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Examining Metacognitive Strategy Preferences of Students at Different Reading Proficiency Levels

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ABSTRACT

The purpose of this study was to evaluate the distribution of students with varying levels of reading competence according to their selection of metacognitive methods from the 2018 Programme for International Student Assessment (PISA) survey. The research group consisted of 6,890 pupils from the Republic of Turkey who participated in the PISA 2018 study. The data were analyzed using the multivariate exploratory technique of correspondence analysis. In comparison to developing readers, skilled readers favored the metacognitive processes of summarizing, understanding and remembering, and evaluating believability. Awareness of appropriate metacognitive reading strategies should be emphasized in order to increase the reading comprehension of developing readers.

Keywords:
Metacognition, metacognitive strategies, reading comprehension, reading proficiency, PISA

1. Introduction

Reading comprehension, which is defined as individuals interacting with the written text and making sense of the text they read (Graham & Bellert, 2005), is expressed as the essence (Ford & Opitz, 2011) or the ultimate goal (Torgesen, 2002) of reading. Students use reading as a tool to acquire academic knowledge in other fields (Best et al., 2008; Wanzek et al., 2013). On the other hand, many students struggle to understand what they read (Knowles et al., 2021). An important reason for this difficulty is the inadequacy of students' metacognitive strategies for reading comprehension (McHardy et al., 2021; Mokhtari & Reichard, 2002).

Since 2009, the PISA reading comprehension tests have incorporated metacognition as a separate measure. This is because metacognition is a key component of reading comprehension.In many studies using PISA data, it stands out that metacognitive strategies are one of the most important variables that predict reading performance (e.g., Callan et al., 2016; Koyuncu & Fırat, 2020; Lau & Ho, 2016; Lim & Jung, 2019; Mikk, 2015; Miyamoto et al., 2019). In this context, it is possible to say that metacognitive strategies significantly contribute to students' reading comprehension. This study was carried out to examine the distribution of students with different reading proficiency levels in the PISA 2018 study according to their choice of metacognitive strategies.

1.1. Metacognitive Strategies and Reading Achievement

Metacognition means being aware of the individual's cognitive process and thinking about this process (Flavell, 1979). This concept can be divided into metacognitive knowledge and metacognitive regulation (Flavell, 1979; Jacobs & Paris, 1987). While metacognitive knowledge expresses the information obtained on

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how to use various learning strategies, Metacognitive regulation refers to the use of those strategies (Jacobs & Paris, 1987; Livingston, 2003). In the framework of metacognition, readers were required to have a set of metacognitive strategy knowledge about "why," "when," and "how" to use the processes of self-regulation before, during, and after reading (Bender, 2002; Dabarera et al., 2014) and the chosen strategies (Harvey & Goudvis, 2013; Pintrich, 2002). Metacognitive knowledge is a prerequisite for effective strategy use (Artelt & Schneider, 2015; Kolić-Vehovec et al., 2014). Therefore, metacognition is at the center of strategic reading (Mokhtari & Reichard, 2002).

There are controversial aspects of metacognition called "fuzzy" despite explanations given for this concept (Akturk & Sahin, 2011; Flavell, 1981; Papleontiou-Louca, 2003). One of them is the relationship of metacognition with cognitive or other reading comprehension skills (Livingston, 2003; Veenman et al., 2006). In this context, it is necessary to understand the relationship between metacognition and cognition. While cognition includes understanding, remembering, and similar cognitive processes, metacognition encloses thinking about these activities (Garner & Alexander, 1989). Cognitive strategies enable individuals to reach a goal and ultimately learn, while metacognitive strategies include self-monitoring, testing, and evaluation (Doganay-Bilgi, 2009). In terms of metacognitive skills, planning cannot be done without performing cognitive activities such as creating problem-solving steps and sequencing these steps. The result of a calculation cannot be checked without comparing the result with an estimate or recalculating the result in some other way (Veenman et al., 2006). From a reading perspective, skilled readers can use their metacognitive strategy knowledge regarding summarizing to test whether they have appropriately implemented this cognitive strategy. For this purpose, readers may ask themselves some questions such as "Does my summary have all the important points in the text? How good is my summary? Does it cover all the information? Does it cover all the important points?" to check their summary (Doganay-Bilgi, 2009; Ferguson, 2001).

Since metacognitive strategies are linked to cognitive domains, they always contain a certain level of learning content and can be considered high-level strategies (Donker, et al., 2014). Metacognitive strategies include establishing a purpose for understanding, considering whether the textual content is suitable for this purpose, and monitoring and evaluating what they read (see Hong-Nam et al., 2014; Fırat & Kocak, 2019). For instance, the fact that a reader thinks about the relationship between the information in the text and their past information while reading or asks themself questions about the text to understand it better after reading could be given as examples to those strategies (see Mason, 2004). It has been stated that students who use metacognitive strategies actively participate in the reading process, can predict the text before reading, monitors their understanding, organize prior information in line with new information, and control what they have learned (Duke et al., 2011; Roberts et al., 2008; Swanson, 1999).

In addition, metacognitive strategies enable readers to participate actively in the reading process by developing critical thinking skills (Hong-Nam et al., 2014; Sencibaugh, 2007). These skills help readers to evaluate the effectiveness of the reading strategy they use and make changes when they detect a problem in understanding (Gajria, & Jitendra, 2016). However, insufficiency of metacognitive strategy knowledge can prevent students from realizing misunderstandings in the reading process (Michalsky et al., 2009). Metacognitive strategies enable active participation in the reading process and are described as characteristic of skilled readers (Hughes & Parker-Katz, 2013; Houtveen & Van de Grift, 2007). In fact, using metacognitive strategies in reading is an important factor that distinguishes skilled and developing readers (Mokhtari & Reichard, 2002).

