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HIGH SCHOOL STUDENTS' LEVEL OF MATHEMATICS ANXIETY AND USE OF SELF-REGULATORY LEARNING STRATEGIES

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Abstract: We aimed to examine high school students' level of mathematics anxiety and use of self-regulatory learning strategies as a function of different variables and to examine the correlation between these variables. The sample consisted of 330 students at 11th and 12th grades from three different high schools in the west of Turkey. We used the Revised Mathematics Anxiety Rating Scale, Self-Regulatory Strategies Scale, and a personal information form. We found that female students' level of mathematics anxiety and use of self-regulatory learning strategies were higher than male students. Moreover, we found that 11th grade students had higher mathematics anxiety than 12th grade students and that there is a significant difference in students' level of mathematics anxiety by mathematics achievement. In contrast, use of self-regulatory learning strategies did not demonstrate a significant difference by mathematics achievement scores. We found no correlation between students' level of mathematics anxiety and use of self-regulatory learning strategies.

Key words: Mathematics anxiety, self-regulatory learning strategies, high school students

1. Introduction

In this age where we are intertwined with information and communication technologies, social change and development also continue without slowing down. With this rapid change, the outlook on mathematics, expectations, the way mathematics is used, and the processes of learning and teaching mathematics are also changing. The aim of Turkey's educational system is to train students with the combined knowledge, skills, and behaviors required to achieve success (Ministry of National Education [MNE], 2018). It also aims to educate students into individuals with problem-solving skills, who have acquired mathematical thinking and application skills, can use mathematics correctly and effectively, value mathematics, have knowledge about the historical process of mathematics, and develop a perspective for problems they face in the real-life (MNE, 2018). While the education system expected students to act in this direction, students who experienced difficulties in mathematics and failed due to errors in their calculations start perceiving mathematics as a course that was difficult to learn and thought that they would not succeed in it. This perspective led students to have unfavorable attitudes towards mathematics and reduced their achievement in mathematics. One of the most important reasons for this is mathematics anxiety and the negative reactions that occur in students over time cause mathematics anxiety (Alkan, 2011; Yenilmez & Özbey, 2006).

Many researchers defined mathematics anxiety (Ashcraft, 2002; Dreger & Aiken, 1957; Fennema & Sherman, 1976; Gresham, 2010; Hembree, 1990; Maloney & Beilock, 2012; Sherard, 1981). Dreger and Aiken (1957) define mathematics anxiety as the emotional response symptoms towards arithmetic and mathematics. Richardson and Suinn (1972), on the other hand, defined it as the feeling of anxiety and tension that prevents solving mathematical problems and manipulating numbers. Although studies on mathematics anxiety were first conducted in the 1950s when the topic first drew the attention of the mathematics teachers, significant studies were conducted in the early 1970s with the emergence of suitable tools to measure mathematics anxiety (Ashcraft & Krause, 2007; Özdemir & Gür, 2011). Most of the studies concentrated on math anxiety and its associations with different variables. When we examined the literature on mathematics anxiety in recent years, we found studies on differences in

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level of mathematics anxiety according to gender or grade levels (Dede & Dursun, 2008; Devine et al., 2012; Dursun & Bindak, 2011; Koçer, 2019; Kurbanoğlu & Takunyacı, 2012; Kutluca et al., 2015; Luo et al., 2009; Süren, 2019; Uysal & Selışık, 2016), studies investigating relationship between mathematics achievement and mathematics anxiety (Dursun & Bindak, 2011; Ergene, 2011; Koçer, 2019; Kutluca et al., 2015; Wu et al., 2012), relationship between mathematics anxiety and socio economic levels (Arslan et al., 2017; Erdoğan et al., 2011), relationship between motivation and mathematics anxiety (Durmaz & Akkuş, 2012; Ergene, 2011; Süren, 2019) and relationship between the use of learning strategies and mathematics anxiety (Arslan et al., 2017). In addition to these studies, we found studies examining the effect of instructional methods on mathematics anxiety (Çakır & Aztekin, 2016; Katipoğlu et al., 2017).

