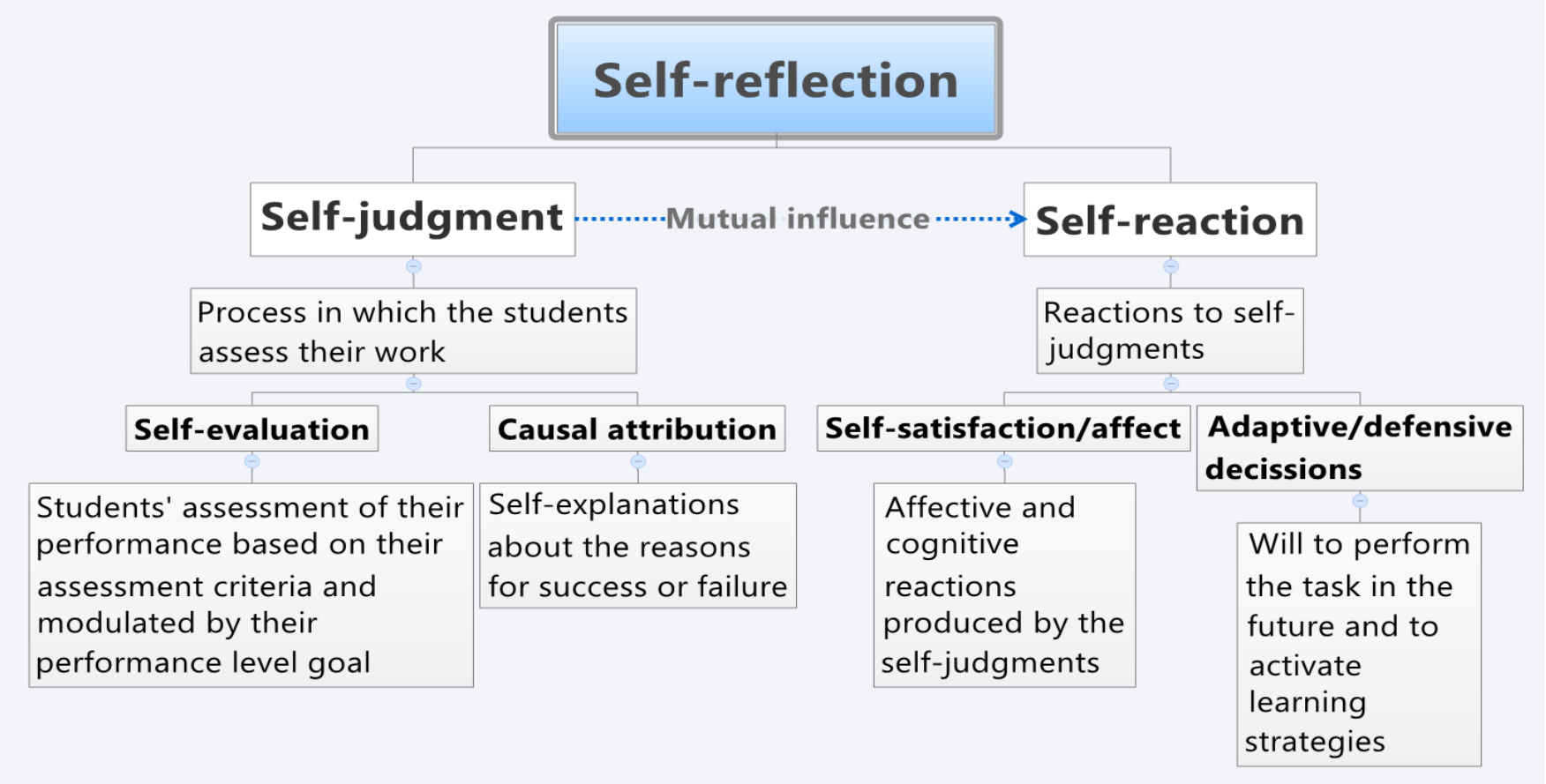

Figure 5 Self-Reflection Phase

2.4 Self- Regulatory Learning Strategies

Since self-regulation and self-regulatory learning are similar and processes are mentiond previous part, in this section only cognitive, metacognitive, and motivational process of learning will be examined and connect with Zimmerman's model.

2.4.1 Cognitive Learning Strategies

Cognitive learning strategies term basically refers to the cognitive actions that learners use in order to achieve certain learning goal or complete a specific learning activity (Mayer, 1988; Schneider & Weinert, 1990). Bandura (1986) explained the strategies as a part of behavioral factors that affect learning in triadic model (see Figure 1). Moreover, Zimmerman (1986) also defined that in self-regulatory learning, learners are behaviraolly active during the process. Highly self-regulated learners have a variety of cognitive methods from which they select the most appropriate one based on their learning objectives and task demands. Because of this, strategic action term was used by Winne and Perry (2000). When describing how to apply cognitive methods effectively, strategic action term was used. In fact, cognitive learning strategies help students do better in school by allowing them to control their cognitive efforts. Many studies on cognitive strategies have found significant connections between cognitive learning strategies and academic achievement (Pintrich & De Groot, 1990; Pintrich & Garcia, 1994; Zimmerman & Martinez-Pons, 1986). Results of these studies proposed that a skilled learner's assests included effective, suitable, and independent technique.

Rehearsal, elaboration, organization which are cognitive learning strategies and linked to self-regulatory learning were explained in this part. *Rehersal strategy* is about activation of knowledge in working memory. This strategy commonly related with repetititon which try to recreate the content in some way. In fact, it consists techniques that reading over and over again, recalling words and

memorizing items. In this strategy, previous knowledge connection is not seen since it is only about preserving knowledge not integrating pre-knowledge. This is a simple learning strategy, helping to learn, and it is not a deep process. However, *elaboration strategy* is called as deep process due to strengthening cognitive engagement (Biggs, 1999; Entwistle, 1988). Unlike rehearsal, elaboration is about making connections with prior knowledge to existence knowledge. Moreover, it happens in long term memory (Weinsten & Mayer, 1986). In elaboration, learners generally use parapharasing, summarizing, making analogies strategies. When learners paraphrase, they restated information with their own words, it helps to connect previous knowledge and new knowledge. Furthermore, clustering information and structuring it into relevant categories, outlining knowledge like heading, subheading, and making concept mapping, creating charts are the example of *organizational strategy* (Weinsten & Mayer, 1986).

Previous researchs found that there is a significant relation between achievement and strategy use. Nevertheless, results of the studies were implicit (Pintrich & De Groot, 1990; Diseth, 2011; Greene et al., 2004; Liem et al. 2008). In the studies which were investigate cognitive strategies one by one stated that rehearsal strategy has a negative effect on achievement while elaboration and organization have positive. On the other hand, Zusho et al. (2003) stated that there is positive relation between rehearsal strategy use and general chemistry achievement.

2.4.2 Metacognitive Strategies

In cognition, “hand-on” term can be used to define behaviroal processes. However, metagonition or metacognitive definition is not clear. It is a “mind-on” term. Learners can discover lesser while performing an experiment, they need to improve concepts and control concepts in their mind (Linnenbrink & Pintrich, 2003).

First metacognition term was presented by Flavell (1979: 906), and it defined as “knowledge and cognition about cognitive phenomena”. In 1987, this unclear term

was enhanced to “thinking about thinking” which supports learners “learn how to learn” (Weinert & Kluwe, 1987). Brown (1987: 171) explained matacognition as “one’s knowledge and control of one’s own cognitive system”. According to the definition of Brown, metacognition was categorized like ‘knowledge of cognition’ and ‘regulation of cognition’. In short, people’s insight or knowledge of how they learn and think as well as the components that influence their learning and thinking, is referred to as metacognitive knowledge. Self-regulated learning has been improved by the metacognitive information and metacognition (Borkowski, Carr, Rellinger & Pressley, 1990; Zimmerman, 1986). *Knowledge of cognition* defines learners’ knowledge about their cognitive system. In fact, it consisted of learners’ comprehension or backing up knowledge concerning the process of thinking and learning. *Regulation of cognition* defines the process of how learners control their learning. In fact, it is related students’ planning, monitoring and evaluation of learning processes which are the parts of Zimmerman’s cyclic phases (See Table 1). Planning how to perform a task, selecting cognitive strategies to utilize, assessing the success of the strategies chosen, and altering or changing the cognitive strategies used when problems arise are all examples of activities that are commonly considered as efforts to control cognition (Pintrich et al., 2000; Schraw & Moshman, 1995). Setting goals, using appropriate strategies, recalling pre-knowledge, and distributing various resources and time management are incorporated with *planning* like in forethought phase (first phase of cyclic process). *Monitoring* refers to cognitive system awareness while completing a task such as evaluating the efficacy of learning while performing the task which is the second phase of cyclic process, performance. Strategies of monitoring permit to check level of comprehension as learners progress through the learning process. Success rate of regulatory process and product of learning is processed by *evaluation.* Evaluation process is the third phase of cyclic process which is reflection. In conclusion, when a student concludes a section or chapter, he or she may pause to consider what they have just learned or understood, or what they can recall about what they have just read is an understandable example of metacognition. Metacognition research studies suggested

that the more metacognitive strategies, the more achievement (Baker, 1994; Butler & Winne, 1995; Pressley et al, 1987).

2.4.3 Motivational Strategies

In all steps of Zimmerman's model (see figure 2) self-regulated learning is a goal-oriented process and targets of the students have an effect on the learning process. Learners who are strongly self-regulated create their own targets according to their competent sides and their flaws, afterwards; they try to monitor their performance. Finally, their progress has been assessed by these learners. Students' self-learning process is also affected by their own self-efficacy beliefs. Based on their self-efficacy beliefs, leaners make discernment about their skills in particular activities and circumstances, engage in activities of learning and maintain their effort. Setting difficult goals, applying dissimilar strategies and adapting them if task fails are skills of highly self-efficacious learners. Beside goal orientation and self-efficacy, in order to assess motivation, task value, control of learning and test anxiety are also considered as motivational strategies.

Elliot (1999) defined goal orientation like reason of engagement in a learning task with respect to Achievement Goal Theory. Related to academic achievement, different types of goal orientation can be found. Nevertheless, intrinsic and extrinsic goal orientations were categorized (Pintrich & Schunk, 2002). Focusing on learning a task and becoming master on it using self-imposed criteria and a desire to improve oneself is referred to *intrinsic goal orientation.* Achievement is mastery and comprehension with a focus on self-improvement in intrinsic goal orientation. Learners, having instrinsic goal orientation, only focuses on meaningful learning for themselves. In order to achive, they make efforts, judgements about processes and ideas (Ames, 1992). On the contrary, *extrinsic goal orientation* is about competence with others or some rewards like getting high scores for publicity, outperforming for competition (Dweck & Leggett, 1988). This type of orientation is generally based on getting higher grades, products raher than processing or self-improvement to assess

achievement. Moreover, learners who have extrinsic goal orientation, have ineffective learning strategies like involving shallow learning procedures, keeping away from difficult tasks, anxiety of failure (Dweck & Leggett, 1988; Jagacinski & Nicholls, 1987; Meece et al., 1988).

Learners' perceptions of their own abilities impact how eager they are to participate in and finish a learning task is referred to *self-efficacy* with respect to social cognitive theory. That's why self-efficacy and beliefs about it are one of the main factors to bear learning and academic achievement. Bandura (1986) explained self- efficacy as people's assessment of their ability to plan and carry out the steps required to achieve specific types of performances. Moreover, Linnenbrink and Pintrich (2003) mentioned that learners who are highly self-efficicous, persist to achieve use strategies effectively, and have an interest in task, therefore these learners' achievement and learning are increased. In addition to highly efficacy learners, they choos more difficult tasks since no fear of failure and persiting to achieve.

Other motivational belief is *task value* which is about perceptions of the learning's relevancy, significance and utility. There are four components in task value related with motivational beliefs which are attainment, intrinsic, utility value and cost (Eccleset et al. 1998). Attainment value is defined as succeeding in the assignment for personal importance. In contrast, intrinsic value is the pleasure derived from participating in the activity, individual's subjective interest in the task. How well n activity ties to recent and future goal like career, determines its utility value. Final component is cost value which is worth of effort and time for a learning task.

The other fundamental motivational belief is *control of learning and performance*. Weiner (1986) defined control beliefs as ideas about failure and success as well as how much power one seems to have over outcomes or conduct. Individuals' beliefs of control are their assumptions that they are able to construct desired outcomes while preventing undesirable one. Results of the studies stated that

learners who control their learning and performance showed higher achievement level than learners who control learning lesser (Pintrich, 2003).