Many studies have determined that skilled readers use metacognitive strategies more effectively than developing readers (Dermitzaki et al., 2008; Fırat & Kocak, 2019; Hong-Nam & Leavell, 2007; Houtveen & Van de Grift, 2007). Muijselaar et al. (2017) stated that since most of skilled readers are eager to learn, (1) they are intrinsically motivated to learn more from the text, (2) they are extremely busy while reading a text and ask questions about the content, and (3) therefore, they tend to use more complex and higher-level strategies than developing readers. On the other hand, studies have determined that metacognitive strategies can be taught to developing readers, and as a result, their reading comprehension skills can be improved (Antoniou & Souvignier, 2007; Cakiroglu & Ataman, 2008; Farkas & Jang, 2019; Jitendra et al., 2000; Mason, 2004; Mason et al., 2012). For example, Cakiroglu and Ataman (2008) determined that teaching metacognitive strategies to developing readers was effective in using metacognitive strategies and developing their reading comprehension skills. Similarly, Antoniou and Souvignier (2007) found that the students who attended the

metacognitive strategy program had significant improvements in their strategy acquisitions and reading comprehension achievements compared to those who did not. In addition, it was concluded that implementing a strategy program in the classroom has long-term effects on strategy knowledge and reading comprehension achievement.

1.2. Reading Literacy and Metacognition Strategies in PISA Studies

PISA studies conducted by the Organisation for Economic Co-operation and Development (OECD) is one of several international studies that have been attracting attention. PISA studies, each called the "PISA cycle", have been carried out every three years since 2000 to assess 15 years-old students' reading, mathematics, and science literacy. While the number of participating countries from around the world was 32 in the year 2000, it reached 79 in 2018. Reading literacy has been considered as the major domain of the interest in PISA studies during the years 2000, 2009, and 2018. Reading literacy skills used in PISA studies enable students to understand, use, evaluate, associate, and reflect on texts given in various structures to achieve their personal goals, develop their knowledge and potential, and participate in society (OECD, 2019a). In this context, those reading skills require students to perform various tasks related to different types of texts. Those tasks cover a wide spectrum that requires simple and/or complex processes such as finding and remembering crucial information, gathering information, interpretation, making inferences, evaluation, reflecting your own thinking, reflecting on the content and properties of the text, separately or simultaneously (Bozkurt, 2016). When all of these tasks are considered, along with the contribution that metacognitive strategies make to reading comprehension, it is possible to assert that metacognition is of crucial significance for the PISA studiesStudents' use of metacognitive strategies plays an important role in explaining variance in PISA reading performances (see Artelt & Schneider, 2015; Artelt et al., 2001; Koyuncu & Fırat, 2020; Säälik et al., 2015; Wu & Peng, 2017). For example, Koyuncu and Fırat (2020) determined that metacognition is an important predictor of PISA 2018 reading performance for China, Turkey and Mexico, that have different performance levels. Using PISA data from 34 countries, Chiu et al. (2007) came to the conclusion that students who used metacognitive strategies demonstrated higher levels of performance, whereas students who relied on memorization strategies received lower levels of achievement.. In addition, students' use of metacognitive strategies was positively correlated with high performance in many countries, particularly in reading (compared to science and mathematics). Tavsancil et al. (2019) determined that the frequency of using control and remembering strategies is a significant variable in predicting students' reading performance. In contrast, the use of an elaboration strategy is not a significant predictor.

It is seen that metacognition is handled in different dimensions in PISA studies. While metacognition was included in PISA studies under the headings of understanding and remembering (UNDREM), and summarizing (METASUM) in 2009, assessing credibility (METASPAM) was added in 2018 (see OECD, 2019a). Understanding and remembering strategies evaluate students' understanding of monitoring, controlling, and organizing behaviors to understand reading tasks (Wu, 2014; Wu & Peng, 2017). Summarizing strategy, on the other hand, evaluates students' knowledge to summarize the reading text (Wu & Peng, 2017). Summarizing requires deeper understanding and cognition to reveal basic information than understanding and remembering (Zhou et al., 2020). On the other hand, assessing credibility evaluates students' understanding of their behavior towards an email they receive. This dimension focuses on assessing sources' quality and reliability (PISA, 2019a). The ability to evaluate the reliability of information is a fundamental skill for understanding the text (Depren & Depren, 2021). Thus, metacognition contributes to separating necessary and unnecessary information in online readings (Coiro & Dobler, 2007). In studies using similar data (Depren & Depren, 2021; Koyuncu & Fırat, 2020), especially assessing credibility and summarizing had a greater predictive effect on reading success, while the effect of understanding and remembering was less. The current study's use of metacognitive strategies within the framework of these three dimensions is expected to present broad and useful findings.

1.3. The Importance of the Study

While the impact of metacognitive strategies on reading achievement has been emphasized in many studies, there is a gap regarding how these strategies are related to reading proficiency levels. In particular, it is important to understand whether some metacognitive strategies might be more useful than other strategies because this can have important implications for teaching. Artelt and Neuenhaus (2010) found that students

with high metacognitive strategy knowledge and low frequency of strategy use performed better than students with low metacognitive strategy knowledge and increased frequency of strategy use. In addition, students with the highest level in both components showed the highest performance in the PISA reading performance test (cited in Karlan, 2016). Therefore, together with the frequency of using metacognitive strategies, the quality of these strategies is of great importance for reading performance.