Apart from anxiety, Akkuş İspir et al. (2011) stated that self-regulation is an affective factor that affect learning. The concept of self-regulation has become significant with teachers' desire to provide students with learning skills and students' need to organize their learning activities (Eker & Arsal, 2014). Bandura (1986) defined self-regulation as an effective process in which an individual controls and recognizes her/his learning, sets learning goals, and adjusts metacognition capacity and behaviors. Self-regulatory learning is the use of self-regulation skills in the process of learning (Pintrich, 2000; Zimmerman, 1990, 2002). Pintrich (2000) defined self-regulatory learning as various self-regulatory stages that students pass to learn how to regulate their cognition and behavior while being active in this process. Also, Zimmerman (1990) defined self-regulatory learning as a process where students actively regulate their learning in a meta-cognitive, motivational, and behavioral manner. When we reviewed the literature on self-regulatory learning in recent years, we found studies investigating effect of self-regulatory learning on mathematics achievement (Ülker, 2019), relationship between mathematics achievement and use of self-regulatory learning strategies (Alpaslan & Ulubey, 2019; Kaya, 2019; Pape & Wang, 2003; Sürmeli & Ünver, 2017), relationship between use of self-regulatory learning strategies and sense of achievement in mathematics (Çalık, 2014; Kocacan, 2018), gifted students' self-regulatory learning strategies (Akkuş İspir et al., 2011), the effect of using course diaries on teaching self-regulation strategies (Eker & Arsal, 2014), relationship between use of self-regulatory learning strategies and achievement (Haşlaman, 2005), relationship between use of self-regulation strategies and non-standard word problem solving ability (Kılıç & Tanrıseven, 2012); relationship between self-regulation skills and self-regulatory learning processes (Haşlaman, 2018), relationship between tutoring, self-study, self-efficacy and self-regulatory learning (Hong & Park, 2012) and relationship between self-regulation skills for mathematics course, mathematics self-efficacy beliefs and mathematics anxiety (İpek, 2019).

When we reviewed the literature in Turkey, we could not find any studies in high schools examining the relationship between the level of mathematics anxiety and the use of self-regulatory learning strategies. We believe that an examination of the relationship between the level of mathematics anxiety and the use of self-regulatory learning strategies can contribute to the field of teaching mathematics in high school. In addition, we thought that it is important for mathematics education to investigate whether the level of mathematics anxiety and the use of self-regulatory learning strategies differ as a function of different variables and to make suggestions consistent with the findings.

We aimed in this study to examine the 11th and 12th grade high school students' level of mathematics anxiety and use of self-regulatory learning strategies as a function of different variables and to examine the relationship between the level of mathematics anxiety and the use of self-regulatory learning strategies. We stated the study's research problem as "the high school students' level of mathematics anxiety and use of self-regulatory learning strategies significantly related?". We sought answers for the following questions to address the research problem:

1. What is the students' level of mathematics anxiety and use of self-regulatory learning strategies?

2. Do the students' level of mathematics anxiety and use of self-regulatory learning strategies differ as a function of different variables (gender, grade level, and mathematics achievement status)?

3. The students' levels of mathematics anxiety and their use of self-regulatory learning strategies significantly related?

2. Method

2. 1. Research Design

We conducted this study using exploratory correlational research design. In the exploratory correlational research design, it is necessary to determine whether there is a difference in two or more variables together, and if there is a difference, the level of this difference is determined (Fraenkel & Wallen, 2006). We collected data cross-sectionally at once with quantitative data collection tools.

2. 2. Participants

The study group consists of 330 students at 11th and 12th grades from three different high schools, in the west of Turkey in the 2019-2020 academic year's fall semester. We determined the study group using the convenience sampling method. Convenience sampling has objectives such as preventing waste of time, money, and labor (Fraenkel & Wallen, 2006).

