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The Sources of Cognitive and Metacognitive Strategies Used By 7th Grade Students While Reading the ” Cells and Divisions " Unit

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Abstract

The purpose of this research is to determine the sources of cognitive and metacognitive strategies that 7th-grade students use when studying the “Cell and Divisions” unit that belongs to the field of Biology. In the study, the case study which is one of the qualitative research methods was used. A total of 6 students from 3 different secondary schools in Kars participated in the study. In the research, 6 7th grade students who study in 3 different secondary schools read the "Cell and Divisions" unit in the 7th grade Science Textbook. Students were observed by the researcher in their process of reading this unit. Students were asked to think aloud to determine the cognitive and metacognitive strategies used in the process of reading the unit. To determine whether the strategies used in reading the unit are cognitive or metacognitive, and to determine the sources (from, where or how) of these cognitive and transcriptional strategies they are using, semi-structured interviews were conducted with them immediately after reading the unit. The observation records of the students' reading process of the unit and transcripts of the data obtained from the semi-structured interviews with the students after reading the unit were made. The transcripts of the data were analyzed. According to the results of the research; It was determined that the sources of the cognitive strategies used by the two students who study in the 1st secondary school and have high grade point averages while reading the "Cell and Divisions" unit were themselves and their teachers and the sources of metacognitive strategies of them were their teachers and friends. It was determined that the sources of the cognitive and metacognitive strategies used by the two students who study in the 2nd secondary school and have medium grade point averages were only themselves. It was determined that the sources of the cognitive strategies used by the two students who study in the 3rd school and have low grade point averages were only themselves, But it was determined that the sources of the metacognitive strategies of one student were himself/herself but since the other student did not use metacognitive strategies the sources of the strategies could not be determined.

Keywords: Cognitive and Metacognitive Strategies, Cell and Division Unit, Reading Strategies.

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INTRODUCTION

The rapid change in science and technology, the changing needs of the individual and society, the innovations and developments in learning-teaching theories and approaches directly affected the roles expected from individuals. Today's educational programs have been prepared in a simple and comprehensible structure that takes into account individual differences rather than a structure that conveys information. In this way, it is integrated around values, skills, and competencies that guide students to the use of metacognitive skills (MEB, 2018). Metacognitive skills are in the form of systematizing individuals' metacognitive information, understanding their own cognitive activities, and planning them within a framework (Schraw and Moshman, 1995). Metacognitive information and skills bring the concept of "metacognition" to the mind. Metacognition, is the awareness of personal knowledge about the individual's mental process, reflection of the cognition and individual's thinking about himself/herself, organization of the cognition, information about the organization of the task that learner's required to handle to get the best use of information of learning process and outputs. (Flavell, 1976, Flavell, 1979; Brown and Palincsar, 1982; Brown, 1987; Lin, 2001; Schön, 1987; Winnie and Perry, 2000; Georgiades, 2004). Some researchers (Chi, 1987; Flavell, 1979; Nelson, 1996; Schraw and Moshman, 1995) have made classifications related to metacognition to provide a common perspective on metacognition. In one of these classifications, Schraw and Moshman (1995) mentioned the types of declarative knowledge, procedural knowledge, and conditional knowledge. Declarative knowledge is the knowledge of the individual as a learner about himself or herself and what factors affect his or her performance. Procedural knowledge includes knowledge about what strategies an individual can use in mental activity. Conditional knowledge is the knowledge that reveals in detail where, when, and how an individual uses the information revealed by his / her declarative and procedural knowledge (Schraw and Moshman, 1995). According to Garner (1987), metacognitive information is the basis of the metacognitive experiences that drive the use of cognitive and metacognitive strategies. According to Flavell (1979), metacognitive experiences occur in situations where there is a high level of conscious thinking that requires a lot of attention. According to Flavell (1979), they activate metacognitive experiences, cognitive and metacognitive strategies. A cognitive strategy is an action that enhances cognitive purpose-oriented knowledge. A metacognitive strategy is to evaluate the information for the metacognitive purpose by creating another metacognitive experience. According to Flavell (1976; 1979) and Livingstone (1997), cognitive and metacognitive strategies have a grift structure. Therefore, a strategy can be cognitive or metacognitive according to its intended use. According to Flavell (1979), the most basic way to distinguish between cognitive strategies and cognitive strategies is to look at the intended use of the strategy. According to researchers, if a strategy is used to execute mental processes it is cognitive; if it is used to control, monitor, or evaluate any part of the solution process, it is classified as a metacognitive strategy (Flavell, 1976, 1979; Livingstone, 1997). Metacognitive in reading and reading comprehension include; "the requirements of the different reading requirements, reading comprehension strategies, an individual learner with information about weak and strong aspects of himself and using this information to control processes when reading for different purposes reading activities" (Brown, Armbruster and Baker, 1986). Some researchers (Anastasiou and Grive, 2009; Ghonsooly and Eghtesadee, 2006; Taraban, 2004; Winne, 1996; Alderman, Klein, Seeley and Sanders, 1993; Blakey and Spence, 1990; Cope, 1990; Çakıroğlu, 2007; Robinson, 1970; Weir, 1999) have identified the reading strategies that individuals use in their reading processes. Some of these researchers considered reading strategies cognitively to carry out only partial mental processes (Anastasiou and Grive, 2009; Ghonsooly and Eghtesadee, 2006; Taraban, 2004; Winne, 1996). Another group of researchers examined reading strategies as strategies for controlling partial mental processes. In other words, the strategies in these processes have been addressed as metacognitive (Alderman, Klein, Seeley and Sanders, 1993; Blakey and Spence, 1990; Cope, 1990; Çakıroğlu, 2007; Robinson, 1970; Weir, 1999). Some researchers have also examined the strategies that individuals use for reading by separating them into cognitive and metacognitive forms (O'Malley and Chamot, 1990; Sandy, 2012). Reading strategies are activities that enable a person to develop both in terms of knowledge and cognitive due to the fact that there are cognitive processes that work when reading comprehension is a problem. The fact that our education system has strategic readers is also important in terms of improving the quality of the educational environment (Topuzkanamış and Maltepe, 2010). Reading strategies are important when students read and understand a text, as well as where, from who or how they learn the reading