This study aimed to examine the differences in strategy use of students with different reading proficiency levels. In addition, it is anticipated that determining the reading strategies that skilled readers prefer will provide some direction in determining the metacognitive reading strategies that are the most effective in developing reading-related skills and improving reading comprehension.Besides, it aimed to examine the distribution of students with different reading proficiency levels according to their choice of metacognitive strategies in the PISA 2018 study. In this context, it was sought to find solutions to the following research problem:

- How do the students' metacognitive strategies preference show distribution according to their reading proficiency levels for understanding and memorizing, writing a summary, and assessing credibility dimensions of metacognition?

2. Methodology

2.1. Research Model

This quantitative study is descriptive research because students' metacognitive strategies were examined according to their reading proficiency levels. In addition, since the concordance between these two variables was examined, the study is also correlational research. Quantitative studies aim to seek, explore, and explain relationships between variables with quantitative data (Fraenkel & Wallen, 2006).

2.2. Research Sample

The target population of the present study was 15 years-old Turkish students. According to PISA 2018 results, when compared to PISA 2015, Turkey's average reading score increased by 38 points to 466 points. Among the Organisation for Economic Co-operation and Development (OECD) countries, Turkey became the second country with the highest reading increase. These results showed that the improvement in Turkish students' reading performance is significant compared to other countries' results. In reading performance, Turkey ranked 50th out of 72 countries participating in the PISA 2015 study while she increased to 40th rank out of 79 countries the PISA 2018 study (Ministry of National Education in Turkey: MEB, 2019). In addition, although Turkey is a member and one of the founding countries of the OECD, it is still in the category of developing countries. Examining Turkey, which differs from many other world countries in this respect, in terms of reading performance will set an example in terms of seeing the situation in a developing country.

The sample of this study is 6890 students participating in PISA 2018 study from Turkey. The sample group was chosen by PISA practitioners using the stratified random sampling method. 3396 students (49.3%) are female and 3494 (50.7%) are male. The distribution of students according to their performance levels determined by PISA practitioners is given in Table 1.

Table 1. *PISA Reading Proficiency Levels and Frequency of the Students*

Level	Performance Group	Explanation	n	%	Cumulative %
Level 1c	Below 262.04	Understanding short and simple sentences, reading for clear, simple, and concrete purposes in a limited time	49	0.70	0.70
Level 1b	From 262.04 to Below 334.75	Evaluating the appropriate meaning of sentences, establishing links between information, finding the relevant page within a few pages of text	445	6.35	7.05
Level 1a	From 334.75 to Below 407.47	Understanding the meaning of sentences and short paragraphs, finding the main idea, finding the main idea of the texts on familiar topics, establishing connections between the information in the text	1330	19.08	26.13
Level 2	From 407.47 to Below 480.18	To be able to comprehend the main idea of medium-length texts, to make a meaning and link from a part of the text when the necessary information is not given clearly, to be able to reflect on the general purpose of the text, to compare and support claims	2082	30.17	56.31

Level 3	From 480.18 to Below 552.89	To be able to explain the meaning of the text even in an unclear situation, to make compilation and inferences, to be able to gather information from different parts to explain the text, to dig deeper and to compare several authors' thoughts	1855	26.88	83.18
Level 4	From 552.89 to Below 625.61	Being able to understand long paragraphs, to compare and interpret different perspectives, to compile and infer the information in the text, to identify the original aspects of the authors, to compare claims and evaluate their reliability	911	13.49	96.67
Level 5	From 625.61 to Below 698.32	Discovering hidden information in long texts, thinking deeply, reasoning, finding answers to questions from different sources, forming hypotheses, evaluating the source and objectivity of the information	206	3.13	99.80
Level 6	At or Above 698.32	Understanding long and abstract texts, combining information, comparing and evaluating with various criteria, analyzing the source of the text in depth with external criteria, determining incompatibilities by comparing different texts, identifying similar and opposite sides of the texts	13	0.20	100.00
		Total	6890	100.00	

According to Table 1, if the levels between Level 1a and Level 4 are considered as intermediate levels, it is seen that the students mostly (89.62%) have a right-skewed performance below the intermediate level.

2.3. Data Collection Tools and Procedure

The data collection tools used in the study were the reading performance cognitive test and "Meta-cognition: understanding and remembering", "Meta-cognition: summarising," and "Meta-cognition: assess credibility" scales included in the PISA student questionnaire. In the reading cognitive test, two tests measure cognitive processes and text structures. Among those tests, there are three cognitive-process subtests: locate information, understand, evaluate, and reflect. For text structure, there are two subtests: single and multiple. Using all questions included in these cognitive sub-tests, 10 plausible values for total reading performance are calculated based on the item response theory. Approximately 25% of these questions are related to locate information, 45% to understanding, and 30% to evaluating and reflect sub-dimensions (OECD, 2019b). In this way, students' performances in all cognitive processes and at the different text structures were considered. Detailed information on the conceptual and theoretical background in the development of those scales and how reading scores are calculated can be found in the PISA 2018 documents (see OECD, 2019a; n.d.).

2.3.1. Levels of reading performance

Since total PISA scores are calculated to fit the standard normal distribution (having mean 500 points and standard deviation 100 points), there are no minimum and maximum scores. Therefore, eight performance levels with approximately 80 points have been developed for interpreting PISA reading scores (OECD, 2019b). These proficiency levels and their definitions are given in Table 1. According to Table 1, the proficiency levels below 1, 1, 2, 3, 4, and 5 used in previous PISA studies were reorganized in 2018 as levels 1a, 1b, 1c, 2, 3, 4, 5, and 6. Those proficiency levels include a wide range of skills, from simple to complex, from students' interpretation of a simple text to comprehending a long and abstract text, making connections, drawing main ideas, comparing ideas, reasoning, and evaluating texts with internal and external criteria.