Table 1. *Participants' demographic characteristic*

		Gender		
		Female	**Male**	**Total**
Grade	11	113	58	191
	12	118	21	139
Total		251	79	330

2. 3. Data Collection Tools

We used a personal information form to obtain the participants' demographic characteristics, the Revised Mathematics Anxiety Rating Scale (R-MARS) (Akın et al., 2011) to determine participants' level of mathematics anxiety, and the Self-Regulatory Strategies Scale (SRSS) (Kadıoğlu et al., 2011) to determine participants' use of self-regulatory learning strategies.

Plake and Parker (1982) developed R-MARS and Akın et al. (2011) adapted it into Turkish. R-MARS consists of 24 five-point likert-type items such as "never worries (1), rarely worries (2), often worries (3), usually worries (4), and always worries (5)". Items 1 through 16 on the scale belong to mathematics learning anxiety sub-dimension, and items 17 through 24 belong to the mathematics evaluation anxiety sub-dimension. R-MARS's maximum available score is 120 and minimum available score is 24. We calculated R-MARS scores by dividing the total scores by the number of items. We used the followting scaling in the evaluation of R-MARS scores: 1.00-1.80: "never worries," 1.81-2.60: "rarely worries," 2.61-3.40: "often worries," 3.41-4.20: "usually worries," 4.21-5.00 "always worries". Since the scale scores ranged from1.00 to 5.00, we assumed that students' level of mathematics anxiety was higher when scores approached 5.00 and lower when they approached 1.00. The Cronbach's Alpha reliability coefficient of the scale was found .93 (Akın et al., 2011).

Kadıoğlu et al. (2011) developed SRSS. There are 29 six-point likert-type items such as "never (1), rarely (2), sometimes (3), often (4), mostly (5), and always (6)" in SRSS. SRSS's maximum available score is 174 and minimum available score is 29. There are eight sub-dimensions such as motivation regulation (items 3, 5, 14, 19, 26), effort regulation (items 11, 21, 28), planning (items 1, 6, 8, 16), attention focusing (items 2, 9, 10, 27, 29), summary strategy (items 15, 17, 18), highlighting strategy (items 4, 12, 23), self-instruction (items 13, 22, 25), using additional resources (items 7, 20, 24) in the scale. We calculated SRSS scores by dividing the total scores by the number of items in the scale. We used the following scaling in the evaluation of SRSS scores: 1.00-1.83: "never," 1.84- 2.67: "rarely," 2.68-3.50: "sometimes," 3.51-4.33: "often," 4.34-5.17: "mostly," 5.18-6.00: "always" scaling was used. Because the scale scores ranged from 1.00 to 6.00, we assumed that students' use of self-regulatory learning strategies was higher when scores approached 6.00 and lower when they approached 1.00. The Cronbach's Alpha reliability coefficient calculated for each factor was found to be between .68 and .82 (Kadıoğlu et al., 2011).

In the personal information form used to determine student demographic characteristics, there were questions about students' gender, grade levels, and mathematics achievement status.

2. 4. Data Analysis

We analyzed the data obtained from participants by using a statistical analysis software package program. We calculated descriptive statistics and examined characteristics of data distribution. We found the reliability coefficient for R-MARS to be 0.94 and the reliability coefficient for SRSS to be 0.88. This reliability coefficients did not differ significantly from the reliability coefficients found in the original forms of the scales, and since they were greater than 0.70, we concluded that the data collection tools were reliable (Büyüköztürk, 2019).

We determined whether the data had a normal distribution by calculating R-MARS and SRSS scores' skewness and kurtosis values and examining boxplot, histogram, Q-Q, and detrended graphs (Alpar, 2016). We presented R-MARS and SRSS scores' skewness and kurtosis values in Table 2.