strategies they use when reading these texts, i.e. the sources of these strategies, are of great importance. In fact, Pesa and Somers (2017) found that in their research, students were unable to use their reading comprehension strategies without being guided or given clues. In the light of the research, it was aimed to determine the cognitive and metacognitive strategies used by the students in reading the "Cells and Divisions" unit which belongs to the field of Biology learning and the sources of these strategies. In this research, it is thought that it may be more effective and possible to teach strategies to students at all grade levels with the help of these resources through cognitive and metacognitive strategies that can help students understand what they are reading by identifying the sources of these strategies.

METHOD

1. Research Pattern

In this study, students who have different general grade point averages in different secondary schools belong to the biology learning area and The cognitive and metacognitive strategies they used in reading the "Cells and Divisions" unit in the 7th-grade science textbook were determined from whom, where or how they learned these strategies, the sources of the strategies. " Cells and Division" Unit was selected from the 7th-grade science textbook. Besides, during the determination of this unit, the views of science teachers and faculty members who are experts in the field of Biology learning were applied. In qualitative research, 7th-grade students were focused. Besides, the research has been privatized as a "case study". This research was determined as a holistic multiple case study (Yin, 2003), in which each case was covered holistically and then compared to each other (Yıldırım and Şimşek, 2006). The research focused on 6 students selected from 3 different secondary schools. These students formed the cases of the research. In this study, the cognitive and metacognitive strategies used by the students while studying the unit and the sources of these strategies, i.e., qualitative data about who, where or how the students learned these strategies were collected. Then the patterns between these situations were looked at.

2. Participants

6 7th-grade students educating in 3 different secondary schools in Kars with different general grade point averages consist the participants of the study. These students were determined on the basis of the "maximum diversity principle" laid down by Patton (2002). When these students were selected, their overall grade point average in the secondary school they studied was taken advantage of by teacher opinions. The overall ranking of 3 different secondary schools in Kars was taken into consideration in the High School Entrance Exam (LGS) conducted in 2019. After the decision was made to the secondary schools where the research was conducted, the recommendations of all the teachers in these secondary schools, the overall grade point average of the applied students in the school, while studying the "cells and divisions" unit in the 7th-grade science textbook, attention was paid to the selection of data providers rich in cognitive and metacognitive strategy uses from these students. The students who participated in the research were determined voluntarily. In the study, the real names of secondary schools and students were kept secret and the secondary schools were named as "1st Secondary School, 2nd Secondary School, 3rd Secondary School" and the students in these secondary schools were named as; "1st Student, 2nd Student, 3rd Student, 4th Student, 5th Student, 6th Student"

The 6 students who participated in the study were evaluated in three categories: "high, medium and low level" in terms of overall grade point average according to criteria set out in the Ministry of National Education Secondary Education Institutions Regulation (MEB, 2019).

According to the Ministry of National Education Secondary Education Institutions Regulation (MEB, 2019), the grades of the students' overall grade point average are given in Table 1.

Table 1. The level of students corresponding to their overall grade point average according to MEB

Point	Level
85,00-100	High
70,00-84,99	High
60,00-69,99	Medium
50,00-59,99	Low
0-49,99	Very Low

Taking into account the achievement levels in Table 1, the levels determined by the overall grade point average of the students in the secondary school where they studied and the criteria of the MEB (2019) are as follows in Table 2.

Table 2. Grade point averages of the students participated in the study in the secondary school where they studied

	Students	Grade Point Average	Level
1st Secondary School	1st Student	94	High
	2nd Student	86	High
2nd Secondary School	3rd Student	68	Medium
	4th Student	62	Medium
3rd Secondary School	5th Student	54	Low
	6th Student	47	Low

When looking at Table 2, with a GPA of 94 1st Student studying in the 1st secondary school and 2nd Student with a GPA of 86 were evaluated in "high level", with a GPA of 68, 3rd Student studying in the 2nd secondary school and the 4th Student with a GPA of 62 in "medium level", 5th Student with a GPA of 54 studying in the 3rd secondary school in "low level", and the 6th Student with a GPA of 47 studying in the 3rd secondary school was evaluated in the "low level" category. In other words, the research was conducted with 6 students at different levels of achievement according to the grade point average in different secondary schools. The reason for this is to be able to determine the maximum number and variety of cognitive and metacognitive strategies that students use when studying the “Cells and Divisions” unit. The 6 students in these 3 different secondary schools in Table 2 were selected on the basis of volunteerism and teacher opinions. This is because of the use of cognitive and metacognitive strategies of these students with different attainment levels in different secondary schools and the patterns for the sources of these strategies are to be identified in depth.

3. Data Collection Tools

Multiple data collection tools were used in the research to provide both consistent and reliable and in-depth analysis (Yin, 2003).

The data collection tools used in the research are as follows.