Finally, last belief is test anxiety. “An uncomfortable sensation or emotional state that is experienced in testing or assessment circumstances and has mental and behavioral attendants.” is test anxiety definition (Dusek, 1980). In addition, test anxiety is also combination of responses like physiological, phenomenological and behavioral, associated with defeatist (ready to accept negative outcomes) or failure on a task (Zeidner, 1998). Cognitive and emotionally anxieties are the two main components of test anxiety. Cognitive anxiety can be expressed like concerning about performance. Moreover, fearing testing situations, negative expectations in performance, worrying about not being eligible to complete a test are examples of cognitive anxiety. On the other hand, emotionally is defined as mentally stress response. Furthermore, its dimension is affective like being nervous, physical discomfort (Liebert & Morris, 1967).

2.4.4 Resource Management

In order to get the most out of study, learners need to be eligible to manage resources. It is basically about managing environment and resourcing in the environment. Pintrich et al. (1991) stated that, time management and study environment, helping with others, effort are types of resource management. *Time management* is one of the management strategies to help learning. Studies showed that time management and training of management improve using self-regulatory skills of learners. Moreover, increasing managing skills, increasing students’ GPA (Zimmerman, Greenberg & Weinstein, 1994). To concentrate on a *study environment*, one must find a place that is calm and reasonably devoid of visual and audible distractions. Zimmerman and Martinez-Pons (1986) stated that self-regulated students are prone to reorganize their own study environment to provide more efficient setup. Moreover, comparably more successful students manage better the study environment than less successful ones. *Regulation of effort* is another

strategy to manage. When task is challenging, learners' propensity to attempt hard is called as *regulation of effort* (Pintrich & Johnson, 1990). Students may resist dull tasks with the help of effort regulation and monitoring. To accomplish academic success, there are mainly two types of *help seeking* methods which are instrumental and executive help seeking. The first one is aimed to improve learning process whereas the latter one is focused to reduce the workload to finish a task (Karabenick & Knapp, 1991).

2.5 Studies About Related Literature

There are several studies related with self-regulation and academic achievement. Moreover, different variables like fatigue, self-efficacy are also included in some studies. For example, Schunk and Hanson (1985) investigated how self-efficacy beliefs and peer learning affect the academic achievement among 8 to 10 years old students. In order to examine the result 72 children were chosen as participants. Results of the study stated that highly self-efficicous children have higher scores in classes. On the other hand, there were not a significant effect of peer learning in academic achievement. Moreover, Karabenick and Knapp (1991) investigated help-seeking and performance relation. Findings supported that help-seeking has a positive effect on achievement and participants who were self-efficacious tended to use more help-seeking and had less fear asking help. In addition, Hembree (1988) combined 562 different study result to write a conclusion about relation of test anxiety and test performance (achievement). Result of correlations stated that high test anxiety causes the weak test performance. To conclude, test anxiety has a negative effect on achievement.

In another study, Zimmerman, and Martinez-Pons (1986) investigated relationship between self-regulatory learning and academic achievement. Highly and slightly successful 80 students were chosen among 10^{th} grade as participants to made interview about study cases. Participants were asked to define their techniques in different learning situation. In the light of students' responses, 14 different self-

regulatory learning strategies were described. Highly successful students preferred to use 13 different of them. The study results showed that achievement was explained with self-regulatory learning strategies in 93% ratio. Furthermore, Cheng (2011) conceptualized the self-regulatory learning as motivation, setting goal, control of learning and learning strategies. Research results of this conceptualization was found that each concept influences achievement. Also, Pintrich and Garcia (1994) stated that students who regulate themselves have higher academic achievement than less self-regulate students. Moreover, researchers have shown that students who use self-regulated strategies, determined appropriate learning methods to reach achievement are happier in their work (Pintrich 2000, Ryan and Deci, 2000). In addition to these, in Eom and Reiser's (2000) study, that is about effect of self-regulatory learning strategies on achievement in computer-based learning. 37 students who were sixth and seventh grade assigned as participants. They were randomly attained program as controlled group and and non-controlled groups in computer-based courses. Findings of the study showed that highly self-regulated students learned computer-based courses easier than less self-regulated learners. In another study, Turan and Demirel (2010) tried to define affect of self-regulatory learning strategies on academic achievement among medicine students. Study was conducted in Hacettepe University with 810 students. Self-regulatory Learning Skill Scale was used as instrument. For academic achievement, participants' grades were used. The results showed that there is a significant relationship between academic achievement and self-regulation among high successful students. Moreover, participants who were more successful tended to use regulatory strategies more.

Likewise, Pintrich and De Groot (1990) investigated the relationship between achievement and motivational beliefs, self-regulatory learning strategies with 7th and 8th grade secondary school students. In the study, motivational beliefs were classified as intrinsic goal orientation, test anxiety and self-efficacy. Moreover, learning strategies were cognitive and metacognitive strategies. Findings stated that self-regulation, self-efficacy, and test anxiety affected the achievement, unlike intrinsic

goal orientation. While self-efficacy affected achievement positively, test anxiety has a negative effect. In addition, intrinsic goal orientation does not have a relation.

Benmansour (1988) explored the students' motivational orientations (intrinsic and extrinsic goal orientation), level of anxiety, strength of self-efficacy, and strategy usage in mathematic learning. In order to examine, self-report questionnaire was applied to 289 high school students in Morocco. The results of the study showed that students generally have extrinsic goal orientation rather than intrinsic. Moreover, they tended to use less strategy use to learning and have more test anxiety. On the other, students who has intrinsic orientation have strong self-efficacy and use more learning strategies to achieve with less anxiety of testing. Moreover, Pintrich (1989) found a significant relationship between metacognitive strategies, monitoring, planning and regulatory, and exam grades in different courses. Learners who use metacognitive strategies become more successful. Moreover, Britton and Tesser (1991) investigated the relation of students' time management strategies and cumulative grade point average (achievement score) in college students. A questionnaire for measure time management strategies which has 3 different sub-scales; short-range planning, long-range planning and time attitudes, was used as instrument. Result of the study showed that short-range planning and time attitudes were good predictor of scores. In another study, Garcia-Ros, Gonzales and Hinojosa (2004) investigated the time management skills and academic achievement among Spanish high school students. A questionnaire for time management skills were applied to 350 participants. Results of the analysis showed that time management skills significantly predict achievement, positively. Higher time management skills, higher achievement.

Pintrich and Wolters (1998) examined task value, self-efficacy, anxiety, cognitive and metacognitive learning strategies and achievement variables accordance with gender, mathematics, and social sciences. Results of the study stated that there is no significant relation between usage of metocognitive self-regulatory learning strategy and gender. Furthermore, task value, anxiety, self-efficacy and learning strategies effects are similarly on achievement. Likewise, Pajares and

Graham (1999) conducted a study with 273 middle school students about their self-efficacy beliefs and mathematical task achievement. Findings suggested that self-efficacy is the only motivational beliefs to predict mathematical task performance among highly successful students and less successful one. To sum up, learners who are self-efficicous become more successful since believe in themselves more. Moreover, Gestsdottir, Suchodoletz et al. (2014) investigated the contribution of early self-regulation to achievement in France, Germany, and Iceland. 260 children were included the study over one to two years. Self-regulation was measured by an observation. Analysis revealed that self-regulation predicted academic achievement and skills, but it was dependent on cultural context.

In another study, DeBacker and Nelson (1999) examined the motivational strategies and biology achievement in 149 high school students. Self-report survey of motivation was used as instrument in the study. Outcomes assessed effort, persistence, and achievement. Internal motivation (intrinsic goal orientation) had a significant effect on biology achievement. students who have more intrinsic goal orientation have higher biology achievement. One of the detail studies conducted on Turkey, Yumusak, Sungur and Cakiroglu's research (2007) was conducted in Turkish high schools. Purpose of the research was to relation of biology achievement and self-regulation. Participants were 519 tenth grade students. In order to measure biology achievement, an achievement test which has multiple-choice questions was developed. Moreover, self-regulation results were collected with MSLQ. Results of the study showed that goal orientation, task value, time management and environment, rehearsal, organization, and peer learning significantly predict the achievement scores. Like Yumusak and his collegues, Sadi and Uyar (2013) investigated the relation of cognitive, metacognitive strategies, time and study environment, effort regulation and biology achievement. 428, 9^{th} and 10^{th} grades high school students in Karaman were chosen as participants. Motivated Strategies for Learning Questionnaire and school biology grades were used as instrument in the study. Result of the study showed that biology achievement is correlated with self-

efficacy, rehearsal, elaboration, organization, critical thinking, metacognitive strategy usage, regulation of effort and time-study environment, positively.

Zusho et al. (2003) studied on motivational level of learners, their usage of specific self-regulatory and cognitive strategies, how they change in time and in turn of predicting students' chemistry achievement. 458 participant who were enrolled chemistry class were chosen for study. Self-report measures were used to assess motivation and strategy utilization at three stages throughout the semester. Findings stated that using rehearsal strategy had a positive effect on achievement. Higher reherseal strategy usage, higher academic achievement in chemistry. Moreover, self-efficacy and task value which are the motivational strategies were the best predictor of achievement in terms of cognition and motivation. Like Zusho, Kadioglu (2014) conducted a study about relation of specific chemistry topic and self-regulatory learning strategies among 11^{th} grade Turkish high school students with mixed method. In both experimental and control group showed that mainly self-efficacy beliefs are significant. In qualitative part, findings revealed that experimental group tent to use more strategies than control group and their self-efficacy beliefs toward chemistry laboratory is higher. On the other hand, the results of quantitative part showed that higher cognitive strategies, higher achievement, and results are similar in both groups.

Nota, Soresi and Zimmerman (2004) published a search about relationship between self-regulation and academic achievement in Italy. They used students who were in last year of high school to observe their academic achievement in higher education. Self-regulated learning interviews were used as instrument. Interviews included cognitive, behavioral, and motivational strategies. Results stated that cognitive and motivational strategies predicted the students' course grades. In cognitive part, organizing is a predictor of achievement and in motivational part, control of learning beliefs is the predictor. In another research, Greene et al. (2004) examined the relationship of cognitive strategy use, and achievement. In order to measure the contribution of cognitive strategies, 220 high school students were chosen and completed questionnaires in course of 3 months period of English

classes. Results showed that achievement can be affected by cognitive strategy use. Moreover, there is an inverse relation between rehearsal strategy and achievement while organization and elaboration had positive. And also, Shu-Shen Shih (2005) explored to relation of achievement and cognitive and motivational processes among sixth grade Taiwanese students. Intrinsic and extrinsic motivation predict strategy usage of students positively and test anxiety negatively. That's why, increasing strategy usage is increasing achievement, unlike test anxiety.

Bembenutty (2005) conducted a study to investigate relation of achievement, ethnicity, gender, motivational beliefs, self-regulatory learning process among 10th grade students. 2000 students joined to study. Results were revealed that ethnicity, gender, self-efficacy, regulation effort, intrinsic goal orientation had significant and posivetly relation with achievement. On the other hand, extrinsic goal orientation had a negative effect on achievement.

Besides, Haslaman (2005) examined the prediction of academic achievement with self-regulation skills in programming course in undergraduate level. Findings of the study stated that the higher rehearsal, the lesser achievement. Moreover, task value, extrinsic goal orientation, setting goals, rehearsal, self-reflection, self-efficacy, peer learning, and time management which are self-regulation skills predicted achievement in 71%. In another study conducted in Turkey, Uredi and Uredi (2005) wrote a paper about prediction of primary school students' mathematical achievement and motivational beliefs with self-regulation. The purpose of the study is the find a relation between achievement and self-regulation by using relational model. Self-regulation strategies were measured by MSLQ and final grades which is seen in report card of the students were used to assess mathematical achievement. 515 eight grade students who have middle socio-economic status were chosen as participants in Kadikoy, Istanbul. Results of the study showed that self-regulatory strategies and motivational beliefs predict only 30% of academic achievement. More specifically, metacognitive self-regulation, self-efficacy, intrinsic goal orientation, cognitive strategies have a positive relation with achievement and test anxiety has a negative impact on achievement, too.

Likewise, Israel (2007) conducted a study about self-regulatory learning, science achievement and self-efficacy. Experimental part of the study was run in a low socio-economic primary school. Participants who were selected randomly were 44 sixth grade students. They took a pilot program about self-regulation which is developed by researcher. Non-experimental part of the study consisted of 594 students to collect data which are achievement test, self-regulation scale, self-efficacy in science scale, ration card and reflection paper. According to findings, self-regulation has a positive and significant effect on self-efficacy and academic achievement.

Kitsansas, Steen and Huie (2009) examined effect of the goal orientation and learning strategies on academic achievement. 51 fifth grade students attented the study. Results of the study is that learning strategies has significant effect on academic achievement. However, there is no significant effect of goal orientation on achievement. Moreover, in Puteh and Ibrahim's study (2010) mathematical problem-solving process and effect of self-regulatory learning strategies on it was examined. Parcipants had certain motivation and learning strategies during solving problems. In motivation, extrinsic goal orientation and task value were the most used techniques. Moreover, time and study environment were the significant learning strategy. In addition, help seeking, and regulation of effort were not used by participants.

