



Okuma Stratejilerine Yönelik Üst Bilişsel Farkındalığın Problem Kurma Becerisini Yordama Düzeyi

The Prediction Level of Metacognitive Awareness of Reading Strategies on Problem Posing Skill

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ÖZ: Araştırmanın amacı yedinci sınıf öğrencilerinin okuma stratejileri üst bilişsel farkındalıkları ile problem kurma beceri düzeyleri arasındaki yordamsal ilişkilerin incelenmesidir. Araştırmaya 373 yedinci sınıf öğrencisi katılmıştır. Araştırmanın verileri “Okuma Stratejileri Üst Bilişsel Farkındalık Ölçeği” ve “Problem Kurma Beceri Testi” kullanılarak toplanmıştır. Verilerin analizinde basit doğrusal regresyon analizi kullanılmıştır. Araştırma sonucunda yedinci sınıf öğrencilerinin okuma stratejileri üst bilişsel farkındalık düzeylerinin; problem kurma becerilerini anlamlı bir şekilde yordadığı ve problem kurma becerisindeki değişimin %42’sini anlamlı bir şekilde açıkladığı belirlenmiştir. Ulaşılan bu sonuçlar doğrultusunda; öğretmenlerin okuduğunu anlama ve bilişsel farkındalığın gelişimine yönelik, farklı okuma ve problem kurma stratejilerinin kullanımını içeren disiplinler arası problem kurma etkinlikleri planlamaları ve uygulamaları önerilmektedir.

Anahtar sözcükler: Matematik öğretimi, okuduğunu anlama, okuma stratejilerine yönelik üst bilişsel farkındalık, problem kurma becerisi, yedinci sınıf öğrencileri

ABSTRACT: The aim of the study was analyzing the predictive relations between reading strategies metacognitive awareness and problem posing skills of seventh grade students. Within the study, 373 seventh grade students participated. The data of the study was collected using “Metacognitive Awareness of Reading Strategies Inventory” and “Problem Posing Skills Test”. Through the analysis of the data, simple linear regression analysis was used. As a result of the study, it was determined that reading strategies metacognitive awareness levels of seventh grade students significantly predicted problem posing skills and explained 42% of the change in problem posing skills. In line with these results; it is recommended that teachers plan and implement interdisciplinary problem posing

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activities that include the use of different reading and problem posing strategies for the development of reading comprehension and cognitive awareness.

Keywords: Mathematics teaching, reading comprehension, metacognitive awareness of reading strategies, problem posing skill, seventh grade students

1. INTRODUCTION

Through today's mathematics curriculum; it is aimed to raise individuals who can use their mathematical knowledge in problem solving processes, who can easily express their mathematical reasoning, who can make correct meanings from what they read by using reading strategies and metacognitive awareness skills (Akay, 2006; Altun, 2002; Ministry of National Education [MoNE], 2018). Problem posing, having an important place among mathematical skills, is accepted as an important mental activity that supports understanding mathematics, abstract and creative thinking in the process of reaching these goals, and serves as a bridge between mathematics and daily life (Brown, 1987; Silver & Cai, 1996; Silver, 1994; Zehir, 2013). Problem posing, in addition to solve the problem, is defined as the skill of composing a new problem based on a given problem or reformulating the given problem (Akay, 2006; Altun, 2002; Işık & Kar, 2012). Problem posing skill (PPS) is closely associated with many variables as primarily with reading comprehension (Akkaya, 2011; Semizoğlu, 2013) and metacognitive awareness skills (Ada, 2019; Yıldız, 2014) an also problem solving skill (Abu Elvan, 2002; Akay, 2016; Cai & Hwang, 2002; English, 1998; Fidan, 2008; Lavy & Shriki, 2007; Suarsana, Lestari & Mertasari, 2019; Şakar, 2018; Turhan 2011), attitude towards reading, reading habits, fluent reading level and writing skills (Kaya Tosun, 2018; Sallabaş, 2008; Yıldız & Akyol, 2011).

The results of related studies put forward that especially reading comprehension skills directly affect problem solving and problem posing skills (Erdem, 2016; Göktaş & Gürbüzürk, 2012; Kocadağ, 2019; Semizoğlu, 2013; Tatar & Soylu, 2006). It is indicated that individuals who ask themselves questions about the problem, visualize the given in the problem and summarize what they read could make a better sense of the problem guessing what the problem is related to (Pesa & Somers, 2007). Besides, within the studies conducted it has been emphasized on individuals' metacognitive awareness regarding the strategies they use in problem posing process; it is stated that individuals whose reading strategies metacognitive awareness level (MARS) are high, are more successful in choosing, planning, applying and making sense of the strategy used in reading and understanding the problem (Hertzog & Robinson, 2005; Naglieri & Dass, 2005; Sternberg, 2005).