3.1. Thinking Aloud Session Conducted With "Cells and Divisions" Unit

The first of the data collection tools in the research is the thinking aloud sessions conducted on the reading process of the “Cell” unit. "Cells and Divisions" unit in the 7th-grade science textbook was selected for the reasons that it has a high number of acquisitions, contains figures, it is very likely that in the High School Entrance Exam (LGS) there will be questions that belong to this unit, students use more types and varieties of cognitive and metacognitive strategies in the process of reading this unit and it was determined through discussion and negotiation with science teachers. Besides, to determine whether any false information or misconceptions in the content of the "Cell" unit in the 7th-grade science textbook, two faculty members who are experts in the field of Biology education controlled this unit and according to their feedback, corrections have been made in this unit.

The subject area of the “Cell" unit according to the Science Education Program and the number of acquisitions of this unit are as shown in Table 3.

Table 3. Subject area to which the cell unit belongs and number of acquisitions

No.	Subject Field Name	Unit Name	Number of Acquisitions
1	Earth and Universe	Solar System and Beyond	10
2	Living Things and Life	Cell and Divisions	8
3	Physical Events	Force and Energy	8
4	Matter and It's Nature	Substances and Mixtures	16
5	Physical Events	Interaction Of Light With Matter	12
6	Living Things and Life	Reproduction, growth, and development in living things	7
7	Physical Events	Electrical Circuits	6
	Total		67

As shown in Table 3, the “Cells and Divisions” unit selected for this research is a unit with 8 acquisitions belonging to the biology learning area and the "Living Things and Life” subject area.

Students read the “Cells and Divisions" unit through think-aloud sessions. Thinking aloud is a technique that determines the relationship between students' reading performances and other situations that are effective in reading (Van Someren, Barnard, and Sandberg, 1994). Before students read the ”Cell " unit, they were informed by the researcher about the thinking aloud session. In other words, students were asked to do their reading process aloud. To enable students to get used to and adapt to the process of thinking aloud, students were taught a small part of a different unit other than the “Cells and Divisions” unit with the technique of thinking aloud before going to the main application. While students are studying this unit, the reading processes of a small part of the students from this different unit are not recorded on camera. After that, the students read the “Cell” unit by going to the main application and recording the camera. During the practice, the camera was held in the right hand of the researcher and the researcher himself was placed on the left side, slightly behind the student. When students read the “Cell” unit, the focus and direction of the camera were adjusted and controlled by the researcher as needed. While the processes of reading the “Cells and Divisions” unit of the students were observed with camera recording, the cognitive and metacognitive strategies they used in this process were also noted by the researcher. When students remain silent for a long time while reading the unit, they have been warned like " Would you please think out loud?". While reading the “cells and divisions” unit, the observations of the students ' thinking aloud sessions enabled them to identify the strategies they used in the process of reading the unit and to separate these strategies cognitively and transcendently.

3.2. Semi-Structured Interview Form

To determine the sources of strategies and the cognitive and metacognitive strategies that become active in the minds of the 6 7^{th} grade students from 3 different secondary schools who participated in the study, while reading the “cell” unit, semi-structured interviews were conducted with them once after each student read the unit. The interview form was developed by Diken (2014), who had previously worked on cognitive and metacognitive strategies. The form, consisting of Semi-Structured Interview Questions developed by Diken (2014), was applied to students.

In the study to determine whether the strategies they use cognitive or metacognitive and from whom, where or how did they learn these strategies i.e. the sources of the strategies when reading the “Cell and Divisions" unit, they were asked questions by the researcher. All the interviews were semi-structured and these semi-structured interviews were recorded as well as in thinking aloud.

A few examples of semi-structured questions from the form prepared by Diken (2014) to determine the source of these strategies and the cognitive and metacognitive strategies students use when studying the “Cells and Divisions” unit are as follows.

* What did you do while reading the unit? What paths did you follow? Can you explain it step by step?

* You did (like reading by underlining the words) while reading the unit. Why did you do that?

* You did (like reading by underlining the words) while reading the unit. Where, from who, or how did you learn that? So what's the source of what you did when you were reading the unit? Can you explain?

3.3. Research Process

The research process was examined in three stages: the process before students read the "cells and divisions" unit, the process of reading the unit and the process after they read the unit.

3.3.1. The process before students read the "Cells and Divisions" unit

a) First of all, the studies on cognitive and metacognitive strategies in Turkey and abroad were examined. A list of cognitive and metacognitive strategies has been established according to the literature studied.

b) The "cell and divisions" unit belonging to the biology learning area of Science in the MEB 7^{th} grade science textbook has been determined to be used in practice in line with the views of science teachers.

C) Semi-Structured Interview Questions developed by Diken (2014) were used to determine the cognitive and metacognitive strategies that students use in the process of reading the "cells and divisions" unit.

d) In the study, students who were interviewed by the teachers of 3 secondary schools were selected.

f) The administrators of secondary schools, teachers, and students in the study group were informed about the research process about the application of the research.

g) Students were informed about the technique of thinking aloud before reading the "cell and divisions" unit.

3.3.2. The process during which students read the "Cells and Divisions" unit

a) Students were asked to think aloud during the reading process to determine the cognitive and metacognitive strategies used in the reading process of the "cells and divisions" unit and these processes were recorded on camera by the researcher.

b) During the students' reading of the "cells and divisions" unit and the semi-structured interviews with them, the direction and focus of the camera were adjusted and controlled by the researcher as needed.

c) The" Cell " Unit is divided into two because of the process of students reading and the length of the implementation period of semi-structured interviews with students.

3.3.3. The process after students read the "Cells and Divisions" unit

A) After reading the "cells and divisions" unit and semi-structured interviews with them, the researcher checked whether there were any deficiencies in their reading process.

B) Transcripts of the process of students reading the “cells and divisions” unit with the technique of thinking aloud and of the semi-structured interviews with the students were made.

C) Observations of the students' thinking aloud in the process of reading the” cells and divisions" unit and analyses of the transcripts of the semi-structured interviews with them after reading the unit were made.