Yamac (2011) conducted a study about motivational beliefs, cognitive and metacognitive self-regulatory strategies, and mathematic achievement in primary school students. Participants, 204, who were in 5^{th} grade primary school students in Afyonkarahisar were selected as sample in the study. MSLQ, Mathematic Attitude Questionnire and personal information form were used as instrument. To decide mathematic achievement, final grades were used. Findings showed that unlike intrinsic and extrinsic goal orientation, task value, control of learning, metacognitive self-regulation; self-efficacy and test anxiety significantly predict the achievement.

Duru, E; Duru S and Balkis (2014) conducted research about relationship between fatigue, academic achievement, and self-regulation. They used two different model to investigate the relation. Second model was related to academic achievement and self-regulation. 383 university students were chosen as participants whose ages are between 18 and 24. Self-regulation scale, Maslach Fatigue Student Scale and personal information form were used as instrument. Results showed that academic achievement has a positive relationship with self-regulation and fatigue has negative impact on academic achievement.

Alci, Erden and Baykal (2015) investigated the predictive relationship pattern between university students' mathematics achievement and their university entrance exam scores, indicating prior knowledge of pre-courses, problem-solving skills, self-efficacy skills, metacognitive self-regulation strategies. Participants, 480 students, who took mathematics I course were chosen Yildiz Teknik University in 2005-2006. Problem solving inventory, MSLQ were used as instruments and students' math scores was used as achievement score. Results of the study showed that, self-efficacy and problem-solving skills have significant relation, like metacognitive self-regulation strategies and problem-solving skills. Moreover, both self-efficacy and self-regulotory learning strategies significantly predicts mathematic achievement in the study. Like, Demir and Budak (2016) research's purpose was to examine relationship of academic achievement in mathematics and learning strategies and motivational beliefs among primary school 4th grade Turkish students. The study was conducted in Bitlis, 2014-2015 education year. Results of the study analysed by multiple regression analysis. Findings showed that motivational beliefs moderately predicted mathematics achievement, like self-regulatory learning strategies. On the other hand, metacognitive strategies slighty predited mathematics achievement.

Aldan, Deveci and Cayli (2018) examined self-regulation and academic self-efficacy among secondary school students. 797 secondary school students attented the study. Perceived self-regulation scale and academic self-efficacy scale were used to collect data in the study. Results stated that self-regulation and academic self-efficacy have a positive relation.

Shing and Rameli (2020) aimed to investigate the effect of self-regulation among upper primary students' English achievement in Johot Bahru. Self-regulated learning questionnaire was used to 389 primary school students. Results showed that self-regulation has a significant impact on academic achievement among participants in the course of forethought and performance phases. However, there is no influence on achievement during performance phase.

To sum up, there were several different studies among all over the world. Some of the results of the studies were consistent eachother and some of them are not. Moreover, there is less study which are conducted in Turkey and also there are only two chemistry achievement and self-regulation studies. Therefore, it is very crucial to investigate the chemistry achievement and self-regulation in Turkey to help generalize the findings and reducing the gap between countries.

CHAPTER 3

METHODOLOGY

Hypothesis and problems of the study were interpreted, in the light of reviewed related literature, significance of study was rationalized in the former chapters. In this chapter, design of the study, population and sampling, description of variables, instruments, procedures and data collection, analysis of data, assumptions and limitations will be defined.

3.1 Design of the Study

In quantitive research, investigation of a fact in order to generalize is a fundamental desire for researcher (Sukamolson, 2007). Therefore, significant differences, relationship types research questions are very common. “What, to what extent, why” types questions have important role in quantitative research since they help to generalize concepts. The purpose of this study is to examine the contribution of self-regulation and its dimensions in chemistry achievement of high school students in Turkey. Relationships among two or more variables are examined without any undertake to affect them. In this study, self-regulation’s dimensions and chemistry achievement are variables and correlational research method and multiple regression analysis were used.

3.2 Population and Sample

12^{th} grade high school students who are in mathematics and science group in all public and private school in Ankara were chosen as a target population. Since the target population is gigantic to reach, appropriate accessible sample is necessary. In order to access, convenience random sampling model is chosen. Since study is about

chemistry only mathematics and science group students in 12th grade students were involved. Table 3 shows the number of schools, number of total students, chosen schools and selected students' number.

Table 2 Number of Schools and Students in Ankara

Schools	Number of Total Students	Selected Schools	Number of Selected Students
1193	270.755 (all grades)	6	161

According to Governorship of Ankara there are 270755 high school students which are the target population. 4 different districts (Çankaya, Etimesgut, Yenimahalle, Lalahan) were chosen by convenience sampling, therefore schools were selected non-randomly. Friendly administered schools are preferred due to extremely huge number of schools.

3.3 Variables

In this research study, 16 different components that are classified as dependent and independent are found. There is only one dependent variable (DV) and other remaining variables are independent variable. (IVs)

3.3.1 Dependent Variable

Students' chemistry achievement scores which are measured with chemistry achievement test are dependent variable. This variable is a continuous variable and measured on interval scale. Maximum and minimum achievement scores ranged between 29 and 0. Both dependent and independent variables are shown in table 4.

3.3.2 Independent Variable

The independent variables in the study are self-regulatory learning components which are motivational beliefs (intrinsic and extrinsic goal orientations, task value and anxiety, learning beliefs control, self-efficacy) cognitive and metacognitive strategies (rehearsal, elaboration, critical thinking, organization, time, environment, metacognitive self-regulation, regulation effort, peer learning and seeking help.)

Table 3 Variables in This Study

Variable Name	Type of Variable
Chemistry Achievement Test (CAT)	DV
Intrinsic Goal Orientation	IV
Extrinsic Goal orientation	IV
Task Value	IV
Learning Beliefs Control	IV
Self-efficacy	IV
Test Anxiety	IV
Rehearsal	IV
Elaboration	IV
Organization	IV
Critical Thinking	IV
Metacognitive Self-regulation	IV
Time and environment	IV
Regulation effort	IV
Peer learning	IV
Help seeking	IV

3.4 Instruments

Two different measurement instruments are used in the current study to obtain data. These are chemistry achievement test (CAT) and Motivated Strategies for Learning Questionnaire (MSLQ) Turkish version.

3.4.1 Chemistry Achievement Test (CAT)

The achievement test consists of 29 multiple-choice items (see Appendix A). The researcher developed the test. The test items were chosen from different sources; as related literature (REF going to write) university enterance exams, Turkish question banks for preparation of university. Selected questions require high thinking ability to answer. All items are suitable for chemistry curriculum. 9^{th}, 10^{th}, 11^{th} grades chemistry topics which were in Table 5 were covered in test. After forming test items, they were checked by four chemistry educators and a chemistry teacher for content validity. Moreover, since the questions are taken from different sources, a pilot study was done to measure reliability (Cronbach value). The pilot study was conducted with one hundred 12^{th} grade students in Çankaya district. Cronbach's alpha value was found to be .853 indicating the test is strongly reliable. Achievement score of participants were calculated by coding "1" for true and "0" for false answers for each question. Maximum score of test is 29 and minimum is 0. In order to prepare for the test following actions were taken: first, chemistry curriculum was investigated. Units which are proper for conceptual/ high order thinking were marked. Then, related literature, university enterance exam questions and question banks were searched for qualified questions. Finally, amount of the questions for each unit was determined by the importance of the chapters in the curriculum. Table 4 reveals the names of chapters and numbers of questions for each chapter.

Table 4 Names and Grade Level of Chapters with Question Number in CAT

Name of the Chapters	Grade Level	Question Numbers in CAT
Atomic Models and Periodic Table	9 and 11	1,2,13
Void Structure and Properties of Matter	9	8,12,14,24
Molecular Interactions	9	20,28
Chemical Reactions	10	9,23,29
Mixtures and Solutions	10 and 11	3,4,5
Acids, Bases and Salts	10 and 11	19,22,25,27
Gases	11	15,16,17
Chemical Reactions and Energy	11	6,7,10,26,29
Chemical Equilibrium	11	11,18,21

3.4.2 Motivated Strategies for Learning Questionnaire (MSLQ)

Another instrument used in the present study was motivated strategies for learning questionnaire (MSLQ). MSLQ is an example of Likert-scale type questionnaire. It was originally created by Pintrich, Garcia, Smith and McKeachie in 1991. Self-report questionnaire has 81-item which measures 15 different components. These constructs were associated with the process of self-regulatory learning. Participants give responses on 7 points. Scale rating is between “not all true of me” to “very true of me” (see Appendix B). In the study, Turkish version of MSLQ was used. It was adapted into biology course and translated by Sungur (2004). Validation of the instrument was measured by Yumusak (2006) by two confirmatory factor analyses. MSLQ covers 81-items, and it consists of two different sections that are motivation and learning strategies parts.

Students' goals and value beliefs for a course, and their beliefs about their ability to perform in a course, anxiety about assessments are evaluated in the first portion which is the motivational part with 31-items. Motivational part is based on constructs of motivation that affect, value and expectancy. Affect is the first basic motivational concept, and it has been implemented through reactions to the test anxiety scale measuring students' fear and concern about taking too many exams. Value beliefs can be explained as intrinsic (for mastery and learning) and extrinsic (for taking grades) goal orientations and task value (belief of where students use the topic). Final concept of motivation is the expectancy which is about self-efficacy (students' confidence in their ability to complete a task) and learning control (students thinks that success is determined by one's own effort.)

Mainly, six hidden factors were investigated to see how well 31-items of motivation fit: Intrinsic Goal Orientation (IGO), Extrinsic Goal Orientation (EGO), Self-Efficacy for Learning & Performance (SELP), Control of Learning (CL), task value (TV), test anxiety (TA). (Pintrich, Smith, Garcia & McKeachie, (1991)

Second part is the learning strategies which has 50-items. 19 of the items measures students' management of various resources named as, Help Seeking (HS) (getting help from teacher or classmate if necessary), Peer Learning (PL) (studying with group or pair to learn), time and study environment (TSE) (managing time and choosing proper study place) and finally regulation of effort (RE) (preserving through tough/uninteresting activities). (Pintrich, Smith, Garcia & McKeachie, (1991).

Other 31-items of the second part measure usage of metacognitive and cognitive strategies of students. Metacognitive strategies are related with self-regulation. Planning is about setting targets; monitoring is understanding someone's own learning process. Regulating is judging or evaluating someone's own learning a task. Cognitive strategies are rehearsal, elaboration, organization, and critical thinking. Rehearsal is about recalling, repeating; elaboration is paraphrasing; organization is outlining ideas. Critical thinking refers to what extent students apply

their previous knowledge in solving a problem and reaching a decision (Pintrich, Smith, Garcia & McKeachie, 1991).

Reliability values of the current study version and Sungur's (2004) version of questionnaire with items are given in Table 5.

Table 5 Realibilty Value and Number of Items in MSLQ

	Scale	Reliability Values of the Study (2022)	Reliability Values of Sungur (2004)	Item Number of Subscale
Motivation	Intrinsic Goal Orientation (IGO)	0.63	0.74	1,16,22,24
	Extrinsic Goal Orientation (EGO)	0.73	0.62	7,11,13,30
	Task Value (TV)	0.83	0.90	4,10,17,23,26,27
	Control of Learning (CL)	0.71	0.68	2,9,18,25
	Self-Efficacy for Learning & Performance (SELP)	0.85	0.93	5,16,12,15,20,21,29,31
	Test Anxiety (TA)	0.65	0.80	3,8,14,19,28
Strategy Use	Help Seeking (HS)	0.54	0.52	40,58,68,75
	Peer Learning (PL)	0.43	0.76	34,35,50
	Time and Study Environment (TSE)	0.71	0.68	35,43,52,65,70,73,77,80
	Regulation of Effort (RE)	0.62	0.69	37,48,60,74
	Metacognitive Self-Regulation (MSR)	0.77	0.79	33,36,41,44,54,55,56,57, 61,76,78,79
	Rehearsal	0.72	0.69	39,46,59,72
	Elaboration	0.79	0.76	53,62,64,67,69,81
	Organization	0.71	0.64	32,42,49,63
	Critical Thinking	0.77	0.80	38,47,51,66,71

3.5 Procedure

Defining research question was the first step of the study. After then, related literature was searched and read. In the light of literature and different sources, chemistry achievement test was developed. Before conducting the study, required ethical permissions from METU and Ministry of Education were taken. Before conducting main study, a pilot study was done to measure reliability of achievement test with 100 participants in 2021-2022 first semester. Then, instruments were applied to 161 12^{th} grade students in 2021-2022 second semester in Ankara. One class hour was given to complete instruments. All directions were given clearly. Personal information was not necessary for the study; therefore, participants did not give any information about themselves. They were informed that their answers will be kept confidential secret and not be shared by others. Moreover, students were told that their responses for achievement test will not affect their chemistry grades in the school. During the collection of data, because of limiting time, cooperation of other teachers who were also informed about the study and collecting process was essential. Finally, collected data were analyzed and results were discussed.