Table 2. *R-MARS and SRSS scores' skewness and kurtosis values*

Scale	Variables		N	Skewness		Kurtosis	
				Value	SE	Value	SE
R-MARS	-		330	0.289	.134	-0.631	.268
	Gender	Female	251	0.275	.154	-0.672	.306
		Male	79	0.369	.271	-0.472	.535
	Grade	11	191	0.173	.176	-0.548	.350
		12	139	0.569	.206	-0.413	.408
	Mathematics achievement status	0-44	89	0.127	-.255	-0.458	.506
		45-54	94	0.264	.249	-0.725	.493
		55-69	70	0.312	.287	-0.385	.566
		70-84	46	0.554	.350	-0.517	.688
		85-100	31	1.403	.421	1.424	.821
SRSS	-		330	-0.271	.134	-0.133	.268
	Gender	Female	251	-0.184	.154	0.123	.306
		Male	79	0.384	.271	-0.225	.535
	Grade	11	191	-0.206	.176	-0.324	.350
		12	139	-0.202	.206	0.024	.408
	Mathematics achievement status	0-44	89	-0.353	.255	-0.186	.506
		45-54	94	-0.214	.249	-0.010	.493
		55-69	70	-0.164	.287	-0.363	.566
		70-84	46	-0.352	.350	0.202	.688
		85-100	31	-0.633	.421	0.375	.821

Note. R-MARS: Revised Mathematics Anxiety Rating Scale; SRSS: Self-regulatory Strategies Scale, SE: Standard Error

The skewness and kurtosis values were in the interval -1.5 and +1.5. For data regarded with a normal distribution, the skewness and kurtosis values should be in interval -1.5 and +1.5 (Alpar, 2016). We decided that data had a normal distribution upon examination of histogram, boxplot, Q-Q, and detrended graphs (Alpar, 2016). Since the data had a normal distribution, we conducted the t-test for independent samples to determine whether the scores differed according to gender and grade. We conducted one way analysis of variance (ANOVA) to decide whether scores differed according to mathematics achievement status (Büyüköztürk, 2019).

We used descriptive statistics determine R-MARS and SRSS scores. We also calculated the Pearson's correlation coefficient for examining relationship between the R-MARS and SRSS scores. The relationship between two variables with continuous and normal distribution is determined with the correlation coefficient (Büyüköztürk, 2019).

3. Results

The study's first sub-problem was "identifying the students' level of mathematics anxiety and use of self-regulatory learning strategies". We calculated the minimum and maximum scores, means of scores, and standard deviation values to answer this question (Table 3).

Table 3. *Descriptive statistics of the scores*

Scale	Sub-dimensions	N	Min	Max	x̄	SD
R-MARS	Learning mathematics anxiety	330	1	5	2.226	0.938
	Mathematics evaluation anxiety	330	1	5	3.367	1.129
	Total	330	1	5	2.606	.909
SRSS	Motivation regulation	330	1	6	3.312	1.037
	Planning	330	1	6	3.235	1.248
	Effort regulation	330	1	6	4.062	1.274
	Self- instruction	330	1	6	4.100	1.341
	Attention focusing	330	1	6	4.652	1.134
	Highlighting strategy	330	1	6	4.516	1.246
	Summary strategy	330	1	6	3.199	1.168
	Using additional resources	330	1	6	3.704	1.224
	Total	330	1.86	5.66	3.845	0.758

Note. R-MARS: Revised Mathematics Anxiety Rating Scale; SRSS: Self-regulatory Strategies Scale; x̄: mean; SD: standard deviation.

The mean of R-MARS scores was 2.606 (Table 3). We concluded that the mean of R-MARS scores was at level of "often worries" according to the scaling given in the method section. Therefore, we interpreted that the students' level of mathematics anxiety was moderate. The mean of SRSS scores was 3.845 (Table 3). We concluded that the mean of SRSS scores was at level of "often" according to the scale given in the method section. We interpreted that the students' use of self-regulatory learning strategies was moderate.

The study's second sub-problem was "to investigate if students' levels of mathematics anxiety and use of self-regulatory learning strategies differ as a function of different variables (gender, grade level, and mathematics achievement status)". We examined the scales scores according to independent variables and performed t-test and ANOVA for independent samples to answer this question (Table 4, 5, 6).