3.4. Analysis of Data and Used Techniques

The cognitive and metacognitive strategies used by the 6 7th-grade students studying in 3 different secondary schools while reading the “Cell” unit and the sources of these strategies were determined from whom, where or how they learned these strategies. To determine the cognitive and metacognitive strategies used by the students in the process of reading the "Cell and Divisions" unit, the data obtained from the observation records of each students belonging to their reading processes and semi-structured interviews after the reading were transferred to the computer and transcripts of these data were obtained.

In the study, which cognitive and transcriptional strategies the students used in the process of reading the “cells and divisions” unit and the sources of these strategies were determined. Whether the strategies that students use cognitive or metacognitive, observation records belonging to the students' think aloud in the reading process, and data sections related to the for which purposes students use strategies when reading the unit and sources of the strategies were determined.

The transcripts were encoded in computer software used for the analysis of qualitative research. To make sure that the data obtained from the encoding was correctly encoded while encoding it was discussed gathering with a lecturer who worked on the subject before and had an adequate knowledge that whether the strategies were cognitive and metacognitive and reliability and consistency of the codes related to their opinions on the sources of the strategies.

A data set belonging to the process of a student reading the unit after completion of the coding is also encoded by the other coder, who is a lecturer. As a result of the coding, the consistency between the codes given by the coders was 81%. Encoders have reworked data sections that were inconsistent. The faculty member, who had sufficient knowledge about the researcher, re-worked on the inconsistent data sections and reached a consensus.

FINDINGS

Findings of the research on the 7th-grade students' cognitive and metacognitive strategies and from whom, where or how they learned these i.e. the sources of the cognitive and metacognitive strategies they used when reading “Cell and Divisions” unit are as follows.

The sources of the cognitive and metacognitive strategies of 1st student who have the highest GPA studying in 1st secondary school when reading the "Cell and Divisions" unit are shown in Table 4.

Table 4. Cognitive strategies used by the 1st student and sources of cognitive strategies

GRADE POINT AVERAGE	HIGH	
COGNITIVE STRATEGIES HE/SHE USES	1st STUDENT	SOURCE OF THE COGNITIVE STRATEGIES
Reading words by following with pencil	√	Himself
Expressing his/her thoughts aloud	√	Himself
Examining the figure	√	Himself
Reflecting thoughts on the figure	√	Himself
Reading by underlining the words	√	Teacher
Note-taking	√	Teacher
Comparing figures	√	Teacher

When Table 4 was examined, it was determined that 1st student who has the highest grade point average, the student used cognitive strategies to follow words with his her pencil, to express his thoughts aloud, examine the figure, to reflect his thoughts on the figure, to underline the words, take notes and compare the figures while reading the "cells and divisions" unit. When the 1st student was asked from whom, where or how he learned the cognitive strategies he used, it was determined that the student had learned the cognitive strategies from his teacher by underlining the words, reading, taking notes and comparing figures. It was found that he developed and implemented cognitive strategies from units he had previously read, such as reading words by following them with a pencil, expressing his thoughts aloud, examining the figure, reflecting his/her thoughts on the figure.

The sources of the cognitive and metacognitive strategies of the 2nd student who has a high grade point average studying in 1st secondary school when reading the "Cell and Divisions" unit are shown in Table 5.

Table 5. Cognitive strategies used by the 2nd student and sources of cognitive strategies

GPA	HIGH	
COGNITIVE STRATEGIES HE/SHE USES	2nd STUDENT	SOURCE OF THE COGNITIVE STRATEGIES
Reading words by following with pencil	√	Herself
Expressing his/her thoughts aloud	√	Herself
Examining the figure	√	Herself
Reflecting thoughts on figure	√	Herself
Reading by underlining the words	√	Teacher
Note-taking	√	Teacher
Comparing figures	√	Teacher

When Table 5 was examined, it was determined that 2nd student who has a high grade point average, the student used cognitive strategies to follow words with her pencil, to express his her thoughts aloud, examine the figure, to reflect her thoughts on the figure, to underline the words, take notes and compare the figures while reading the "cells and divisions" unit. When the 2nd student was asked from whom, where or how she learned the cognitive strategies she used, it was determined that the student had learned the cognitive strategies from his teacher by underlining the words, reading, taking notes and comparing figures. It was found that she developed and implemented cognitive strategies of reading by following words with his pencil, expressing her thoughts aloud and examining figures from units he/she had previously read.

A cross-section of the interview on the sources of cognitive strategies used by 2nd student with a high grade who studies in secondary school and has a high grade point average while reading the "Cell and Divisions" unit is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

2nd Student: *To understand the text, when I first start reading the text, I draw the bottom of the words with a pencil. I learned that from my teacher. There's a lot of different information in this text that I read. If it was the same kind of information, I wouldn't even have to pick up the pencil. But because there is so much different information in this unit, I need to understand this information*

better. I read the words with my pencil to get a better understanding of this unit. I've developed myself over time to follow words with my pencil.

The cognitive strategies used by the 2nd student with a medium level grade point average who study in 2nd secondary school while reading the "Cells and Divisions" unit and the sources of the cognitive strategies are as shown in Table 6.

Table 6. Cognitive strategies used by the 3rd student and sources of cognitive strategies

GPA	MEDIUM	
COGNITIVE STRATEGIES HE/SHE USES	3rd STUDENT	SOURCE OF THE COGNITIVE STRATEGIES
Envisaging	√	Himself
Expressing his/her thoughts aloud	√	Himself
Examining the figure	√	Himself
Comparing figures	√	Himself
Reading by following words with colored pencil	√	Himself

When Table 5 was examined, it was determined that 3rd student with a medium grade point average who studied in the 2nd secondary school, the student used cognitive strategies to follow words with his colored pencil, envisage, to express his thoughts aloud, examine the figure, compare figures, while reading the "cells and divisions" unit. When the 3rd student was asked from whom, where or how he/she learned the cognitive strategies he used, it was determined that the student had learned the cognitive strategies from the previous units that he read before and he improved himself/herself and applied that strategies.