3.6 Analysis of Data

Collected data were analyzed by 25^{th} version of SPSS, analyzing program. The variables were analyzed for both descriptive and inferential statistics.

3.6.1 Descriptive Statistics

Maximum and minimum scores and range, skewness-kurtosis values of tests, means and standard deviations were included in the descriptive statistics part.

3.6.2 Inferential Statistics

To answer research question and test hypothesis of the study, multiple regression analysis results were included in the inferential statistics part.

3.7 Assumptions of the Study

- The participants answered items clearly, honestly.
- The participants did not interact with each other while answering questionnaire.
- The instruments were given to schools in similar conditions.

3.8 Limitations of the Study

- The findings are about chemistry; therefore, it may not be generalized for other sciences.
- Sampling was determined by convenience method; therefore, sample may not represent the population very well.
- The participants were limited to only 12^{th} grade students.
- In this study, Chemistry Achievement Test was limited to 29 questions. In future, item numbers of test can be increased.
- In the study, students' demographical information was not taken therefore researcher does not know learners' characteristics.

CHAPTER 4

RESULTS

In this section, descriptive and inferential statistics were covered. According to statistical results, null hypotheses of the research question were tested. Finally, findings of study were concluded.

4.1 Descriptive Statistics

Descriptive statistics are suitable to describe and summarize the characteristic of a sample by giving variable name, standard deviation, skewness and kurtosis values, range, maximum and minimum values of scores. In this study, chemistry achievement test scores, and subscale of MSLQ, motivational beliefs and learning strategies, statistics were given in the Table 6.

Students' chemistry achievement scores ranged "0" to "29" and mean of the chemistry achievement scores is 11.11 with 6.11 standard deviation. Skewness and kurtosis values are between "-1" and "+1" to check normality. According to Byrne (2010), if skewness and kurtosis values are between -2 and +2, data can be considered as normal. Both motivational and learning strategies scores are normally disturbed.

Motivational part scores (IGO, EGO, TV, CL, SELP, TA) range between "1" and "7". Higher score represents better results but in test anxiety, it is reversed. Higher scores of test anxiety mean that students are more anxious. Table 6 reveals that control of learning has the highest score. Therefore, high school students in the present study think that one's own effort bring success. The lower score of motivational part is test anxiety. It means students do not have much test anxiety.

Learning strategies part (HS, PL, TSE, RE, MSR, R, E, O, CT) scores also range between "1" and "7". Help seeking is the highest preferable learning strategy among participants which has score 4.51. It means that high school students in this study look for help of the others in case they do not comprehend the topic. CT has the lowest score meaning that high school students do not make critical thinking in the learning process.

Table 6 Descriptive Statistics of Achievement Score, Motivational and Learning Strategies Use Variables

Variable	Mean	Standard Deviation	Minimum	Maximum	Range	Skewness	Kurtosis
ACHSCO	11.11	6.11	0	28.00	28.00	.733	.028
IGO	4.43	1.19	1.00	7.00	6.00	.192	-.517
EGO	4.82	1.35	1.00	7.00	6.00	-.515	-.407
TV	6.72	1.24	1.00	7.00	6.00	-.486	-.398
CL	5.34	1.11	1.00	7.00	6.00	-1.025	1.272
SELP	4.54	1.17	1.00	7.00	6.00	-.406	-.149
TA	3.99	1.27	1.00	7.00	6.00	.065	-.382
HS	4.51	1.17	1.00	7.00	6.00	-.392	.073
PL	3.94	1.18	1.00	7.00	6.00	.137	.192
TSE	4.44	1.01	1.00	7.00	6.00	-.030	-.385
RE	4.13	1.32	1.00	7.00	6.00	-.113	-.047
MSR	4.33	.94	1.00	7.00	6.00	-.124	-.078
R	4.02	1.33	1.00	7.00	6.00	-.177	-.543
E	4.25	1.23	1.00	7.00	6.00	-.295	.026
O	3.98	1.38	1.00	7.00	6.00	.043	-.274
CT	3.78	1.28	1.00	7.00	6.00	-.055	-.357

4.2 Inferential Statistics

Multiple regression analysis is used to test hypothesis of search. Multiple regression analysis can be suitable when there are more than one independent variable and help how well a variable can predict a particular outcome. In this

study, motivational beliefs and learning strategies use are the predictors of chemistry achievement.

4.2.1 Assumptions of Multiple Linear Regression

Null hypotheses are needed to test by multiple regression method. Before conducting analysis, assumptions of method should be checked. Assumptions of regression are listed and analyzed in below.

1. Sample Size: sample size represents the generalizability of the population. Generalization is important for findings. Tabachinch and Fidell (2007) suggested a formula for sample size calculation which is N>50+8m where m represents the number of independent variables. In this study number of independent variables are 6 for motivational part and 9 for learning strategies part. N>50+8.(6); N> 98 is representative sample size for motivational part and in the study number of participants are 161. Moreover, N>50+8.(9); N>122 is the sample size for learning strategies part and again number of participants are 161 in this section. Therefore, sample size assumption is met in the study.
2. Multicollinearity and Singularity

Multicollinearity problem can be seen if more than two independent variables are correlated with each other. In order to check multicollinearity, there are 3 different ways that bivariate correlations between independent variables, tolerance value and variation inflation factor. In the study, bivariate correlation technique and variation inflation factor (VIF) are used to check assumption. Independent variables correlation values, r, should not be higher than .90 (r<.90). Moreover, VIF value should be less than 10 (VIF<10) to say no multicollinearity is seen. In the present study, correlations between independent variables and VIF were given in the Table 7.

Table 7 Correlation Values of Dependent and Independent Variables

	ACHSCO	IGO	EGO	TV	CL	SELP	TA	HS	PL	TSE	RE	MSR	R	E	O	CT
ACHSCO	1.000	.097	-.012	.293	.152	.251	-.191	.069	.050	.309	.332	.228	-.032	.160	.000	.108
IGO		1.000	.479	.660	.490	.654	.233	.345	.443	.402	.359	.574	.367	.455	.354	.428
EGO			1.000	.447	.344	.377	.495	.341	.216	.285	.118	.434	.487	.440	.462	.236
TV				1.000	.442	.696	.138	.244	.396	.427	.431	.605	.363	.509	.394	.497
CL					1.000	.579	.076	.196	.224	.189	.172	.321	.172	.244	.227	.179
SELP						1.000	-.024	.333	.441	.467	.458	.592	.334	.457	.367	.365
TA							1.000	.131	.170	-.008	-.164	.209	.318	.249	.320	.160
HS								1.000	.319	.340	.327	.393	.370	.407	.372	.155
PL									1.000	.412	.297	.452	.347	.546	.376	.481
TSE										1.000	.643	.574	.310	.340	.338	.162
RE											1.000	.588	.252	.395	.268	.259
MSR												1.000	.646	.744	.686	.555
R													1.000	.676	.675	.543
E														1.000	.634	.676
O															1.000	.495
CT																1.000

Table 8 VIF Values for Independent Variables

IV	VIF VALUE
IGO	2.553
EGO	2.181
TV	2.730
CL	1.648
SELP	3.143
TA	1.688
HS	1.460
PL	1.886
TSE	2.357
RE	2.353
MSR	4.821
R	2.600
E	3.735
O	2.534
CT	2.489

Both correlation and VIF values stated that there is no correlation between independent variables since correlation values of each independent variables are less than .90 and VIF values are less than 10, therefore multicollinearity assumption is also checked.

3. Outliers is about checking extreme scores for dependent and independent values. Tabachnick and Fidell (2007) explained outliers as standard residual of more than 3.3 and less than -3.3 for dependent variables. It means -3.3<scatterplot<3.3, there is no outliers. In the present study, outlier of independent variables are checked by using scatterplot (see Figure 3 and 4) and Mahalanobis distance value (Tabachnick and Fidell, 2007). In the Tabachnick and Fidell (2007), Table C.4, number of independent variables is given. In this study, there are two different sections, motivational beliefs and learning strategies sections. In motivational section, there are 6 independent variables and Mahalanobis distance value is

22.46 for df=6, and analysis results showed that all independent variables values are less than 22.46 and maximum distance is 19.104 for alpha value=.001.

In the second part, there are 9 independent variables and distance value is given 27.88 for df=9, alpha=.001. Maximum distance value is found 24.162 which is less than 27.88, therefore independent variables do not have any outliers.

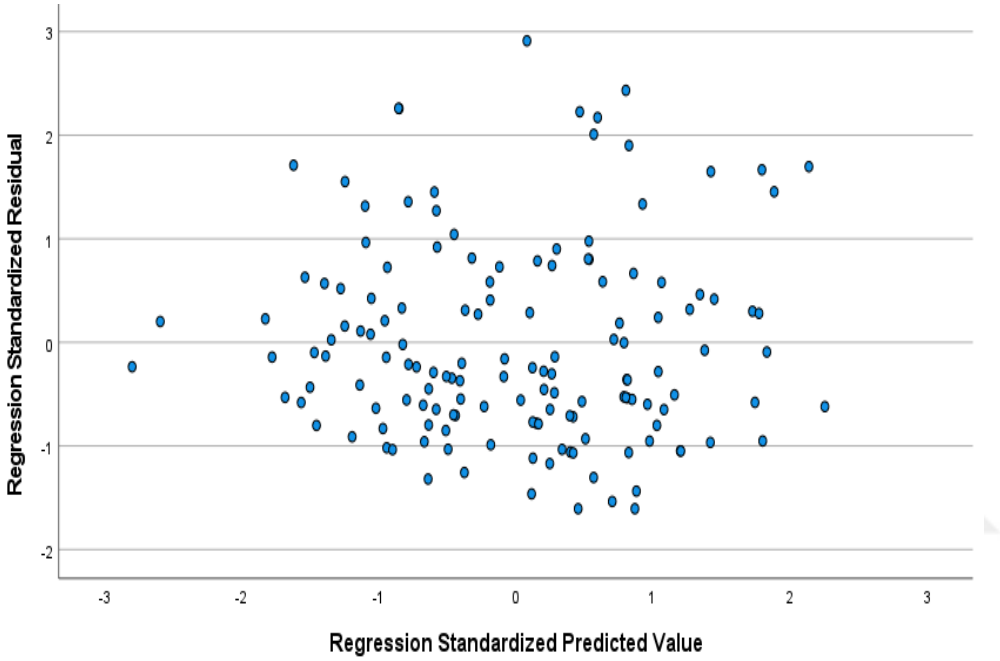

Figure 6 Scatterplot of Motivational Beliefs

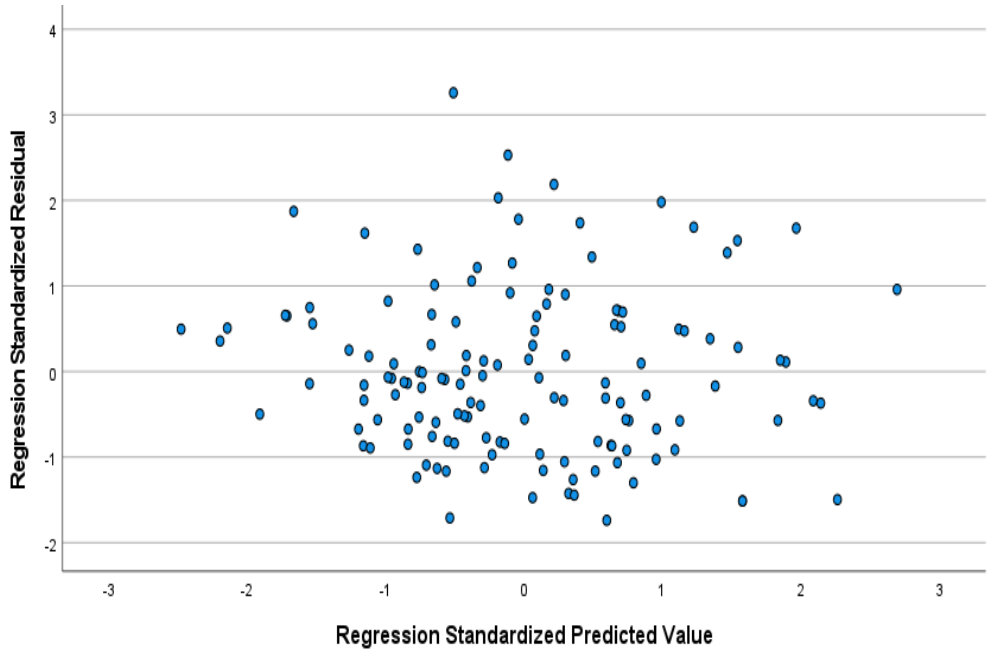

Figure 7 Scatterplot of Learning Strategies

4. Normality, Linearity, Homoscedascity of Residual; normality is also checked by scatterplot of regression (see Figure 3 and 4) which is satisfied. Linearity check is done by checking straight line relationship with dependent variable. In the study, analysis of normality for both motivational beliefs and learning strategies is satisfied (Figure 5 and 6). Moreover, homoscedasticity is the variance of residuals about predicted dependent variable scores should be same for all scores.