2.3.2. Self-reported metacognitive strategies

Meta-cognition scales were discussed in the PISA 2018 assessment and analytical framework under the heading of non-cognitive and metacognitive constructs, which covers all variables other than those included in the student background, teaching and learning activities, and school policies and governance constructs. Module 4 under non-cognitive and metacognitive constructs, includes attitudes, motivation, and strategies that are reading-related outcomes (see OECD, 2019a). Metacognition scale scores were obtained from the students and experts' scoring of the metacognitive strategies given in each scale item. Self-reported metacognitive strategies were scored from not useful-appropriate at all (1) to very useful-appropriate (6). These strategies were given in Table 2.

Table 2. *Metacognitive Strategies Used in Subscales*

Scale	Code	Explanation
Meta-cognition: understanding and remembering	Usefulness for understanding and memorising text:	
	UNDREM1	I concentrate on the parts of the text that are easy to understand.
	UNDREM2	I quickly read through the text twice.
	UNDREM3	After reading the text, I discuss its content with other people.
	UNDREM4	I underline important parts of the text.
	UNDREM5	I summarise the text in my own words.
	UNDREM6	I read the text aloud to another person.
Meta-cognition: summarising	Usefulness for writing a summary:	
	METASUM1	I write a summary. Then I check that each paragraph is covered in the summary, [...]
	METASUM2	I try to copy out accurately as many sentences as possible.
	METASUM3	Before writing the summary, I read the text as many times as possible.
	METASUM4	I carefully check whether the most important facts in the text are represented [...]
	METASUM5	I read through the text, underlining the most important sentences. Then I write [...]
Meta-cognition: assess credibility	How appropriate in reaction to this email:	
	METASPAM1	Answer the email and ask for more information about the smartphone
	METASPAM2	Check the sender's email address
	METASPAM3	Click on the link to fill out the form as soon as possible
	METASPAM4	Delete the email without clicking on the link
	METASPAM5	Check the website of the mobile phone operator to see whether [...]

According to Table 2, under the "Meta-cognition" title, there were 6 strategies in the "understanding and remembering" subscale and 5 strategies in the "summarising" and "assess credibility" subscales. Those scales include students' strategies in understanding and remembering a text, summarizing by writing, and responding to an advertising email.

2.4. Data Analysis

Correspondence analysis was conducted in this study to examine the consistency between the metacognitive strategies used by the students and their reading proficiency levels. This analysis method is an exploratory technique that statistically and graphically examines the concordance in cross tables consisting of two or more variables (Alpar, 2013; Bartholomew et al., 2008). This non-parametric method does not require any assumptions except that there are no empty cells in the frequency tables. This multivariate technique is a generalized form of a simple scatterplot, representing data in a plane consisting of vertical and horizontal coordinates. Correspondence analysis, which is based on the study of Hirschfeld (1935) in the field of algebra, deals with the geometric representation of the distance (usually Euclidean and Chi-Square distance) of the profiles in the rows and columns of a crosstab in a two-dimensional plane (Greenacre, 2017). In cases where bivariate cross tables are examined, simple correspondence analysis is used, and when there are more than two variables, multiple correspondence analysis is preferred. Using **N**(*I x J*), the sum (n) of each of row n_{i+} (i = 1 ... I), and the columns n_{+j} (j = 1 ... J) in a two-way crosstab, the row and column profiles distances (d) are calculated with χ^2 (weighted Euclidean metric) as follows (Greenacre, & Hastie, 1987):

$$d = \sum_{j=1}^{J} \frac{(n_{ij}/n_{i+} - n_{i'j}/n_{i'+})^2}{(n_{+j}/n)} \qquad (2.1)$$

The mass for each row and column is obtained by weighting each profile by the sum of rows and columns, respectively. χ^2 significance test for testing the row-column independence is calculated as follows:

$$\chi^2 = \sum_{i=1}^{I} \sum_{j=1}^{J} \frac{(n_{ij} - n_{i+}n_{+j}/n)^2}{n_{i+}n_{+j}/n} \qquad (2.2)$$

The total inertia values, the weighted average of the squares of the distance the profiles from the centroid, are evaluated by dividing the χ^2 value obtained from this testby the row and column totals (n). This value is similar to the total explained variance value in the exploratory factor analysis. The significance of the χ^2 value indicates that there is a significant interaction or dependence between rows and columns in the contingency table (Greenacre & Hastie, 1987). In the interpretation of the CA results, the χ^2 value and its significance level, the inertia values of the dimensions, the contribution of points to the inertia of dimensions, the contribution of the dimensions to the points, the plots with the column and row profiles on the two-dimensional plane, and the

biplots in which the column and row profiles are located together are examined. The fact that the row and column points of two variables on the cartesian coordinate are together or close to each other indicates a correspondence between the related categories.

In the present study, the frequency tables required to carry out CA were created using IDB Analyzer and IBM SPSS Statistics software. Before beginning the analysis, the scores given to metacognitive strategies between 1 and 6 were coded as '0' for the interval 1 to 3 and as '1' for 4 to 6. Thus, all calculations were done by using the number of students who found a strategy useful or appropriate (coded as 1). SPSS syntaxes, which will perform analysis with 80 replications for each of plausible values (from 1 to 10) representing reading performance, were created with IDB Analyzer software to obtain the number of people at each proficiency level. Then, correspondence analysis was performed using the frequency tables obtained from running SPSS syntaxes.