A cross-section of the interview on the sources of cognitive strategies used by 3rd student with a medium grade point average who studies in 2nd secondary school while reading the "Cell and Divisions" unit is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

3rd Student: *I envisaged the subject. Because if I didn't envisage it, I'd think I didn't understand it. I improved myself to envisage the subject, to make it more permanent while studying the previous subjects.*

The cognitive strategies used by the 4th student with a medium level grade point average who study in 2nd secondary school while reading the "Cells and Divisions" unit and the sources of the cognitive strategies are as shown in Table 7.

Table 7. Cognitive strategies used by the 4th student and sources of cognitive strategies

GPA	MEDIUM	
COGNITIVE STRATEGIES HE/SHE USES	4th STUDENT	SOURCE OF THE COGNITIVE STRATEGIES
Examining the figure	√	Herself
Comparing figures	√	Herself
Reading by following words with colored pencil	√	Herself

When Table 7 was examined, it was determined that 4th student with a medium grade point average who studied in the 2nd secondary school, the student used cognitive strategies to follow words with her colored pencil, examine the figure, compare figures, while reading the "cells and divisions" unit. When the 4th student was asked from whom, where or how she learned the cognitive strategies she used, it was determined that the student had learned the cognitive strategies from the previous units that he/she read before and she improved herself and applied that strategies.

A cross-section of the interview on the sources of cognitive strategies used by 4th student with a medium grade point average who studies in 2nd secondary school while reading the "Cell and Divisions" unit is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

4th Student: *When reading a unit, I read the words by following them with my colored pencils. That way, I don't lose the places I read, I read more comfortably. I learned them myself when I was reading textbooks or science-technical journals. I read words more easily when I follow them with colored pencils. I am a 7th-grade student. As of this year, I started doing these things. I need to understand the subjects better and easier as I prepare for the LGS exam next year. I learned these things by myself. I think because I know that I have to prepare for the exam, I think, "using ways like this, for example, to read the unit with colored pencils makes it easier for me to understand."*

The cognitive strategies used by the 5th student with a low level grade point average who study in 3rd secondary school while reading the "Cells and Divisions" unit and the sources of the cognitive strategies are as shown in Table 8.

Table 8. Cognitive strategies used by the 5th student and sources of cognitive strategies

GPA	LOW	
COGNITIVE STRATEGIES HE/SHE USES	**5th STUDENT**	**SOURCE OF THE COGNITIVE STRATEGIES**
Reading words by following their pencil	√	Himself
Expressing his/her thoughts aloud	√	Himself
Examining the figure	√	Himself
Repeating words	√	Himself

When Table 8 was examined, it was determined that 5th student with a low grade point average used cognitive strategies to follow words with his colored pencil, express his thoughts aloud, examine the figure and repeat words while reading the "Cells and Divisions" unit and it was determined that the student had learned the cognitive strategies from the previous units that he read before and he/she improved himself and applied that strategies.

A cross-section of the interview on the sources of cognitive strategies while reading the "Cell and Divisions" unit used by 5th student with a medium grade point average who studies in 3rd secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

5th Student: *I repeated some words to understand this unit. I've examined the figures. I repeated words I couldn't understand. When reading a unit, I usually read the words that I did not understand by following them with my pencil. I can understand more easily by repeating words I don't understand. I started doing these this year. I would not have studied much in the last year and earlier years. But I'm going to take the LGS next year, and I need to work with a better understanding of these issues so I can answer more questions correctly. So I improved these paths myself over time.*

The cognitive strategies used by the 6th student with a low level grade point average who study in 3rd secondary school while reading the "Cells and Divisions" unit and the sources of the cognitive strategies are as shown in Table 9.

Table 9. Cognitive strategies used by the 6th student and sources of cognitive strategies

GPA	LOWEST	
COGNITIVE STRATEGIES HE/SHE USES	6th STUDENT	SOURCE OF THE COGNITIVE STRATEGIES
Examining the figure	√	Herself
Repeating words	√	Herself

When Table 9 was examined, it was determined that 6th student with a low grade point average who study in 3rd secondary school used cognitive strategies to examine the figure and repeat words while reading the "Cells and Divisions" unit and it was determined that the student had learned the cognitive strategies from the previous units that he/she read before and she improved herself and applied that strategies.

6th Student: *I repeated these words because I misread some places here. So I read the words by correcting them. I tried to read it a little more properly. This topic is too long. That's why I didn't use a pencil. I learned all this on my own and started implementing it as of this year.*

The metacognitive strategies used by the 1st student with the highest grade point average who study in 1st secondary school while reading the "Cells and Divisions" unit and the sources of the metacognitive strategies are as shown in Table 10.

Table 10. Metacognitive strategies used by the 1st student and sources of metacognitive strategies

GPA	HIGH	
METACOGNITIVE-BASED STRATEGIES	1st STUDENT	SOURCE OF METACOGNITIVE STRATEGIES
Underlining the clues	√	Teacher
Note-taking	√	Teacher
Circling the clues	√	Teacher
Reading over	√	Teacher
Examining the figure again	√	Teacher
Taking notes on figure	√	Teacher

When Table 10 was examined, it was determined that 1st student with the highest grade point average who study in 1st secondary school used metacognitive strategies of underlining clues, note-taking, circling the clues, reading over, reexamining the figure and taking notes on the figure while reading the "Cells and Divisions" unit and it was determined that the student had learned the metacognitive strategies from his/her teacher.