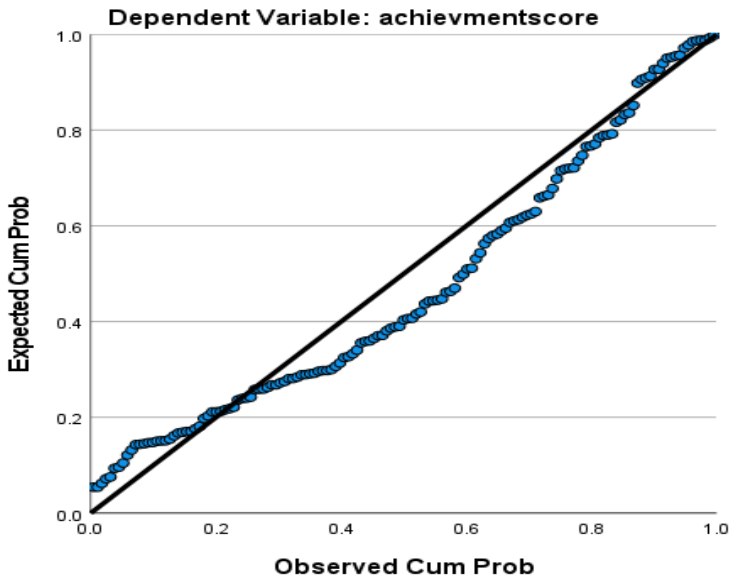

Figure 8 Normality Line for Motivational Beliefs

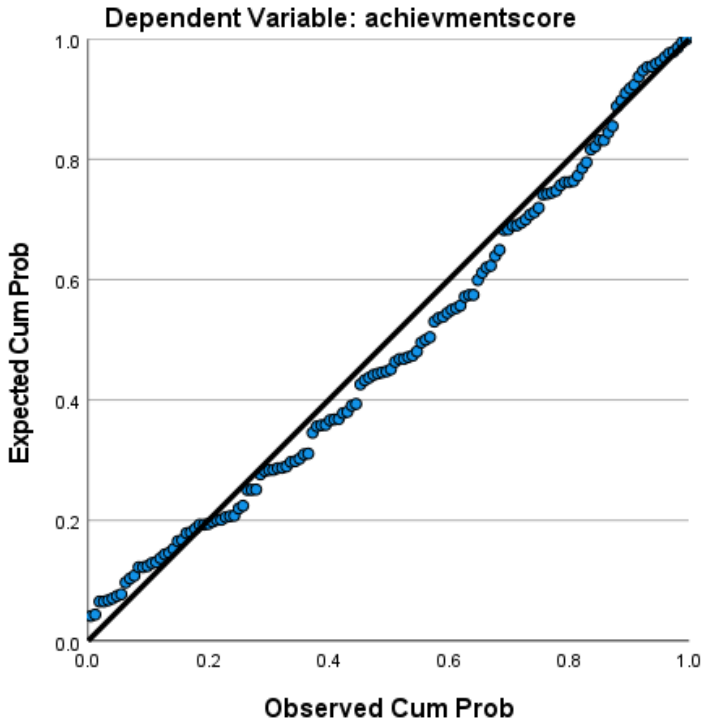

Figure 9 Normality Line for Learning Strategies

4.2.2 Research Question 1

Research question one is about motivational beliefs and its contribution to chemistry achievement which will be investigated. The first research question was "What is the relationship between motivational beliefs and chemistry achievement among 12th grade Turkish high school students?". Moreover, the null hypothesis of the question was, $H_0$1: There is no significant relationship between motivational beliefs and chemistry achievement among 12th grade Turkish high school students. In the motivational part, intrinsic goal orientation (IGO), extrinsic goal orientation (EGO), task value (TV), Control of Learning Beliefs (CL), Self-Efficacy in Learning and Performance (SELP) and Test Anxiety (TA) were investigated. Analyze result of multiple linear regression tested the problem and hypothesis. Findings of the analysis showed that motivational beliefs significantly predict chemistry achievement in 15.6% (R=.395, R^2= .156, p< .05). When checking all independents for motivational beliefs, results stated that only task value is the predictor of achievement (p < .05). Moreover, other independents' values are not valid (p > .05). Highest beta coefficient value belongs to task value which is .363. It explains that most positive predictor of achievement is task value. According to beta coefficients, test anxiety value is the second one which is -.174. Plus, and minus signs indicate that variable predicts achievement positively or negatively. In this study, task value coefficient is positive which means that participants become more successful when they have task value. In addition, test anxiety has a negative impact on achievement. If students have strong test anxiety, their achievement is less. Beta coefficients and significance values of motivational beliefs are given in the Table 9.

Table 9 Motivational Beliefs Contribution to Achievement

Independent Variables	Beta	p
IGO	-.156	.182
EGO	-.066	.524
TV	.363	.002
CL	.051	.596
SELP	.092	.476
TA	-.174	.065

4.2.3 Research Question 2

Research question two is about using learning strategies and its contribution to chemistry achievement which will be investigated. The second research question was "What is the relationship between using learning strategies and chemistry achievement among 12th grade Turkish high school students?". Moreover, the null hypothesis of the question was, $H_0$1: There is no significant relationship between using learning strategies and chemistry achievement among 12th grade Turkish high school students. Learning strategies include help seeking (HS), peer learning (PL), time management and study environment (TSE), regulation of effort (RE), metacognitive self-regulation (MSR), rehearsal (R), elaboration (E), organization (O), and critical thinking (CT). Findings of the multiple regression analysis showed that using learning strategies significantly predict the chemistry achievement in 20.7% ($R=.455$, $R^2=.207$, $p < .05$). When checking all independents in using learning strategies, time management and study environment, and rehearsal strategy use are the predictor of achievement ($p < .05$). However, other strategies are not valid for prediction since $p > .05$. Highest beta coefficient value belongs to rehearsal which is -.284. It means that higher rehearsal strategy usage is lower chemistry achievement. Moreover, beta coefficient of time management and study environment is .273. When participants have study environment and can manage time properly, their

chemistry achievement increases. Beta coefficients and significance values of using learning strategies are given in the Table 10.

Table 10 Using Learning Strategies Contribution to Achievement

Independent Variables	Beta	p
HS	-.006	.944
PL	-.186	.064
TSE	.273	.018
RE	.123	.269
MSR	.142	.363
R	-.284	.018
E	.231	.111
O	.166	.162
CT	.124	.274

4.3 Summary of Findings

In this part, general findings of both descriptive and inferential statistics are summarized.

The average of the chemistry achievement tests' result is 11.11 out of 29. Results implies that scores are not high for the study.

In the motivational beliefs part, only task value has a significant contribution to predict chemistry achievement. Moreover, results stated that the higher task value, the higher chemistry achievement.

In the using learning strategies part, rehearsal strategies and time management and study environment have significant contribution to predict chemistry achievement. Moreover, the most significant contribution comes from rehearsal strategy. Explanation of rehearsal strategy is, the higher rehearsal strategy,

the lower chemistry achievement scores. In addition to rehearsal strategy, higher time management and study environment provide higher achievement in chemistry.

CHAPTER 5

DISCUSSION, CONCLUSION, AND IMPLICATIONS

In this chapter, summary of research study, discussion and conclusion, implications and finally recommendation for further studies will be presented.

5.1 Summary of Research

Chemistry achievement and self-regulatory learning relations among 12th grade students were examined. 161 students were selected by conveince random sampling. CAT and MSLQ were applied to participants in the course of 2021-2022 semester. Results of the study showed that academic achievement has been affected by motivational beliefs and learning strategies in some ways. Task value which is a motivation belief, predicts the achievement. Moreover, source management which are time management and study environment, positively related with chemistry achievement while rehearsal strategies have negative relationship with chemistry achievement. There is not a significant relationship between other motivational and learning strategies variables and chemistry achievement in this study.

5.2 Discussion and Conclusion

Turkish high school students' achievement in chemistry and the relationship between achievement and self-regulatory learning processes is the main goal of this study. Adapted Turkish version of motivated strategies for learning questionnaire (MSLQ) which was originally developed by Pintrich based on social cognitive theory was used to find contribution of self-regulation on chemistry achievement.

Findings of the present study showed that task value, rehearsal strategy use and management of time and study environment are related to chemistry achievement of 12th grade high school students. Task value has the most contribution among motivational beliefs on chemistry achievement (β=.363 and $p<.005$) and this contribution was positive meaning that higher the task value, the higher chemistry achievement students have. This finding is consistent with the majority of related literature. Firstly, in 1998, Pintrich and Wolter stated the task value influenced achievement in social science and mathematics. Later, Zusho and her collegues (2003) worked on motivational beliefs and academic achievement in chemistry and task value predicted the achievement. Similarly, Haslaman (2005) found the effect on task value in programming course for undergraduate students and Yumusak and his colleagues (2007) found that biology achievement is increased by increasing task value. Moreover, in Puteh and Ibrahim's study (2010) results showed that there is a significant relationship between task value and mathematical problem-solving skills. On the other hand, Yamac (2011) who investigated the relationship between motivational beliefs and academic achievement, did not find any relation between task value and achievement. The positive relationship between task value and chemistry achievement may be explained by the study of McCoach and Siegle (2003) who stated that learners who do not value task or consequences will not motivate themselves to finish task with best effort. Task value effect on achievement was found positive which means the higher task value, higher score on chemistry. In this case, the result of this study agrees with the majority of the literature. Although there was not a signitificant contribution of extrinsic goal orientation, its beta coefficient value was found negative which means learners who have more extrinsic motivation, have less chemistry achievement scores. In the related literature, contradictory findings have been reported. Some studies found the negative relationship between extrinsic goal orientation and achievement (Benmansour, 1988; Bembenutty, 2005; Haslaman, 2005; Yumusak, 2007; Puteh & Ibrahim, 2010). However, some studies about extrinsic goal orientation and achievement could not find any relation between them but only intrinsic one (Yamac, 2011; Pintrich & De Groot, 1990; De Backer &

Nelson, 1999; Eshel & Kohavi, 2003). Moreover, though the relationship between intrinsic goal orientation and chemistry achievement was not significant, negative coefficient for intrinsic goal orientation was found. This means that when students have more intrinsic goal orientation, their chemistry achievement decreases. In the studies which found significant relation between intrinsic goal orientation and achievement, stated that the relation is positive. Higher intrinsic goal orientation makes learner more successful (Yamac, 2011; Pintrich & De Groot, 1990; De Backer & Nelson, 1999; Eshel & Kohavi, 2003). However, this negative relationship in this study may be explained by university entrance examination. Participants of the present study were enrolled in the last year of high school. Last year students focus more on university entrance examination, that's why maybe their intrinsic motivation for learning decreased because of this important exam.

In the learning strategies part, rehearsal and time management and study environment are significantly related with chemistry achievement. Rehearsal which is related with rote learning is simply remembering and recalling words or items. Learners who use rehearsal strategy are not able to link pre-knowledge and current knowledge (Biggs, 1999). The result of the current study has an expected result. Rehearsal strategy and achievement are inversely related with each other. Since the chemistry achievement test is conceptual and covers three grade levels, rehearsal is not enough to answer items. Achievement test in the present study requires connection between previous topics since spiral curriculum is used in Turkey and topics are related with each other. Result of the study is related with the literature. For example, Greene et al. (2004) investigated the English course achievement and found that rehearsal strategy is negatively related with achievement. Moreover, Haslaman (2005) in programming course and Yumusak (2007) in biology course found that increase in rehearsal strategy caused less academic achievement. This was also consistent with the study Sadi and Uyar in 2013. However, Zusho et al. (2003) found a positive relationship between rehearsal strategy and chemistry achievement. Reason of this difference may be teaching methods, curriculum, or even cultural differences.