2.5. Ethical

Ethical review and approval were not required for the study on human participants of PISA following the local legislation and institutional requirements. The participants' legal guardians provided informed consent to participate in PISA.

3. Findings

The distributions (frequencies) of students' use of metacognitive strategies according to their proficiency levels are given in Table 3.

Table 3. *Correspondence Table for Metacognitive Strategies*

	Level 1c	Level 1b	Level 1a	Level 2	Level 3	Level 4	Level 5	Level 6	Total
UNDREM1	12	128	556	1045	882	407	82	5	3117
UNDREM2	13	127	502	861	752	353	76	4	2688
UNDREM3	11	148	541	980	970	532	137	11	3330
UNDREM4	23	210	810	1491	1429	714	156	11	4844
UNDREM5	21	186	720	1366	1373	741	176	11	4594
UNDREM6	23	172	567	902	804	398	98	7	2971
Total	103	971	3696	6645	6210	3145	725	49	21544
METASUM1	12	127	518	921	824	407	88	7	2904
METASUM2	13	149	543	902	678	244	41	3	2573
METASUM3	13	169	670	1244	1171	570	125	8	3970
METASUM4	17	194	735	1396	1448	805	193	13	4801
METASUM5	24	205	788	1496	1485	796	185	12	4991
Total	79	844	3254	5959	5606	2822	632	43	19239
METASPAM1	9	123	483	822	699	284	49	3	2472
METASPAM2	10	122	517	1091	1246	682	167	10	3845
METASPAM3	10	121	428	682	421	105	12	0	1779
METASPAM4	16	115	339	542	558	319	84	6	1979
METASPAM5	15	141	569	1080	1211	711	175	12	3914
Total	60	622	2336	4217	4135	2101	487	31	13989

In Table 3, it was observed that, among understanding and remembering strategies, from highly preferred to less preferred, underlining important parts of the text, summarising the text in their word, discussing text content with other people after reading it, concentrating on the parts of the text that are easy to understand, reading the text aloud to another person, and quickly reading through the text twice strategies were selected by the students, respectively.

For summarising strategies, from highly preferred to less preferred, the students choose reading through the text and to underline the most important sentences, carefully checking whether the most important facts in the text are represented, writing the summary after reading the text as many times as possible, writing a summary and then checking that each paragraph is covered in summary, and trying to copy out accurately as many sentences as possible strategies, respectively.

Among assessing credibility strategies, highly preferred to less preferred, deleting the email without clicking on the link, checking the website of the mobile phone operator, clicking on the link to fill out the form as soon as possible, checking the sender's email address, and answering the email and ask for more information about

the smartphone strategies were selected by the students, respectively. CA results regarding whether the strategies used by the students show correspondence with their proficiency levels are given in Table 4.

Table 4. *Summary Statistics for Metacognitive Strategies*

	Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
						Accounted for	Cumulative	Standard Deviation	Correlation 2
UNDREM	1	.058	.003			.709	.709	.007	.029
	2	.035	.001			.251	.960	.007	
	3	.012	.000			.031	.991		
	4	.005	.000			.005	.996		
	5	.004	.000			.004	1.000		
	Total		.005	103.640	.000[a]	1.000	1.000		
METASUM	1	.099	.010			.979	.979	.007	.028
	2	.011	.000			.012	.991	.007	
	3	.007	.000			.005	.996		
	4	.007	.000			.004	1.000		
	Total		.010	191.100	.000[b]	1.000	1.000		
METASPAM	1	.186	.035			.927	.927	.007	-.041
	2	.050	.003			.068	.996	.009	
	3	.009	.000			.002	.998		
	4	.008	.000			.002	1.000		
	Total		.037	520.926	.000[c]	1.000	1.000		

a. 35 degrees of freedom, b. 28 degrees of freedom, c. 28 degrees of freedom.

According to Table 4, five dimensions were derived for UNDREM and four dimensions for METASUM and METASPAM strategies. However, two of them for UNDREM and METASPAM, and only one of them for METASUM were interpretable. The singular value shows the correlation between two variables in each dimension, and its standard deviation was given in the confidence singular value column. The correlation between the two dimensions was .029 for UNDREM, .028 for METASUM, and -.041 for METASPAM. The first dimension explained 70.90% of the total inertia for UNDREM, 97.90% for METASUM, and 92.70% for METASPAM. However, the first two dimensions together explained 96.00% of total inertia for UNDREM, 99.10% for METASUM, and 99.60% for METASPAM. Low inertia values indicate that the coordinate profiles were close to the centroid. However, row profiles in general were statistically significantly far from centroid of the plane for UNDREM ($\chi 2$ [35] = 103.640, p <.001), METASUM ($\chi 2$[28] = 191.100, p<.001), and METASPAM ($\chi 2$[28] = 520.926, p<.001). This result shows that the metacognitive strategies chosen by the students were not independent of their proficiency levels. In other words, it has been observed that students with different proficiency levels preferred different strategies. Appendix A provides a summary of row and column points, which includes masses, inertias, scores in dimensions, the contribution of points to the inertia of dimensions, and the contribution of dimensions to the inertia of points. In addition, the appendix also describes the contribution of points to the inertia of dimensions. Figure 1 presents the biplot chart for UNDREM, which takes into account both the row and column profiles simultaneously.