A cross-section of the interview on the sources of metacognitive strategies while reading the "Cell and Divisions" unit used by 1st student with the highest grade point average who studies in 1st secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

1st Student: *I learned all of this from my teachers. Especially our Turkish teacher always tells us to use colored pencils, to underline important words, to take notes on important places. And I've done it all the time from the day our teacher told me to. That's how I realize that I can understand what I'm reading, I can remember the places that matter.*

The metacognitive strategies used by the 2nd student with a high grade point average who study in 1st secondary school while reading the "Cells and Divisions" unit and the sources of the metacognitive strategies are as shown in Table 11.

Table 11. Metacognitive strategies used by the 2nd student and sources of metacognitive strategies

GPA	HIGH	
METACOGNITIVE-BASED STRATEGIES	2nd STUDENT	SOURCE OF METACOGNITIVE STRATEGIES
Reading over	√	Teacher
Underlining the clues	√	Teacher
Circling the clues	√	Teacher
Note-taking	√	Friend
Mark on a figure	√	Friend

When Table 11 was examined, it was determined that 2nd student with a high grade point average who study in 1st secondary school used metacognitive strategies of reading over, underlining clues, note-taking, circling the clues, putting a mark on the figure while reading the "Cells and Divisions" unit and it was determined that the student had learned the reading over, underlining the clues, circling the clues metacognitive strategies from his/her teacher, taking notes and putting a mark on the figure metacognitive strategies from his/her friend.

A cross-section of the interview on the sources of metacognitive strategies while reading the "Cell and Divisions" unit used by 2nd student with a high grade point average who studies in 1st secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

2nd Student: *Our science teacher and Turkish teacher used to underline some words or draw a round on them while reading and solving the question. When we asked our teachers, they said," underline or circle the words that you think are important when reading a question, re-read sentences that you don't understand several times." So I started doing it after I learned it from my teachers.*

When I take notes on some things while reading the text, I look at those notes again, I read the places I took notes. That's what my friend, who I sit at the same desk at school, does. He/she also mark some parts of the shapes. I saw it from my friend. When I get back, I get a glimpse of the places I've marked. I can look at the notes and immediately grasp the important parts of the subject. I started taking notes on places that I thought were important since 6th grade.

The metacognitive strategies used by the 3rd student with a medium grade point average who study in 2nd secondary school while reading the "Cells and Divisions" unit and the sources of the metacognitive strategies are as shown in Table 12.

Table 12. Metacognitive strategies used by the 3rd student and sources of metacognitive strategies

GPA	MEDIUM	
METACOGNITIVE-BASED STRATEGIES	3rd STUDENT	SOURCE OF METACOGNITIVE STRATEGIES
Underline the clues with a colored pencil	√	Himself
Circling the clues with a colored pencil	√	Himself
Taking notes on the figure with a colored pencil	√	Himself
Marking on a figure with a colored pencil	√	Himself
Reading by underlining words with a colored pencil	√	Himself

When Table 12 was examined, it was determined that 3rd student with a medium grade point average who study in the 2nd secondary school used cognitive strategies of underlining the clues with a colored pencil, circling the clues with a colored pencil, putting a mark on a figure with a colored pencil, taking notes on a figure with colored pencil and reading by underlining words with a colored pencil while reading the "Cells and Divisions" unit and it was determined that the 3rd student had learned the metacognitive strategies from the previous units that he read before and he improved himself and applied that strategies.

A cross-section of the interview on the sources of metacognitive strategies while reading the "Cell and Divisions" unit used by 3rd student with a medium grade point average who studies in 2nd secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

3rd Student: *When I was reading a unit, I underlined the words that I saw as important with a red-colored pencil, and there were words that I circled. When I use a colored pencil, I see more important places in front of me. That's how I realize I have a better understanding of the unit. For example, when I realize that I did not understand the subject when I read the subject again, I know that the places I drew with a colored pencil before are important and I focus more on the places I drew. When I'm working on a topic and I draw in a colored pencil where I think it's important, this leads me to study more. It allows me to study more and more efficiently. Because colored pens are more eye-catching than lead pencils. I learned all of this at the beginning of this period and by myself. I do this all the time when I'm studying. I started using colored pencils this year. When I used colored pencils, I started to take more notes with these pencils, especially on figures and pictures. I started to underline the words that I thought were important more often. I started to use too much colored pencil in the process. I learned all this by myself.*

The metacognitive strategies used by the 4th student with a medium grade point average who study in 3rd secondary school while reading the "Cells and Divisions" unit and the sources of the metacognitive strategies are as shown in Table 13.

Table 13. Metacognitive strategies used by the 4th student and sources of these strategies

GPA	MEDIUM	
METACOGNITIVE-BASED STRATEGIES	4th STUDENT	SOURCE OF METACOGNITIVE STRATEGIES
Reading over	√	Herself
Underline the clues with a colored pencil	√	Herself
Examining the figure again	√	Herself
Expressing his/her thoughts aloud	√	Herself

When Table 13 was examined, it was determined that 4th student with a medium grade point average used cognitive strategies of underlining the clues with a colored pencil, rereading, reexamining the figure, and expressing thoughts aloud while reading the "Cells and Divisions" unit and it was determined that the 4th student had learned the metacognitive strategies from the previous units that she read before and he/she improved himself/herself and applied that strategies.