Time management and study environment is highest predictor of achievement in the study. One more time, result is proper for senior year students since they will try to pass university entrance examination, they need to manage time effectively and choose comfortable study area for success. Finding in the study is related with the literature. Britton and Tesser (1991) only investigated the managing time and academic achievement and found a significant relation between them. Similarly, other research studies reported similar findings (Garcia-Ros et al., 2004; Haslaman, 2005; Yumusak, 2007; Sadi & Uyar, 2013). Garcia-Ros et al. (2004) examine the Spanish high school students time management strategies, Haslaman (2005) investigated the same relation among undergraduate students in Turkey. In addition to Turkey studies, Yumusak (2007) found positive relation of time management and biology achievement in high school, 10^{th} grade, like Sadi and Uyar (2013). According to related literature, grade level of students whether they are high school learners or undergraduate learners, or country did not affect the managing time strategy. All the learners in these studies know how to manage time to become more successful.

Furthermore, this study showed that there was not any significant relationship between help seeking/ peer learning and chemistry achievement. However, though not significant, the relationship was negative which means that the more peer learning takes place, the less chemistry achievement students have. Regarding this, there are inconsistent findings in the literature since some of the studies supports help seeking and peer learning (Karabenick & Knapp, 1991; Haslaman, 2005; Yumusak, 2007) and some of them do not (Schunk & Hanson, 1985; Yumusak, 2007; Puteh & Ibrahim, 2010; Sadi & Uyar, 2013) for academic achievement. These studies are conducted in different countries, so cultural difference may be a reason for this difference. In Turkey educational curriculum, there is not much group work and students do not work cooperatively in the chemistry clasess, therefore learners may think that they always need to study by themselves to learn better. Moreover, university entrance exam in thisstdy ma be another reason for the negative

relationship. Student may mostly study individually for the university entrance exam and they may not ask help from other students.

There is a critical result about metacognitive self-regulation strategies which is measured with MSLQ. In current study, metacognitive self-regulatory strategies do not have a significant relationship with chemistry achievement. Studies in the literature mainly found significant relation between achievement and metacognitive self-regulation (Zimmerman & Martinez-Pons, 1986; Pintrich, 1989; Pintrich & De Groot, 1990; Pintrich & Wolters, 1998; Bembenutty, 2005; Haslaman, 2005; Israel, 2007; Sadi & Uyar, 2013; Alcı, Erden & Baykal, 2015). On the other hand, some studies could not find any relation of metacognitive self-regulatory learning strategy on achievement (De Backer & Nelson, 1999; Yumusak, 2007; Puteh & Ibrahim, 2010; Yamac, 2011). Moreover, in some studies relations were slightly significant (Demir & Budak, 2016; Shing & Rameli, 2020). For further studies, metacognitive self-regulatory learning strategies should be investigated more deeply. Getsdottir and Suchodoletz et al. (2014) stated that there is a significant prediction of metacognitive self-regulatory strategies on achievement, but results are changeable because it depends on the cultural context. Chemistry curriculum in Turkey do not include activities that require using metacognitive self-regulatory strategies. Moreover, teachers and experts have less information about the strategy and how integrated in the class.

Finally, critical thinking is an important strategy for meaningful learning. However, in this study there was not a significant relationship between critical thinking aand chemistry achievement. Actually, expected results on literature is higher critical thinking should bring higher achievement (Sadi & Uyar, 2013). In the current study descriptive statistics revelaed the low score in the critical thinking levels of the participants. Achievement test includes conceptual questions which require high critical thinking ability but mean of the score is 11.11 out of 29. It means that leaners were not successful enough. Since rehearsal strategy (memorizing) is higher, critical thinking ability is less. In chemistry curriculum, terms are in surface level and not conceptual, therefore learners may not improve their critical thinkings.

In the class, teachers should encourage students to improve their critical thinkings. Although result is not significant, literature also reported insignificant result of critical thinking (Haslaman, 2005; Yumusak, 2007; Yamac, 2011). All studies were conducted in Turkey and different grade levels and topics. To sum up, in Turkey, critical thinking skills of learners is not improved. Beside this, test anxiety is a problem for learners' stress, and actions, although significant prediction is not found in the study like Yumusak (2007), Sadi and Uyar (2013), Haslaman (2005). Studies in other countries suggested that there is a negative relation of test anxiety and achievement (Reteguiz, 2006; Shu-Shen Shih, 2005; Uredi & Uredi, 2005; Pintrich and De Groot; 1990). In order to eliminate test anxiety, emphasizing importance of grades should be minimized.

5.3 Implications

Based on the results of the study, these suggestions may be proposed;

- Chemistry achievement test is a conceptual test and average score of test was 11.11 out of 29 which is less than half, therefore, conceptual understanding should be given importance and teaching methods that enhance conceptual understanding should be used in chemistry classes.
- Importance of chemistry, usefulness of science in daily life should be expressed.
- Learning strategies and how learners should use them properly may be integrated into courses.
- Students should be encouraged to use different strategies and their interests be increased by motivating them.
- Learners should be encouraged to try harder in case of failure insead of giving up.
- Students should be encouragered to improve intrinsic goal orientation.
- Since rehearsal had a significant negative relationship with achievement, teachers should emphasise meaningful learning rather than rote learning.

Therefore, learners should be encouraged to learn chemistry concepts without memorizing.

- Learners critical thinking abilities should be improved.
- Experts, teachers and school administration should be aware of the test anxiety and take some precautions to decrease stress.
- Teachers should not overemphasize exam and not make difficult items to finish. It may promote anxiety and rote learning.
- Students should know that self-improvement is important than performing better among class.
- Teachers may try to vary teaching strategies and materials and use them properly instead of textbook definitions to motivate the students in the classroom.

5.4 Recommendations

Based on the study, these suggestions may be proposed for further studies;

- Based on literature review, there are few studies about the relationship between self-regulation and chemistry achievement and no studies were not found regarding physics courses. Further studies can examine high school level science courses in detail.
- In order to investigate effect of different teaching method on self-regulation, experimental studies can be conducted especially in primary schools since they are in the beginning of educational life.
- Motivational beliefs, learning strategy usage may be investigated qualitatively.
- Motivational beliefs, cognitive and metacognitive self-regulatory strategies are different in accordance with task, course or grade level, therefore different courses can be investigated.
- This study focused on 12^{th} grade students, further studies may focus on different grade level or cross-age study may conduct to understand self-regulation clearly.

- The item in the study covers 9^{th}, 10^{th} and 11^{th} grade chemistry curriculum topics, further researchs may concentrate only one grade level or only one specific topic in the curriculum.
- The sample size of the study is 161 students, for furher more sample can be selected.
- In this study, gender is not considered, for further studies how learning strategies and motivational beliefs are affected by gender can be investigated.
- To generalize the result in Turkey, further studies may be conducted on different cities.
- Metacognitive self-regulatory learning strategy results are inconsistent, further studies may focus on this topic specifically.

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APPENDICES

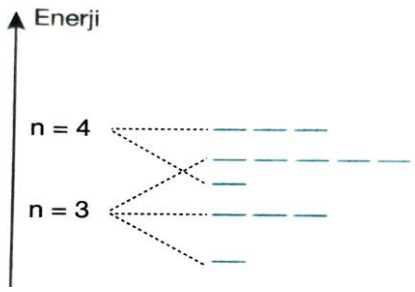
A. CHEMISTRY ACHIEVEMENT TEST

1. *Rutherford yaptığı alfa ışınları saçılma deneyinde ışınların büyük bir kısmının hiçbir sapmaya uğramadan ekranda iz bıraktığını ancak çok küçük bir kısmının ise sapmaya uğradığını gözlemlemiştir.*

Bu gözleme göre Rutherford aşağıdaki sonuçlardan hangisini elde etmiş olabilir?

A. Elektronların düşük enerjiden yüksek enerjiye doğru sıralandığını
B. Çekirdeğin pozitif yüklü, atomun merkezinde ve çok yoğun olduğunu*
C. Her atomun kendisine özgü bir pozitif yükü olduğunu
D. Atomlarda bulunan yüksüz taneciklerin sayılarını
E. Elektronların hareketini

2.



Yukarıda kabuk (n) ve alt enerji düzeyinde bulunacak elektron enerjileri verilmiştir.

Buna göre;

I. Baş kuantum sayısı (n) 3 olan üç tür orbital bulunur.
II. 3d orbitalinin enerjisi 4s orbitalinin enerjisinden yüksektir.
III. Yan kuantum sayısı (ℓ) 0 olan orbitallerin baş kuantum sayısı arttıkça enerjisi artar.

Yargılarından hangisi veya hangileri doğrudur?

A. Yalnız I B. Yalnız II C. I ve II

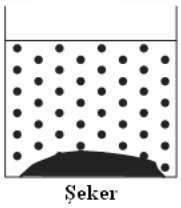
D. II ve III E. I, II ve III*

3. *Amalgam, civanın diğer metaller ile yaptığı bir alaşımdır ve kullanılan metale göre adlandırılır. Endüstri, sağlık, kimya gibi birçok sektörde kullanılan amalgamlar arasında gümüş amalgamı en yaygın olanıdır ve diş hekimliğinde dolgu maddesi olarak kullanılır.*

Bu bilgilere göre, amalgamlar ile ilgili olarak aşağıdaki ifadelerden hangisi doğrudur?

A. Amalgamı oluşturan maddeler özelliklerini kaybederler.
B. Sıvı halde olmadıkları için çözelti değillerdir.
C. Fiziksel ayırma yöntemleri ile bileşenlerine ayrılamazlar.
D. Saf madde değillerdir.*
E. Adi karışıma örnek olarak verilebilirler.

4. Oda sıcaklığında bulunan yandaki kabın içerisinde şekerli su çözeltisi bulunmaktadır.
Kabın dibinde çözünmeden kalan şeker çözeltinin bir bileşeni değildir. **Bunun nedeni aşağıdakilerden hangisidir?**



A. Aşırı doymuş çözeltilerin dibinde çökelek oluşur.
B. Çözelti karıştırılmadığında çözünme olmaz.
C. Su çözebileceği en fazla maddeyi çözmüştür.
D. Su sıcak olmadığı için şeker çözünmez.
E. Çözelti karıştırıldığında daha fazla şeker dibe çöker.

5. *Aynı ortamda bulunan iki sıvı karıştırıldığında iki farklı tabaka oluşmaktadır.*

Bu sıvıların birbirinden ayrılmasıyla ilgili aşağıda verilen bilgilerden hangisi doğrudur?

A. Tanecik boyutu farkına göre birbirinden ayrılabilirler.
B. Toplama kabına aktarılan maddenin yoğunluğu diğerinden daha küçüktür.
C. Ayırma hunisi yardımıyla birbirinden ayrılabilirler*
D. Yoğunluğu diğerinden küçük olan sıvı ilk olarak ayrılır.
E. İki sıvı olduğu için özütleme yoluyla ayrılabilirler.

6. **Aşağıdakilerden hangisi katalizörü <u>en iyi</u> tanımlar?**

A. Kimyasal tepkimelerde ürün verimini arttıran maddedir.
B. Tepkimeye girerek hiçbir değişikliğe uğramadan tekrar oluşan ve tepkimenin hızını arttıran maddedir.*
C. Aktivasyon enerjini artırarak, tepkime hızını artıran maddedir.
D. Sadece ileri yöndeki tepkimenin hızını arttıran maddedir.
E. Tepkimeye girmeden tepkimenin hızını arttıran maddedir.

7.

I. Aktifleşme enerjisi ne kadar fazla olursa tepkime o kadar hızlı gerçekleşir.
II. Ekzotermik tepkimelerin aktifleşme enerjisi endotermik tepkimelerden daha düşüktür.
III. Yüksek sıcaklıkta aktifleşme enerjisini aşan tanecik sayısı artar.

Yukarıda aktifleşme enerjisi ile ilgili verilen bilgilerden hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız III C. I ve II

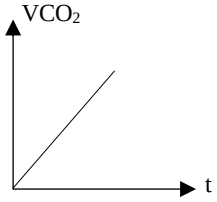
D. II ve III E. I, II ve III

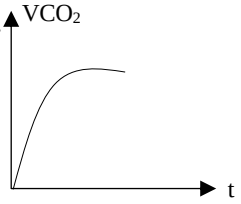
8. Aşağıdaki olaylardan hangisi atom ya da moleküllerin hareketiyle **açıklanamaz?**

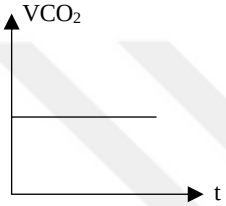
A. Benzin dolu bidonun kapağı açıldığında, benzin kokusunun odanın her tarafına yayılması
B. Bardaktaki suya damlatılan mürekkebin dağılarak suya renk vermesi
C. Şişe mantarının suyun yüzeyinde kalması
D. Rüzgârlı havalarda rüzgâr gülünün dönmesi
E. Giysi sandığının kapağı açılığında buruna gelen keskin naftalin kokusu

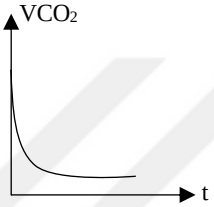
9. $CaCO_{3(k)} + 2HCl_{(suda)} \rightarrow CaCl_{2(suda)} + H_2O_{(s)} + CO_{2_{(g)}}$

tepkimesinde oluşan CO_2 gazının hacmi ile zaman arasındaki grafik aşağıdakilerden hangisidir (tepkime kapalı kapta gerçekleşmektedir)?