MARS is defined as being aware of cognitive skills available in reading and comprehending process; checking herself/himself and the comprehending process, being aware of the strategies and methods one uses in pre-reading, reading and post-reading phases; receiving feedback on comprehension of the text and skill for making evaluations regarding the comprehension of the text (Gelen, 2003; Kanmaz, 2012; Öztürk, 2012; Pressley & Harris, 2006). MARS skills show to what extent an individual is aware of metacognitive knowledge within reading comprehension and how effective s/he uses the reading strategies (Pressley & Harris, 2006). Also, within problem posing process individuals should be aware of their reasoning and mental activities and control these activities (Cai & Hwang, 2002; Çetinkaya & Soybaş, 2018; English, 1998). It is stated that individuals whose MARS levels are low have difficulty in recognizing the expressed idea in the problem and making sense of it. Therefore, it is getting difficult for these individuals to determine, apply, follow, and evaluate the necessary strategies for the solution of the problem (Gelen, 2003). This situation shows that students' MARS skills should be at a sufficient level in order to pose problems of quality (Göktaş & Gürbüzürk, 2012; Oluk & Başöncül, 2009; Sapungan, Gabor & Rayos, 2018; Tatar & Soylu, 2006).

Through studies on this subject; it was found out that the relationship between MARS level and problem solving perception (Karakelle, 2012) and problem solving success (Bakioğlu, Küçükaydın & Karamustafaoğlu 2015; Balcı, 2007; Dülger, 2019; Lee, Teo & Bergin, 2009; Özsoy, 2007) were examined and also it was determined that metacognitive awareness for reading strategies make important

contributions to development of problem solving skill (Özsoy, 2007), reading comprehension skill and positive attitude for reading (Akkaya, 2011; Hedin, Mason & Gaffney, 2011; Kanmaz, 2012; McElvain, 2010; Tuna, 2016). While the related research results present significant data regarding the relationship between problem solving, reading comprehension and metacognitive awareness skills, there seems to be a limited number of studies where problem posing performance is examined in terms of reading comprehension (Semizoğlu, 2013) and metacognitive awareness skills (Ada, 2019; Silver, 1994). Within this context, the absence of any study investigating the predictive relationships between problem posing skill and metacognitive awareness of reading strategies has been evaluated as an important deficiency.

This study is conducted based on this need and it sought for an answer to the question ‘Do seventh grade students' reading strategies and metacognitive awareness levels significantly predict their problem posing skills?’. It is expected that the results of the study will contribute to teachers' planning, implementing and evaluating qualified and comprehensive problem posing activities. With the obtained results, it is thought that significant contributions will be made to curriculum development experts in structuring the mathematics course curriculum by considering metacognitive awareness and problem posing skills.

2. METHOD

2.1. Research Design

Predictive research design was used within the study. Within predictive research design, the relationships between determined variables are explained, and predictions are made about a variable based on the other (Büyüköztürk et. al., 2018). The predicted variable of the study was determined as problem posing skill and the predictor variable as reading strategies metacognitive awareness level.

2.2. Population and Sample

In the target population of the study; there were 2778 seventh grade students studying in middle schools in a city center in the western part of Turkey in 2019-2020 education year. Among these students, 373 seventh grade students were selected by proportional cluster sampling method and composed the sample of the research. About sampling of seventh grade students; some conditions such as the studies on the subject are concentrated at other grade levels; the acquisitions in the seventh grade mathematics and mathematics applications curriculum include problem posing skills more than other grade levels has been effective.

2.3. Data Collection Tools

Within data collection, the “Metacognitive Awareness of Reading Strategies Inventory” developed by Mokhtari and Reichard (2002) and adapted to Turkish by Öztürk (2012) and the “Problem Posing Skills Test” developed by Turhan Türkkkan (2017) were used. The Metacognitive Awareness of Reading Strategies Inventory consisted of 30 items regarding three sub-factors as “support reading strategies”, “problem solving strategy”, and “general reading strategy” and it is a five-point Likertscale. While the total variance explained by the scale was 42.60%, the Cronbach's alpha reliability coefficient for the total scores obtained from the scale was calculated as .93. It was determined that the reliability coefficients for the sub-factors ranged from .76 to .85. As a result of the second level confirmatory factor analysis performed during the adaptation of the scale (RMSEA=.044, SRMR=.052, GFI=.86, AGFI=.85,

CFI=.98, NFI=.94, IFI=.98 and NNFI=.98), it was determined that the scale had a good fit or was very close to a good fit.