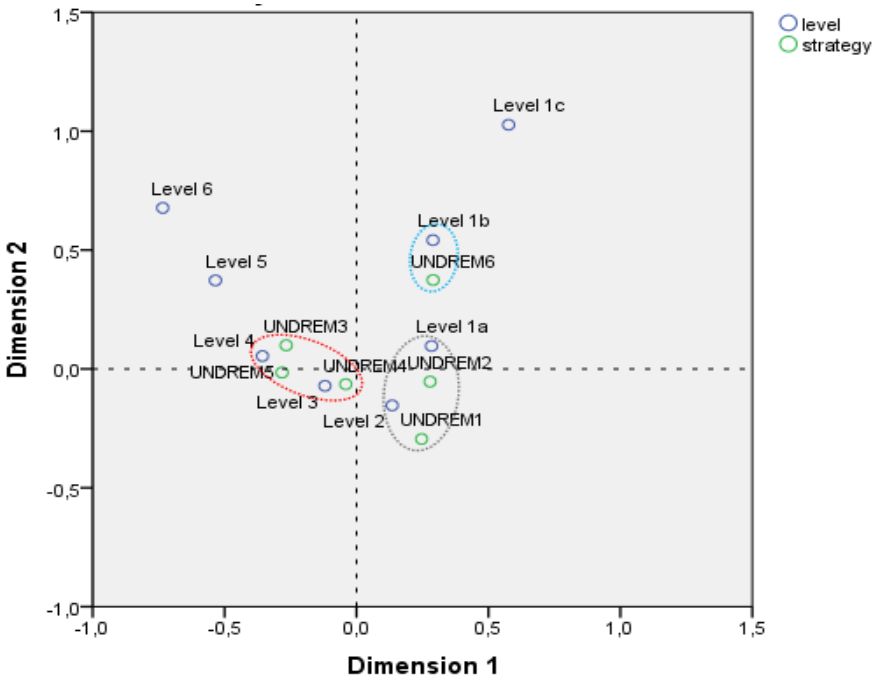

Figure 1. *Biplot Visualization for Understanding and Remembering Strategies*

When Figure 1 was examined, it was observed that students at the lowest reading proficiency level (1c) differed from all other students and did not have a specific strategy preference. Similarly, students at the 5th and 6th levels, which are the highest levels of reading proficiency, differ from other students but have a position close to level 4. Skilled readers prefer understanding and remembering strategies that differ significantly from developing readers. Accordingly, while reading the text aloud to another person strategy was predominant for developing readers, discussing text content with other people after reading it, underlining important parts of the text, and summarising the text in their words had concordance with high reading proficiency levels. At the other levels, there was correspondence with the strategies of concentrating on the parts of the text that are easy to understand and quickly reading through the text twice. The biplot chart, including row and column profiles together for METASUM was given in Figure 2.

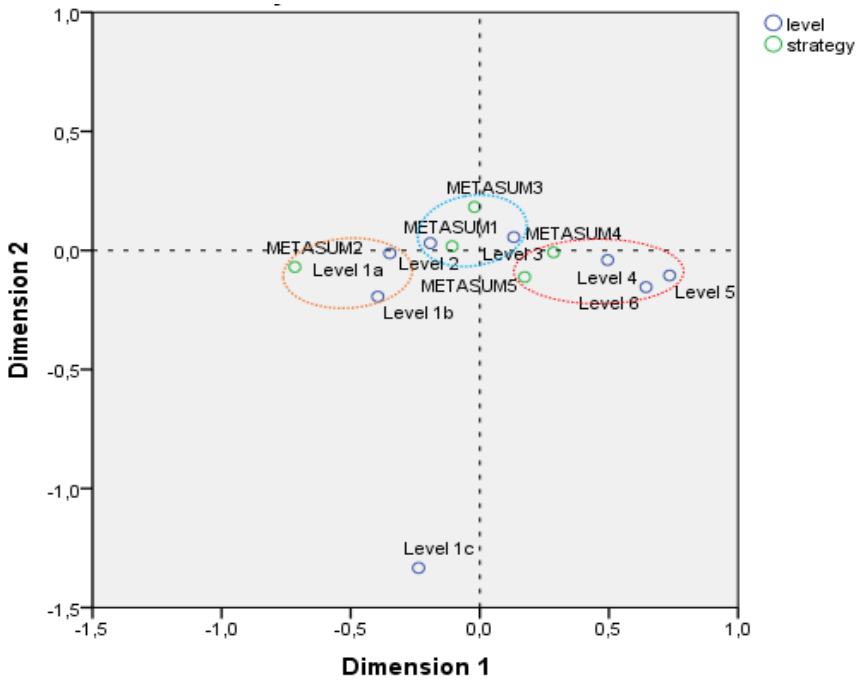

Figure 2. *Biplot Visualization for Summarising Strategies*

According to Figure 2, similar to biplot for UNDREM, readers with low proficiency level (1c) differentiated from all other students and did not prefer a specific strategy. Skilled readers differ significantly from developing readers. Accordingly, while the strategy of trying to copy out accurately as many sentences as possible was predominant for developing readers, carefully checking whether the most important facts are represented in the text, and reading through the text and underlining the most important sentences had concordance with high reading proficiency levels. At the other levels, there was correspondence with the strategies of writing the summary after reading the text as many times as possible, writing a summary, and then checking that each paragraph is covered in summary. The biplot chart, including row and column profiles together for METASPAM is given in Figure 3.