A.


*B.


C.


D.


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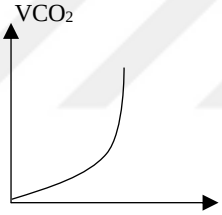
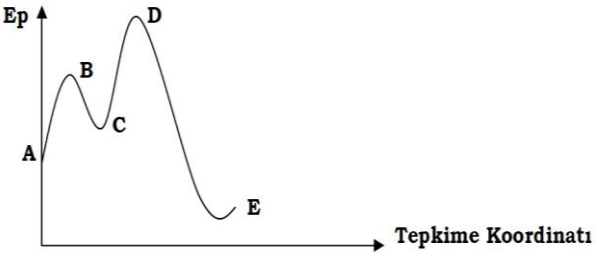


10.



Yukarıda potansiyel enerji (Ep) ve tepkime koordinatı grafiği verilen tepkime için aşağıda verilen ifadelerden hangisi doğrudur?

A. A → C tepkimesi hızı belirleyen adımdır.
B. B ve D katalizördür.
C. C ara üründür.*
D. A → E tepkimesi için ΔH > 0'dır.
E. Tepkime 3 adımlıdır.

11. *Bir kimyasal tepkime için t_1, t_2 ve t_3 zaman aralıklarında yapılan ölçümlerde ileri ve geri yöndeki tepkime sonuçları için aşağıdaki sonuçlar elde edilmiştir.*

- *t_1 anında $v_i > v_g$*
- *t_2 anında $v_g > v_i$*
- *t_3 anında $v_i = v_g$*

Bu tepkime ile ilgili aşağıdaki yargılardan hangileri doğrudur? (v_i: ileri tepkime hızı, v_g: geri tepkime hızı)

A. t_3 anında sistem dengededir çünkü ileri ve geri tepkime hızları eşit olup tepkime tamamlanmıştır.
B. t_2 anında sistem dengededir çünkü geri tepkime hızı ileri tepkime hızından büyüktür.
C. t_3 anında sistem dengededir çünkü ileri ve geri tepkime hızları birbirine eşittir.*
D. t_3 anında sistem dengede değildir çünkü ileri ve geri tepkime hızları eşittir.
E. İleri ve geri tepkime hızları sistemin dengede olup olmadığı hakkında bilgi vermediğinden t_1, t_2 ve t_3 anları için yorum yapılamaz.

12. **Bir miktar buz eridiğinde oluşan sıvı kütlesi hakkında aşağıda verilenlerden hangisi doğrudur?**

A. Toplam kütle aynı kalır sadece moleküller arasındaki uzaklık değişir.*
B. Katıların kütlesi sıvıların kütlesinden daima daha fazla olacağından toplam kütle azalır.
C. Sıvı halinin hacmi daha az olduğundan toplam kütle azalır.
D. Sıvı halinin hacmi daha fazla olduğundan toplam kütle artar.
E. Sıvı halinin tanecikleri daha küçük olduğundan toplam kütle azalır.

13. **Elektronların hareketi ile ilgili olarak aşağıdakilerden hangisi günümüzde kabul edilen modern atom teorisi ile uygunluk göstermektedir?**

A. Elektronlar pozitif yüklü küre içinde homojen olarak dağılmışlardır.
B. Elektronlar çekirdeğin etrafında dairesel yörüngelerde hareket ederler.
C. Elektronların çekirdeğin etrafında bulunma ihtimalinin yüksek olduğu bölgeler vardır.*
D. Elektronlar çekirdeğin etrafında belirli enerji düzeylerinde bulunur.
E. Elektronlar atomun çekirdeğinde bulunurlar.

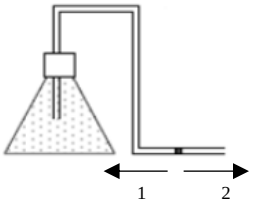
14. **Havanın özellikleri ile ilgili aşağıdaki yargılardan hangisi doğrudur?**

A. Sıcak hava soğuk havadan daha hafiftir.
B. Sıcak hava soğuk havadan daha ağırdır.
C. Havanın kütlesi de hacmi de yoktur, sıcak ya da soğuk olması etkilemez.
D. Sıcak hava ile soğuk hava farklı hacimlere fakat aynı kütleye sahiptirler.*
E. Sıcak havayı oluşturan tanecikler genleşir, soğuk hava tanecikleri ise büzülür.

15. *Atmosfer basıncının P_{atm} olduğu bir ortamda hava ile dolu elastik olmayan bir balonun basıncı P_{dolu} olarak ölçülmektedir. Balonun ağzı açılıp sönmesi beklenmektedir ve sönmüş balonun basıncı $P_{sönmüş}$ olarak ölçülmektedir.*
P_{dolu}, P_{atm} ve $P_{sönmüş}$ basınçları arasındaki ilişki aşağıdakilerden hangisinde doğru verilmiştir?

A. $P_{sönmüş} < P_{atm} < P_{dolu}$
B. $P_{sönmüş} = P_{atm}$, $P_{atm} < P_{dolu}$*
C. $P_{atm} = P_{dolu} = P_{sönmüş}$
D. $P_{atm} > P_{dolu}$, $P_{sönmüş} = 0$
E. $P_{atm} < P_{dolu}$, $P_{sönmüş} = 0$

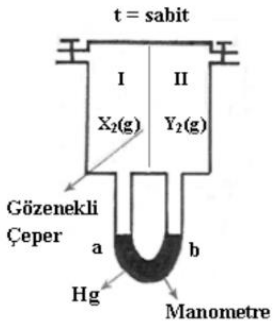
16. *Şekilde verilen sistemde cam borunun içerisinde bir damla cıva bulunmaktadır. Kabın içindeki basınç ve sıcaklık değişimine bağlı olarak cıva sağa veya sola doğru hareket etmektedir.*



Eğer düzenek sıcaklığı 25℃ oda sıcaklığından 5 ℃ sıcaklığındaki ortama götürülürse cıvanın hareketi ile ilgili aşağıdakilerden hangisi doğru olur?

A. Hareketsiz kalır çünkü açık hava basıncı sabittir.
B. Önce 1 yönüne sonra 2 yönüne hareket eder.
C. 1 yönüne hareket eder çünkü sıcaklık azaldığında kaptaki basınç da azalır.*
D. 2 yönüne hareket eder çünkü, sıcaklık azaldığında kabın içerisindeki basınç azalır ve hacim artar.
E. 2 yönüne hareket eder çünkü, sıcaklık azaldığında hacim azalır ve kaptaki basınç da artar.

17. Şekilde görüldüğü gibi bir kap gözenekli bir çeper ile I ve II bölmelerine ayrılarak manometreye bağlanıyor. *Manometrenin kollarındaki cıva seviyeleri aynı olacak şekilde kabın I. bölmesine X_2 gazı, II. bölmesine Y_2 gazı dolduruluyor. Aynı sıcaklıkta çok kısa bir süre sonra manometrenin a kolunda cıva seviyesinin yükseldiği gözlemleniyor.*



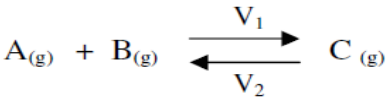
Bu gözleme göre, X_2 ve Y_2 gazları ile ilgili;

I. X_2 molekülleri Y_2 moleküllerinden hızlıdır.
II. Y_2 gazının mol kütlesi, X_2 gazınınkinden büyüktür.
III. Gözlem sırasında II. kabın toplam basıncı artmıştır.

yargılarından hangileri doğrudur?

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

18. *A, B ve C gazları sabit hacimli bir kapta;*



tepkimesine göre dengede bulunmaktadır. Bu kaba aynı sıcaklıkta C gazı ekleniyor. **Bozulan denge yeniden sağlandığında ileri ve geri tepkime hızlarının ilk dengeye göre değişimi ve denge derişimleri ile ilgili olarak aşağıdaki ifadelerden hangileri doğrudur?** (V_1: ileri tepkime hızı, V_2: geri tepkime hızı)

A. Geri tepkimenin hızı artarken, ileri tepkimenin hızı azalır çünkü denge girenler lehine kaymıştır.
B. Geri tepkimenin hızı artarken, ileri tepkimenin hızı değişmez çünkü denge girenler lehine kaymıştır.
C. Hem ileri hem de geri tepkime hızı artar çünkü hem girenler hem de ürünlerin derişimleri azalmıştır.
D. Hem ileri hem de geri tepkime hızı artar çünkü hem girenler hem de ürünlerin derişimleri artmıştır.*
E. Hem ileri hem de geri tepkimenin hızı azalır çünkü hem girenler hem de ürünlerin derişimi artmıştır.

19. *Farklı iki kapta eşit hacimlerde zayıf baz ve kuvvetli baz çözeltileri vardır*. **Bu kaplardan hangisinin kuvvetli baz çözeltisi olduğunu anlamak için aşağıdakilerden hangisinin verilmesi tek başına yeterlidir?**
A. Çözeltilerin pOH değerleri
B. Çözeltilerin pH değerleri
C. Çözeltilerin derişimleri
D. Çözeltilerdeki bazların iyonlaşma yüzdeleri*
E. Çözeltilerdeki toplam iyon sayıları

20. *ClF molekülünde, klor ile flor arasındaki bağlar polar kovalent bağ olarak adlandırılır*. **Bunun nedenini aşağıdaki ifadelerden hangisi en iyi tanımlar?**
A. Klor ve Flor bileşiklerinde negatif yüklü olduğu için aralarında iyonik bağ yoktur ve bağ %100 kovalenttir.
B. İki atomun elektronegatiflikleri farklıdır. *
C. Cl – F bağı için her iki element de bir elektron paylaşırlar.
D. Klor elementinin Flordan daha fazla elektronu vardır.
E. Klor elementinin çapı Flordan büyüktür.

21. *Hareketli sürtünmesiz pistonlu bir kapta, belirli sıcaklıkta;*

$2NO_2(g) \rightleftharpoons N_2O_4(g)$
(kahverengi) (renksiz)

tepkimesi dengededir. Bu tepkimenin sıcaklığı artırıldığında rengi koyulaşmaktadır.

Buna göre aşağıda verilen ifadelerden hangisi doğrudur?

A. 50 ℃'deki molekül sayısı 20 ℃'den azdır çünkü ekzotermik bir tepkime olduğundan sıcaklık artırıldığında denge girenler yönüne kayar.
B. 50 ℃'deki molekül sayısı 20 ℃'den azdır çünkü endotermik bir tepkime olduğundan sıcaklık artırıldığında denge ürünler yönüne kayar.
C. 50 ℃'deki molekül sayısı 20 ℃'den fazladır çünkü endotermik bir tepkime olduğundan sıcaklık artırıldığında denge girenler yönüne kayar.
D. 50 ℃'deki molekül sayısı 20 ℃'den fazladır çünkü ekzotermik bir tepkime olduğundan sıcaklık artırıldığında denge girenler yönüne kayar.*
E. 50 ℃'deki molekül sayısı ile 20 ℃'deki molekül sayısı aynıdır çünkü sıcaklık değişimi dengenin konumunu değiştirmez.

22. *NH_3 için $K_b = 1{,}8.10^{-5}$*
CH_3COOH için $K_a = 1{,}8.10^{-5}$
KOH için K_b= çok büyük
HCl için K_a= çok büyük

Oda koşullarında hazırlanan CH_3COOK, KCl ve NH_4Cl tuzlarının eşit derişimli sulu çözeltileri için;

I. CH_3COOK çözeltisinin pH değeri 7'den büyüktür.
II. KCl çözeltisi elektrik akımını iletmez.
III. NH_4Cl çözeltisinin pH değeri 7'den küçüktür.

yargılarından hangileri doğrudur?

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

23. *Yanma reaksiyonları için*

I. Tüm yanma reaksiyonları için oksijen gazı gereklidir.
II. Bütün yanma reaksiyonları kendiliğinden gerçekleşir.
III. Ateş ve alev olmayan bir reaksiyon yanma reaksiyonu değildir.

ifadelerinden hangisi/hangileri <u>yanlıştır</u>?