The Problem Posing Skill Test is about operations with whole numbers and rational numbers, ratio and proportion, percentages, equality and equation, data analysis and probability which are sub-learning areas in the seventh-grade mathematics and mathematics applications course curriculum. The test is composed of eight questions two of which are free problem posing questions, three semi-structured problem posing questions and three structured problem posing questions. In this study, as the probability sub-learning area was not found in 2019-2020 education year seventh grade mathematics and mathematics applications courses curricula, one question was removed from the test. Instead, another question was added in the same problem posing situation without disrupting the content validity of the test.

Regarding the reliability studies of the test, Pearson correlation coefficient between the raters was .98; while Spearman-Brown reliability coefficient was found as .79. During scoring and evaluating the data obtained through the Problem Posing Skill test, the "Problem Posing Skill Test Rubric" developed by Turhan Türkkan (2017) was used. The Analytical Rubric consisted of five criteria which are difficulty level, the use of the desired state, the dissolution, originality and language-expression skills. Problems posed by students for each criterion were scored as in beginner level (1), successful (2), exemplary (3 and the total score was reached).

2.4. Data Analysis

Within data analysis, simple linear regression analysis was used. Through preparing the data for analysis, normal distribution characteristics and the linear relationship between the variables, which are among the basic requirements of simple linear regression analysis, were examined. In this respect, mean, mode and median values and skewness and kurtosis coefficients were calculated regarding the scores of the PPS test and MARS scale. As a result of the examination, it was determined that the central tendency measures regarding the total scores were close to each other and the coefficients of skewness and kurtosis varied between +1 and -1. In normal distribution measurements, the skewness and kurtosis values between the range of ± 1.0 are accepted as perfect (George & Mallery, 2001, p. 86). In line with this, it was found that the scores of the scales showed normal distribution. As a result of simple linear regression analysis to test the linear relationship, it was determined that there was a moderate significant relationship between the relevant variables ($r = .649$; $p = .00 < .01$).

Within the scope of the validity studies of the research, the content validity of the PPS test was evaluated in line with the expert opinions. For this purpose, first of all, the question to be added to the test was determined by considering all the attainments in the seventh-grade mathematics curriculum. Afterwards, the views of two lectures with a PhD in curriculum and instruction and who have conducted studies in mathematics education, and the views of four mathematics teachers regarding the prepared question were determined, and it was detected that the determined question also ensured the test's content validity.

Regarding reliability studies; Cronbach alpha reliability coefficient for total scores by MARS scale was calculated as $\alpha = .92$. The reliability coefficients for sub-dimensions were found to be as follows: for problem solving strategy $\alpha = .75$, for support reading strategies $\alpha = .79$, for general reading strategies $\alpha = .85$. The reliability of the PPS test was tested on the data of 100 seventh grade students. In this context, the data were scored separately by the researcher and an experienced mathematics teacher and the evaluation results were compared. While the interrater Pearson correlation coefficient was found as .99, the

Spearman-Brown reliability coefficient was .80. As for the reliability studies of PPS test rubric, used within the research, correlation analyses for each sub-dimension of the rubric were conducted. As a result of the analyses, Pearson correlation coefficients were found to be as follows: for the difficulty level dimension .99, for the use of the desired state dimension .99, for the dissolution dimension .95, for originality dimension .99, and for language-expression skills dimension .99.

3. FINDINGS

The mean, standard deviation and correlation values for predicted and predictor variables are shown in Table 1.

Table 1: Mean, Standard Deviation, and Correlation Values for Reading Strategies Metacognitive Awareness and Problem-Posing Skill Level Variables

Variable	N	X	Sd	1	2
1.Metacognitive Awareness of Reading Strategies (MARS)	373	2.99	.65	-	.65**
2.Problem Posing Skill (PPS)	373	74.55	19.30	.65**	-

** p<.01

It is seen in Table 1 that the mean for predicted variable (PPS) was 74.75; and the standard deviation was 19.30. It was found that the mean for predictor variable (MARS) was 2.99, standard deviation was .65. Mean values for predictor and predicted variables show that MARS and PPS levels of students were moderate. When the correlation value was examined, on the other hand, it was determined that there is was a moderately significant relationship between MARS and PPS levels of students ($r = .65$; $p < .01$). The simple linear regression analysis results for predictor and predicted variables are presented in Table 2.

Table 2: Simple Linear Regression Analysis Results for MARS Level and PPS Level Variables

Variable	B	Std. Error	B	t	p
Constant	17.56	3.55		4.95	.00
MARS level	.64	.04	.65	16.43	.00
R=	.65	R ² =.42	Adjusted R ² =	.42	
F (1-371) =	270.08	p=	.00		

As a result of the simple linear regression analysis in Table 2, it was determined that the seventh-grade students' MARS levels significantly predicted their problem posing skills ($R = .65$, $R^2 = .42$, $F(1-371) = 270.08$, $p < .01$). It is seen that students' reading strategies metacognitive awareness levels significantly explain 42% of the change in problem posing skills.