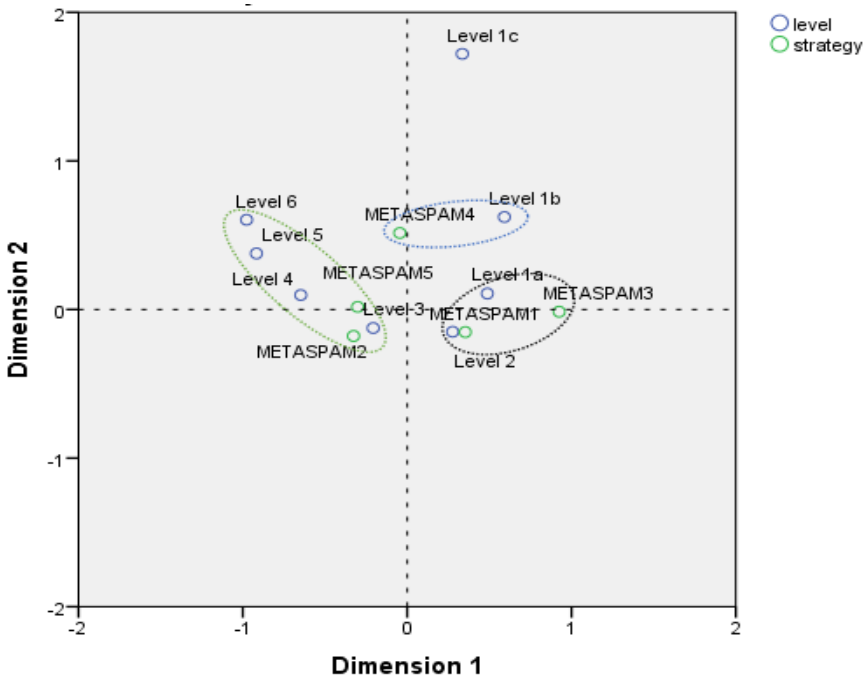

Figure 3. *Biplot Visualization for Assessing Credibility Strategies*

In Figure 3, for METASPAM, similar to both UNDREM and METASUM, developing readers (especially level 1c) differ from all other students. Skilled readers differ significantly from developing readers. Accordingly, while the strategies of answering the email and asking for more information about the smartphone, deleting the email without clicking on the link, and clicking on the link to fill out the form as soon as possible was predominant for developing readers, checking the website of the mobile phone operator and checking the sender's email address had concordance with high reading proficiency levels. However, in general, it is observed that students with high proficiency levels did not have high correspondence with a specific strategy and had low concordance with other students.

4. Conclusion and Discussion

As a result of this study, it was determined that students at different reading levels preferred significantly different strategies for all three metacognition variables. In other words, the strategy choices of skilled and developing readers differ significantly. Especially, it was found that students at level 1c differ from all other students and do not prefer a specific metacognitive strategy. This result is consistent with research results showing that skilled readers use metacognitive strategies more effectively than developing readers (Artelt et al., 2001; Chiu et al., 2007; Koyuncu & Fırat, 2020; Mikk, 2015). Metacognitive strategy knowledge refers to the ability to evaluate the usefulness of some strategies compared to others (Zhou et al., 2020). Lau and Chan (2003) found that developing readers use all reading strategies, especially sophisticated cognitive and metacognitive strategies, less than skilled readers and score lower in reading. Säälik et al. (2015) showed that student awareness of metacognitive learning strategies was the most predictive variable in explaining reading achievement at both student and school levels. In addition, Koyuncu and Frat (2020) came to the conclusion, which is consistent with the findings of the present research, that skilled readers favor metacognitive strategies that focus primarily on evaluating the credibility of the source and summarizing its key points.Skilled and

developing readers differently preferred understanding and remembering strategies. While reading the text aloud to another person is predominant for developing readers, discussing the content of the text, underlining the important points, and summarizing the text in their sentences are predominant for skilled readers. When this result is examined, reading the text aloud requires a less cognitive process, while identifying the important points in the text and expressing them in their sentences requires more cognitive effort. Skilled readers (especially 5th and 6th) of the PISA study are expected to fulfill more complex, difficult, and higher-level thinking skills (e.g., the ability to think deeply, make connections, and compare). Similar to these results, Anastasiou and Griva (2009) found that skilled readers use reading comprehension strategies as a way to deepen their knowledge, support or explain their interpretation of the text, and choose the best strategies that will enable them to understand the text; however, developing readers have a limited metacognitive strategy preference and tend to use the same strategies all the time. Fırat and Kocak (2019) urged skilled readers explain the content of the text they read to their friends, siblings, or parents, and thus their knowledge becomes more permanent.

Developing readers mostly use summarizing strategy of “trying to copy out accurately as many sentences as possible”. However, skilled readers mostly used summarizing strategies of "checking whether the most important facts in the text are represented " and "reading through the text, underlining the most important sentences.". Similarly, Mak et al. (2017) illustrated that these two strategies are more effective than others for summarizing a long and rather complex text. On the other hand, they determined that ineffective novice readers prefer to try to copy as many sentences accurately as possible. Summarizing requires students to make a deep mental effort (Lim, & Jung, 2019). Hong-Nam et al. (2014) found that skilled readers make connections with their previous knowledge to reveal the meaning of the text, not only questioning themselves while reading but also reassessing expectations when contradictory information could emerge, engaging more actively by seeking answers to the questions and cross-check the text content to verify their understanding. Bilican and Yıldırım (2014) determined that there is a positive relationship between students' reading scores and the use of understanding and remembering, summarizing, and checking strategies; however, there is a negative relationship with memorization strategies.

As a result of this study, developing readers mostly chose to assess credibility strategies for learning details by replying to an email, filling out the form immediately in the email, and deleting the email without clicking on the link. On the other hand, skilled readers mainly prefer assessing credibility strategies for checking the sender's address and the related website. The importance of digital reading activities was also emphasized in studies conducted with PISA data (see; Mikk, 2015; Vázquez-Cano et al., 2020). Critical thinking to evaluate the source of information is undoubtedly more important in digital texts than in printed ones (Lim & Jung, 2019). Moreover, new skills and strategies are required for students to effectively use digital tools such as emails (Lee & Wu, 2012). When an incoming email within the framework of metacognitive knowledge is considered, students are expected to look over the email (look at the header and the sender or link/s in the email), estimate (think about whether the email is important or unimportant), understand the content of the email (look at important and unimportant information in the email) and think about whether or not to reply to this email.