A cross-section of the interview on the sources of metacognitive strategies while reading the "Cell and Divisions" unit used by 4th student with a medium grade point average who studies in 3rd secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

4th Student: *There were some places I realized I didn't understand when I was reading this unit. I look back and reread those sentences that I didn't understand. When I examine the figures over and over again, they are much more permanent in my mind, so I can remember them right away, for example, in exams. I also use colored pencils. For example, I circle words that I consider important with colored pencils. It's boring to use a lead pencil. Since I am a 7th-grade student and preparing for the LGS, I am very likely to understand and not forget the subjects. I learned these things by myself.*

The metacognitive strategies used by the 5th student with a low grade point average who study in 3rd secondary school while reading the "Cells and Divisions" unit and the sources of the metacognitive strategies are as shown in Table 14.

Table 14. Metacognitive strategies used by the 5th student and sources of metacognitive strategies

GPA	LOW	
METACOGNITIVE-BASED STRATEGIES	5th STUDENT	SOURCE OF METACOGNITIVE STRATEGIES
Examining the figure again	√	Himself
Reading over	√	Himself
Underlining the clues	√	Himself

When Table 14 was examined, it was determined that 5th student with a low grade point average who study in the 3rd secondary school used cognitive strategies of reexamining the figure, rereading, and underlining the clues while reading the "Cells and Divisions" unit and it was determined that the 5th student had learned the metacognitive strategies from the previous units that he read before and he improved himself/herself and applied that strategies.

A cross-section of the interview on the sources of metacognitive strategies while reading the "Cell and Divisions" unit used by 5th student with a low grade point average who studies in 3rd secondary school is as follows:

Researcher: *What is the source of what you did while reading this unit? Where did you learn all this?*

5th Student: *I circled the words I stuck with while reading this subject. I reexamined the figures. And I went back to the beginning and read it again to check if I understood the unit correctly. I learned these things by myself over time. I'm going to take LGS next year. I'm studying more, solving questions. That's why I do these things.*

In the study, it was found that the 6th student with the lowest grade point average and who study in the 3rd secondary school, did not use metacognitive strategies while reading the "Cells and Divisions" unit. Since the 6th student did not use metacognitive strategies while studying the unit there are no sources of the 6th student's metacognitive strategies. Hence we could not provide a table related to the sources of metacognitive strategies of 6th student who have the lowest grade point average and who studied in 3rd secondary school.

CONCLUSION, DISCUSSION, AND SUGGESTIONS

The following are the results of this research.

In the research, it was determined that the 1st student who has the highest grade point average and who study in the 1st secondary school and the 2nd student who studies in the same secondary school and who have a high grade point average used the cognitive strategies of reading words by following with a pencil, expressing thoughts aloud, examining the figure, reflecting thoughts on a figure, reading words by underlining, note-taking and comparing figures while reading the "Cell and Divisions" unit.

It was determined that 3rd student who has medium grade point average and who study in the 2nd secondary school used the cognitive strategies of envisaging, expressing thoughts aloud, examining figures, comparing figures and reading by following words with a colored pencil while reading the "Cell and Divisions" unit. It was determined that 4th student who has medium grade point average and who study in 2nd secondary school used the cognitive strategies of examining figures, comparing figures and reading by following words with a colored pencil while reading the "Cell and Divisions" unit.

It was determined that 5th student who has low grade point average and who study in 3rd secondary school used the cognitive strategies of reading words by following with pencil, expressing thoughts aloud, examining figures, repeating the words while reading the "Cell and Divisions" unit. It was determined that 6th student who has a medium grade point average and who study in 3rd

secondary school used the cognitive strategies of examining figures and repeating words while reading the "Cell and Divisions" unit.

In this study, it is possible to encounter the cognitive strategies used by students when studying the “Cells and Divisions” unit in research conducted in the literature. It has been identified that reading and reading comprehension cognitive strategies use; Robinson (1970) repetition; Thomas and Robinson (1972) thinking and reflecting in detail, making mental repetition; Eanet and Manzo (1976) evaluation in the mind; O'malley and Chamot (1990) taking notes, expressing in their own sentences; Alderman et al. (1993) self-inquiry, reflection; Weir (1999) re-envisaging Taraba (2004) note-taking; Ghonsooly and Eghtesadee (2006) repetition in order to reach the meaning of a word, repetition before the difficult words; Anastasiou and Grive (2009) repeating words or phrases, note-taking; Kumlu (2012), note-taking, examining figure, drawing figure, repeating the processes mentioned in the text; Diken and Yuruk (2019) reading by following the words with a pencil, note-taking, examining figure, comparing the figures, repeating thoughts aloud, reflecting thoughts on the figure, and note taking cognitive strategies.

In the research, it was determined that the sources of the reading words by following with a pencil, expressing thoughts aloud, examining the figure, reflecting thoughts on a figure, reading words by underlining cognitive strategies that the 1st student who has the highest grade per point average and 2nd student who study in the 1st secondary school use are themselves; the sources of the reflecting thoughts on a figure, reading by underlining the words, note-taking and comparing figures cognitive strategies are their teachers.

It was determined that the sources of the envisaging, expressing thoughts aloud, examining figures, comparing figures and reading by following the words with a colored pencil cognitive strategies that 3rd student uses who has medium grade point average and who study in 2nd secondary school is himself/herself. It was also determined that the sources of the examining figures, comparing the figures, and reading by following words with a colored pencil cognitive strategies that 4th student uses who has medium grade point average and who study in 2nd secondary school is himself/herself.

It was determined that the sources of the reading the words by following with a pencil, expressing thoughts aloud, examining figures, and repeating words cognitive strategies that 5th student uses who has low grade point average and who study in 3rd secondary school is himself/herself. It was determined that the sources of examining figures and repeating words cognitive strategies that 6th student use who has the lowest grade point average and who study in 3rd secondary school is himself/herself.