4. DISCUSSION and RESULT

In this study, it was aimed at analyzing the predictive relationships between MARS and PPS levels of seventh grade students. As a result of the study, it was found that MARS levels of seventh graders significantly predicted their problem posing skills. It was determined that students' MARS levels significantly explained the change in their problem posing skills. MARS involves the metacognitive skills necessary for an individual to be aware of their metacognitive knowledge in the reading comprehension process and to use reading strategies effectively (Pressley & Harris, 2006). Through this process, it is required that individuals use the necessary metacognitive knowledge for reading comprehension in this process, follow and evaluate the process (Lee et al., 2009). That MARS level significantly predicts the problem posing skills shows that individuals are aware of their purpose and the metacognitive strategies to be used in the process of comprehending the problem, and use the strategies they choose effectively, are more successful in problem posing process. In studies examining the relationship between reading comprehension and metacognitive awareness skills and problem-solving skills, it has been concluded that there is a high level of positive correlation between these variables (Dülger, 2019; Lee et al., 2009; Matel, 2013; Özsoy, 2007; Pugalee, 2001; Semizoğlu, 2013). On the other hand, in Ada's (2019) study, it was put forward that metacognition has a significant positive relationship with problem posing performance. Considering that problem posing is a comprehensive process including problem solving as well (Altun, 2002; Balcı, 2007; Matel, 2013), the results reached also supports the findings of this study. In this context, MARS skills were found to play a significant role over problem solving skill, and are also an important variable in increasing the problem posing performance.

In other studies supporting the current study's findings, the ability to read and comprehend the problem is considered as a prerequisite of problem posing (Altunkaya, 2017; Kandemir, 2019; Sapungan et al., 2018; Saraç-Ekmen, 2019; Sert, 2010; Yantr, 2011). In Silver's (1994) research, it was concluded that students whose language usage level is insufficient, posed mathematically difficult problems and they were similar to each other. Within the study by Bakioglu et al. (2015) it was determined that students who could comprehend the text they read using the strategy they created on their own are more successful in solving and posing the problem they might encounter in daily life. This finding similar to Silver's (1994) findings. On the other hand, in the research by Ada (2019), it was determined that academic success in mathematics and Turkish courses played a mediating role in problem posing performance. In this context, it is seen that the problem posing process is not limited to mathematical skills. These results draw attention to the fact that reading comprehension is an important variable that activates using the language required by the problem posing process and establishing relationships. On the other hand, MARS skills used in comprehension process help the reader realize the strong and weak sides of himself/herself while reading the texts of different characteristics and contribute to the development of self-control (Kanmaz, 2012). Therefore, it is seen that metacognitive strategies used in understanding the problem, which is the first step of the problem posing process, play an important role in increasing the success of problem posing. When middle school mathematics and Turkish course curricula were examined, reading comprehension and effective use of reading strategies were significantly emphasized among Turkish course curriculum objectives (MoNE, 2019). Problem posing, on the other hand, is in the curriculum as a skill related to the mathematics course (MoNE, 2018). It has been determined that metacognitive skills are mentioned with very limited explanations, which are common in both programs, and it is recommended to acquire these skills through interdisciplinary activities (MoNE, 2018; 2019). The role of reading comprehension metacognitive awareness in development of problem posing skill draws the attention to the significance of teaching activities serving simultaneously for developing

reading comprehension, metacognitive awareness and problem posing skills. Hence, it is thought that interdisciplinary activities that support the development of reading comprehension and cognitive awareness skills are needed in the development of problem posing success.

Consequently, in the current research, it was determined that MARS levels of seventh graders significantly predicted PPS levels and their MARS levels significantly explained change in PPS. In line with these results; it is recommended that teachers who play a guiding role in the teaching process should plan and implement interdisciplinary problem posing activities that include the use of different reading and problem posing strategies and serve the use of reading comprehension and cognitive awareness. Considering the skills of using the language and establishing relationships required by the problem-posing process, it is thought that learning attainments that support reading comprehension before problem-posing activities and the development of cognitive awareness in the problem-posing process should be included in the middle school mathematics curriculum.

The results of the study are limited to the data obtained by seventh grade students. So, with the researches at different grade levels, studies could be conducted to determine metacognitive awareness and problem posing skill levels for reading strategies and to examine the predictive relationships between related variables.

Declaration of Contribution Rate of Authors

The authors contributed equally to the research.

Conflict of Interest Declaration

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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