On the other hand, the weakness in these skills may cause developing readers to immediately fill out the form in the link or delete the email immediately. As a result, while skilled readers improve their knowledge and understanding by using advanced metacognitive strategies in the online environment, developing readers may be deprived of those skills' advantages. In this context, studies have shown that supporting students with digital reading contributes to their reading literacy skills (Chen & Chen, 2014; Chen et al., 2014). Chen et al. (2014) combined the self-regulated learning (SRL) mechanism with a digital reading annotation (DRAS) that students in grade 7 can use collaboratively to create rich, high-quality content that encourages their English reading. Compared with students using DRAS without SLR support, students using DRAS supported by SLR mechanisms significantly improved their reading comprehension. In addition to basic reading skills, educators and teachers should focus on teaching, monitoring, evaluating, and integrating strategies in both offline and online reading environments so that their students can develop effective strategies in the reading process (Lee & Wu, 2013).

As the last important result of the study, the dilemma may arise whether skilled readers use more effective metacognitive strategies or readers who use effective metacognitive strategies are more successful in reading.

Reading comprehension is a complex process. In addition to metacognitive strategies for successful reading comprehension, many factors such as reading fluency (Torppa et al., 2020), text structure knowledge (Bogaerds-Hazenberg et al., 2020), motivation (Logan et al., 2011), prior knowledge (Ozuru et al., 2009), vocabulary knowledge (Quinn et al., 2020) and memory (Johann et al., 2020) must be used together and implemented successfully. In this context, skilled readers use metacognitive strategies more effectively than developing readers. The reason for this situation is that experienced readers know much more about the content of texts in general, and they are more motivated and have more vocabulary knowledge than developing readers.

Moreover, without motivation, use of content, and text structure knowledge, metacognitive knowledge may not function well (Wang et al., 2014). Therefore, metacognitive skills are important factors for reading comprehension, but they are not sufficient. For this purpose, along with metacognitive strategy teaching, intervention programs designed to increase access to reading materials, motivation, and skills should be offered to students (to developing readers especially) on an ongoing basis (Brozo et al., 2007).

In addition, the data used in this study were obtained from students' self-reports. While Veenman (2011) explained that being easily applied to large groups and processed accordingly are advantages of this method, it was stated that there are serious validity issues in the data obtained. The disadvantages of this method are (a) students' answers are based on their past experiences, (b) memory failure and distortions can harm this process, (c) and students' tendency to give the desired or expected answers (Veenman, 2011). However, methods of thinking aloud, observation, eye movement recording, and log file recording of student activities on the computer can also be used to determine the use of metacognitive strategies (Veenman et al., 2006; Veenman, 2011). Schraw (2009) pointed out the difficulty of measuring metacognition and stated that no single method allows measuring processes related to metacognition alone. The researcher also recommended using multiple outcome measures whenever possible in determining metacognition.

Another issue that needs to be discussed in this study is related to the items used in the scales to measure the metacognitive strategies used in the PISA study. These scales include strategies students use to understand and remember, summarize a text, and respond to an advertising email. Although the items in these scales aim to determine metacognitive strategies, these items can also be considered in the dimension of reading comprehension strategy supported by metacognition. In addition, metacognitive and cognitive strategies may overlap because a strategy such as questioning can be considered a cognitive or metacognitive strategy depending on the purpose of using that strategy (Ku & Ho, 2010; Livingston, 2003). For example, the strategy of questioning can be used as a means of obtaining information (cognitive) or as a way of monitoring what is read (metacognitive) while reading (Livingston, 2003). Whether these items reflect metacognitive strategies needs to be investigated further.

To conclude, the results of this study revealed that the students' choice of metacognitive strategies is highly related to their reading proficiency levels. That is, while the students with high proficiency levels prefer complicated and effective strategies, the low performers use more simple techniques that did not provide insight into the text. Countries with average or below PISA reading performance such as Turkey need to focus on enhancing their students' metacognitive strategy use in addition to other non-cognitive and metacognitive factors. Although metacognition has been a focal point for improving learning as a tool for nearly 30 years, the importance of it or how to teach students about it may not have been accepted by all educators (Säälik et al., 2015). Metacognitive awareness can be improved through classroom instruction, which has also resulted in significant improvements for developing readers (see Çakıroglu & Ataman, 2008; Firat, 2019). Brozo et al. (2013) emphasize the importance of cooperation between teachers from different disciplines and literacy experts in teaching reading strategies and creating related classroom activities. Since teachers and schools have an opportunity to help their students by teaching those skills, their awareness of useful strategies may possibly depend on teaching at school (Säälik, 2015). In this context, policy makers and teachers have important roles in teaching and development of metacognitive skills.

5. Limitations and Recommendations

Despite the important results obtained in current study, there are some limitations. First, the study's data were limited to the students' answers in the PISA 2018 student questionnaire. It is an important limitation that the

participants were not observed while reading the texts to determine their use of metacognitive strategies. As another limitation, the data used in this study was limited to the responses of the participants from Turkey. Moreover, although Turkey took place in mid-rank among the OECD countries in terms of reading performance, a small number of students reached the reading proficiency levels of 5 and 6. This situation was also a limitation to generalize the findings of the present study. Accordingly, by choosing countries at different levels in PISA reading performance, metacognitive strategies used by skilled and developing level readers can be compared.

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