In the research, it was determined that 1st student who has the highest grade point average and who study in the 1st secondary school, used underlining the clues, note-taking, circling the clues, rereading, reexamining the figure and taking notes on the figure metacognitive strategies while reading the "Cell and Divisions" unit.

In the research, it was determined that 2nd student who has a high grade point average and who study in the 1st secondary school, used rereading, underlining the clues, note-taking, circling the clues, putting a mark on the figures metacognitive strategies while reading the "Cell and Divisions" unit.

It was determined that 3rd student who has a medium grade point average and who study in the 2nd secondary school, used underlining the clues with colored pencils, circling the clues with colored pencils, taking notes on the figure with colored pencils, putting marks on the figures with colored pencils, and reading by underlining the words with colored pencils metacognitive strategies while reading the "Cell and Divisions" unit. It was determined that 4th student who has a medium grade point average and who study in the 2nd secondary school, used rereading, underlining the clues with colored pencils, reexamining the figures and

expressing thoughts aloud metacognitive strategies while reading the "Cell and Divisions" unit.

It was determined that 5th student who has a low grade point average and who study in the 3rd secondary school, used underlining the clues with colored pencils, circling the clues with colored pencils, taking notes on the figure with colored pencils, taking notes on the figure with colored pencils, putting marks on the figures with colored pencils, and reading by underlining the words with colored pencils while reading the "Cell and Divisions" unit. It was also determined that the 6th student who has the lowest grade point average and who study in the 3rd secondary school, did not use metacognitive strategies while reading the "Cell and Divisions" unit.

In this study, it is possible to encounter the metacognitive strategies used by students in reading the “Cells and Divisions” unit in the research conducted in the literature. Weir (1999) determined the metacognitive strategies as rereading; Taraban (2004) note-taking, framing, underlining, rereading; Caliskan, Sezgin Selçuk and Erol (2006) and Sezgin Selçuk, Çalışkan and Erol (2007) underlining the clues, rereading; Ghonsooly and Eghtesadee (2006) repeating in order to reach the meaning of the word, repeating before the difficult words; Anastasiou and Grive (2009), underlining, repeating words or phrases, note-taking; Kumlu (2012) drawing with colored pencils, getting into the frame, underlining with a lead pencil, circling with a lead pencil, rereading, expressing with their own words. Diken (2014), Diken and Yuruk (2019) have identified metacognitive strategies as underlining the clues, circling the clues, re-reading, taking notes on the figures, putting marks on the figures, expressing thoughts aloud and re-examining figures.

It was determined that the sources of the metacognitive strategies such as; underlining the clues, note-taking, circling the clues, rereading, reexamining the figure, and taking notes on the figure which are used by the 1st student who has the highest grade point average and who studies in 1st secondary school are his/her teacher. It was determined that the sources of the metacognitive strategies such as; rereading, underlining the clues, and circling the clues which are used by the 2nd student who has a high grade point average and who studies in 1st secondary school are his/her teacher and sources of the metacognitive strategies such as note-taking and putting marks on the figures are his/her friend.

It was determined that the sources of the metacognitive strategies such as; underlining the clues with colored pencil, circling the clues with colored pencil, taking notes on the figure with colored pencil, putting marks on the figure with colored pencil and reading by underlining the words with colored pencil which are used by the 3rd student who has medium grade point average and who studies in 2nd secondary school are himself/herself. It was also determined that the sources of the metacognitive strategies such as; rereading, underlining the clues with colored pencils, reexamining the figure, and expressing thoughts aloud which are used by the 4th student who has medium grade point average and who studies in 2nd secondary school are himself/herself.

It was determined that the sources of the metacognitive strategies such as; reexamining the figure, rereading, and underlining the clues which are used by the 5th student who has low grade point average and who studies in the 3rd secondary school are himself/herself. In the research, the sources of the metacognitive strategies of 6th student who has the lowest grade point average and who studies in the 3rd secondary school could not be determined since he/she does not use metacognitive strategies while reading the "Cell and Division" unit.

In the study, the sources of cognitive and metacognitive strategies used by students with different grade point averages in different secondary schools while studying in the “Cells and Divisions” unit can be summarized as follows.

It was determined that the sources of the cognitive strategies used by the two students who study in the 1st secondary school and have high grade point averages while reading the "Cell and Divisions" unit were themselves. It was also determined that the sources of metacognitive strategies used by the two students who study in the 1st secondary school and have high grade point averages while reading the "Cell and Divisions" unit were their teachers.

It was determined that the sources of the cognitive and metacognitive strategies used by the two students who study in the 2nd secondary school and have medium grade point averages were themselves.

It was determined that the sources of the cognitive strategies used by the two students who study in the 3rd school and have low grade point averages were only themselves, But it was determined that there were no sources of the metacognitive strategies of two students who study in the 3rd school and have low grade point averages since they did not use metacognitive strategies.

In this study, the sources of cognitive and metacognitive strategies used by students while reading the "Cells and Divisions" unit were determined. It is thought that the resources responsible for determining these resources and providing students with reading strategies are of great importance for improving their academic achievement by teaching students reading comprehension strategies (Baydik, 2010). In other words, learning the cognitive and metacognitive strategies related to reading and reading comprehension in the literature themselves, from their teachers, friends, parents, (sister, brother, mother, father, etc.) can be said to be important in the increase of their reading comprehension skills. Therefore, students can teach themselves, their teachers, their friends and, if necessary, their parents, cognitive and metacognitive strategies in a much more comprehensive and systematic manner. In this way, students can improve their comprehension of reading plain texts or units in textbooks, especially those belonging to the field of Biology learning.

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