A. Yalnız II B. Yalnız III C. I ve II

D. II ve III* E. I, II ve III

24. *Oda koşullarında bulunan saf X(k) maddesi elektriği iletebilmektedir.*
Buna göre, X(k) maddesi ile ilgili;
I. Tel ve levha haline getirilebilir.
II. Asitlerle tepkimesinden H_2 gazı açığa çıkar.
III. Kovalent kristaldir.
ifadelerinden hangilerinin doğruluğu kesin değildir?
A. Yalnız I B. Yalnız II C. Yalnız III
D. II ve III E. I, II ve III*

25. **Bazik çözeltiler için, aşağıdakilerden hangisi <u>her zaman</u> doğrudur?**

A. Renkleri mavidir.
B. Mavi turnusol kağıdını kırmızıya çevirirler.
C. Elektriği iletirler. *
D. Asit üretiminde kullanılırlar.
E. Zararlı değillerdir.

26.

I. Sıcaklık bir nesneden diğerine geçebilir.
II. Isıtılan nesnelerde ısı emişi nesnenin kütlesine bağlıdır.
III. Bir tepkimede girenler kısmına yazılan enerji aktivasyon enerjisidir.
IV. Ekzotermik bir tepkimede girenlerin potansiyel enerjileri toplamı ürünlerinkinden büyüktür.

Yukarıdaki ifadelerden hangisi ya da hangileri doğrudur?

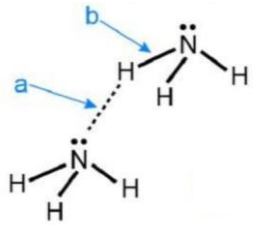
A) Yalnız IV B) I ve II C) II ve IV*

D) I, II ve IV E) I, II ve III

27. *Laboratuvarda, içerisinde derişik hidroklorik asit ve derişik sülfürik asit çözeltisi oldukları bilinen ancak üzerinde etiketleri olmayan iki şişe bulunmaktadır.* **Bu şişeleri içerdikleri asitler açısından doğru şekilde etiketlemek için aşağıdakilerden hangisinin yapılması uygundur?**

A. Çözeltilerin pH değerlerini belirlemek
B. Potas kostik üzerindeki etkilerini incelemek
C. Sönmüş kireç üzerindeki etkilerini incelemek
D. Cıva metali üzerindeki etkilerini incelemek*
E. Magnezyum metali üzerindeki etkilerini incelemek

28.



Sıvı haldeki amonyakta atomlar ve moleküller arasındaki etkileşimler yukarıdaki şekilde modellenmiştir.

Buna göre modelde gösterilen etkileşimlerle ilgili;

I. b etkileşimi hidrojen bağı olarak adlandırılır.
II. a etkileşiminde en baskın olan dipol – dipol etkileşimidir.
III. b etkileşimi a etkileşiminden güçlüdür.

İfadelerinden hangileri doğrudur?

A. Yalnız I B. Yalnız III* C. I ve II

D. II ve III E. I, II ve III

29.

I. Sabit bir sıcaklıkta sisteme verilen ısı, sistemin potansiyel enerjisini artırır.
II. Kimyasal reaksiyonların gerçekleşebilmesi için ısı vermek gibi her zaman dışarıdan bir etkide bulunmak gerekir.
III. Kendiliğinden gerçekleşen bütün reaksiyonlar ekzotermiktir.

Yukarıda verilen ifadelerden hangisi ya da hangileri <u>her zaman</u> doğrudur?

A. Yalnız I* B. Yalnız II C. Yalnız III

D. I ve III E. I, II ve III

B. MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

ÖĞRENMEDE GÜDÜSEL STRATEJİLER ANKETİ

Bu anket iki kısımdan oluşmaktadır. İlk kısımda kimya dersine tutumunuzu, motivasyonunuzu ikinci kısımda ise kimya dersinde kullandığınız öğrenme ve çalışma becerilerini belirlemeye yönelik ifadeler yer almaktadır. Cevap verirken aşağıdaki ölçeği göz önüne alınız. Eğer ifadenin sizi tam olarak yansıttığını düşünüyorsanız 7'yi yuvarlak içine alınız. Eğer ifadenin sizi hiç yansıtmadığını düşünüyorsanız 1'i yuvarlak içine alınız. Bu iki durum dışında ise 1 ile 7 arasında sizi en iyi tanımladığını düşündüğünüz numarayı yuvarlak içine alınız. Unutmayın, bu ankette doğru veya yanlış cevap yoktur, yapmanız gereken sadece sizi en iyi tanımlayacak numarayı yuvarlak içerisine almanızdır. Tüm seçenekleri okuyup cevaplandırmanız araştırmanın geçerliliği için büyük önem taşımaktadır.

1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7

beni hiç yansıtmıyor — beni tam olarak yansıtıyor

A. MOTİVASYON (GÜDÜLENME)

		Beni hiç yansıtmıyor						Beni tam olarak yansıtıyor
1.	Kimya dersinde yeni bilgiler öğrenebilmek için, büyük çaba gerektiren sınıf çalışmalarını tercih ederim.	1	2	3	4	5	6	7
2.	Eğer uygun şekilde çalışırsam, kimya dersindeki konuları öğrenebilirim.	1	2	3	4	5	6	7
3.	Kimya sınavları sırasında, diğer arkadaşlarıma göre soruları ne kadar iyi yanıtlayıp yanıtlayamadığımı düşünürüm.	1	2	3	4	5	6	7
4.	Kimya dersinde öğrendiklerimi başka derslerde de kullanabileceğimi düşünüyorum.	1	2	3	4	5	6	7
5.	Kimya dersinden çok iyi bir not alacağımı düşünüyorum.	1	2	3	4	5	6	7
6.	Kimya dersi ile ilgili okumalarda yer alan en zor konuyu bile anlayabileceğimden eminim.	1	2	3	4	5	6	7
7.	Benim için şu an kimya dersi ile ilgili en tatmin edici şey iyi bir not getirmektir.	1	2	3	4	5	6	7

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

B. ÖĞRENME STRATEJİLERİ

		Beni hiç yansıtmıyor						Beni tam olarak yansıtıyor
32.	Kimya dersi ile ilgili bir şeyler okurken, düşüncelerimi organize etmek için konuların ana başlıklarını çıkarırım.	1	2	3	4	5	6	7
33.	Kimya dersi sırasında başka şeyler düşündüğüm için önemli kısımları sıklıkla kaçırırım.	1	2	3	4	5	6	7
34.	Kimya 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.	Kimya dersi ile ilgili bir şeyler okurken, okuduklarıma odaklanabilmek için sorular oluştururum.	1	2	3	4	5	6	7
37.	Kimya 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.	Kimya dersiyle ilgili duyduklarımı ya da okuduklarımı ne kadar gerçekçi olduklarına karar vermek için sıklıkla sorgularım.	1	2	3	4	5	6	7
39.	Kimya dersine çalışırken, önemli bilgileri içimden defalarca tekrar ederim.	1	2	3	4	5	6	7
40.	Kimya dersinde bir konuyu anlamakta zorluk çeksem bile hiç kimseden yardım almaksızın kendi kendime çalışırım.	1	2	3	4	5	6	7
41.	Kimya dersi ile ilgili bir şeyler okurken bir konuda kafam karışırsa, başa döner ve anlamak için çaba gösteririm.	1	2	3	4	5	6	7
42.	Kimya dersine çalışırken, daha önce okuduklarımı ve aldığım notları gözden geçirir ve en önemli noktaları belirlemeye çalışırım.	1	2	3	4	5	6	7
43.	Kimya dersine çalışmak için ayırdığım zamanı iyi değerlendirebiliyorum.	1	2	3	4	5	6	7
44.	Eğer kimya dersi ile ilgili okumam gereken konuları anlamakta zorlanıyorsam, okuma stratejimi değiştiririm.	1	2	3	4	5	6	7
45.	Kimya dersinde verilen ödevleri tamamlamak için sınıftaki diğer öğrencilerle çalışırım.	1	2	3	4	5	6	7

46.	Kimya 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.	Kimya 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.	Kimya dersine çalışırken konuları sınıftaki arkadaşlarımla tartışmak için sıklıkla zaman ayırırım.	1	2	3	4	5	6	7
51.	Kimya 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.	Kimya 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.	Kimya dersinde islenen 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.	Kimya 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.	Kimya dersine çalışırken, konuları sadece okuyup geçmek yerine ne öğrenmem gerektiği konusunda düşünmeye çalışırım.	1	2	3	4	5	6	7

62.	Mümkün olduğunca kimya dersinde öğrendiklerimle diğer derslerde öğrendiklerim arasında bağlantı kurmaya çalışırım.	1	2	3	4	5	6	7
63.	Kimya dersine çalışırken notlarımı gözden geçirir ve önemli kavramların bir listesini çıkarırım.	1	2	3	4	5	6	7
64.	Kimya 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.	Kimya dersinde öğrendiklerimle ilgili ortaya çıkan fikirlerimi sürekli olarak gözden geçirmeye çalışırım.	1	2	3	4	5	6	7
67.	Kimya dersine çalışırken, dersle ilgili okuduklarımı ve derste aldığım notları inceleyerek önemli noktaların özetini çıkarırım.	1	2	3	4	5	6	7
68.	Kimya dersinde bir konuyu anlayamazsam sınıftaki başka bir öğrenciden yardım isterim.	1	2	3	4	5	6	7
69.	Kimya dersiyle ilgili konuları, ders sırasında öğrendiklerim ve okuduklarım arasında bağlantılar kurarak anlamaya çalışırım.	1	2	3	4	5	6	7
70.	Kimya derslerinde verilen ödevleri ve derse ilgili okumaları zamanında yaparım.	1	2	3	4	5	6	7
71.	Kimya dersindeki konularla ilgili bir iddia ya da varılan bir sonucu her okuduğumda veya duyduğumda olası alternatifler üzerinde düşünürüm.	1	2	3	4	5	6	7
72.	Kimya dersinde önemli kavramların listesini çıkarır ve bu listeyi ezberlerim.	1	2	3	4	5	6	7
73.	Kimya 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.	Kimya dersine çalışırken iyi anlamadığım kavramları belirlemeye çalışırım.	1	2	3	4	5	6	7
77.	Başka faaliyetlerle uğraştığım için çoğu zaman kimya dersine yeterince zaman ayıramıyorum.	1	2	3	4	5	6	7
78.	Kimya 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.	Kimya sınavından önce notlarımı ya da okuduklarımı gözden geçirmek için fazla zaman bulamam.	1	2	3	4	5	6	7
81.	Kimya dersinde, okuduklarımdan edindiğim fikirleri sınıf içi tartışma gibi çeşitli faaliyetlerde kullanmaya çalışırım.	1	2	3	4	5	6	7

C. ETHICAL PERMISSIONS

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

Sayı : E-14588481-605.99-35740172 28.10.2021
Konu : Araştırma İzni

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Öğrenci İşleri Daire Başkanlığı)

İlgi : a)MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 2020/2 nolu Genelgesi.
b)13.10.2021 tarihli ve 238 sayılı yazınız.

Üniversiteniz Fen Bilimleri Ana Bilim Dalı, Fen Bilimleri Eğitimi Yüksek Lisans programı öğrencisi Hülya Gizem URLU'nun **"Lise Öğrencilerinin Kimya Başarısı ile Öz Düzenlemeleri Arasındaki İlişkinin İncelenmesi"** konulu çalışması kapsamında İlimiz 25 ilçesindeki Liselerde, uygulama talebi ilgi (a) Genelge çerçevesinde incelenmiştir.

Yapılan inceleme sonucunda, söz konusu araştırmanın Müdürlüğümüzde muhafaza edilen ölçme araçlarının; Türkiye Cumhuriyeti Anayasası, Milli Eğitim Temel Kanunu ile Türk Milli Eğitiminin genel amaçlarına uygun olarak, ilgili yasal düzenlemelerde belirtilen ilke, esas ve amaçlara aykırılık teşkil etmeyecek, eğitim-öğretim faaliyetlerini aksatmayacak şekilde okul ve kurum yöneticilerinin sorumluluğunda gönüllülük esasına göre uygulanması Müdürlüğümüzce uygun görülmüştür.

Bilgilerinizi ve gereğini rica ederim.

Harun FATSA
Vali a.
Milli Eğitim Müdürü

Dağıtım:
Gereği: Bilgi:
Orta Doğu Teknik Üniversitesi 25 İlçe MEM

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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06 AĞUSTOS 2021

Konu : Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi : İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Yezdan Boz

Danışmanlığını yaptığınız Hülya Gizem Urlu'nun "Lise Öğrencilerinin Kimya Başarısı ile Özdüzenlemeleri Arasındaki İlişkinin İncelenmesi" başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **332-ODTU-2021** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof. Dr. Mine MISIRLISOY
İAEK Başkan