Table 4. *R-MARS and SRSS scores according to independent variables and t-test results*

Scale	Variables		N	x̄	SD	df	t	p	η^2
R-MARS	Gender	Female	251	2.674	0.904	328	2.449	.015	.02440
		Male	79	2.389	0.896				
	Grade	11	191	2.824	0.872	328	5.306	.000	.0806
		12	139	2.307	0.877				
SRSS	Gender	Female	251	4.012	0.652	328	7.740	.000	.1994
		Male	79	3.315	0.828				
	Grade	11	191	3.756	0.806	328	2.508	.013	.0192
		12	139	3.967	0.671				

Note. R-MARS: Revised Mathematics Anxiety Rating Scale); SRSS: Self-regulatory Strategies Scale; x̄: mean; SD: standard deviation.

The mean of female students' R-MARS scores was 2.674 and the one for the SRSS scores was 4.012, and the mean of male students' R-MARS scores was 2.389 and the mean for SRSS scores was 3.315 (Table 4). When we compared the scores according to gender, the means of female students' R-MARS and SRSS scores were higher than male students' scores. According to the t-test result, R-MARS scores demonstrated a significant difference by gender, $t(330)=2.449$, $p<.05$, $\eta^2=.0244$. We also calculated Cohen's d value (d=.316) from the t-test result (Cohen, 1988). The d value of about 0.3 was described as having a small effect size (Lenhard & Lenhard, 2016). Based on Cohen's d and eta square (η^2) values, we interpreted that the effect of gender on students' level of mathematics anxiety was small. SRSS scores also demonstrated a significant difference according to gender, $t(330)=7.740$, p.05, $\eta^2=.1994$. We stated that Cohen's d value (d = .998) calculated from the t-test result (Cohen, 1988) was greater than .9, which was interpreted as large effect size (Lenhard & Lenhard, 2016). Based on Cohen's d and eta square (η^2) values, we interpreted that the effect of gender on students' self-regulatory learning strategies was large.

The mean of 11th grade students' R-MARS scores was 2.824, the mean of 12th grade students' scores was 2.307 (Table 4). When we compared R-MARS scores, the scores demonstrated a significant difference according to grade level, $t(330)=5.306$, $p<.05$, $\eta^2=.0806$. We also calculated Cohen's d value from the t-test result (d=.592) (Cohen, 1988). The d value of approximately 0.5 was considered to be an intermediate effect size (Lenhard & Lenhard, 2016). We interpreted that the effect of grade level on students' mathematics anxiety was moderate based on Cohen's d and eta square (η^2) values. The mean of 11th grade students' SRSS scores was 3.756 and the mean of 12th grade students' scores was 3.967. SRSS scores differed significantly by grade level, $t(330)=2.508$, $p<.05$, $\eta^2=.0192$. The Cohen's d value (d=.2800) (Cohen, 1988) approximately .3 was interpreted as small effect size (Lenhard & Lenhard, 2016). Based on Cohen's d and eta square (η^2) values, we interpreted that the effect of grade level on students' self-regulatory learning strategies was small.

Table 5. *Distribution of R-MARS and SRSS scores by mathematics achievement scores*

Scale	Mathematics achievement status	N	$\bar{x}$	SD
R-MARS	0-44	89	2.984	.886
	45-54	94	2.795	.835
	55-69	70	2.446	.811
	70-84	46	2.340	.850
	85-100	31	1.704	.680
SRSS	0-44	89	3.676	.732
	45-54	94	3.886	.720
	55-69	70	3.857	.801
	70-84	46	4.032	.773
	85-100	31	3.900	.775

Note. R-MARS: Revised Mathematics Anxiety Rating Scale; SRSS: Self-regulatory Strategies Scale; $\bar{x}$: mean; SD: standard deviation value.

R-MARS and SRSS scores differed according to the students' mathematics achievement status (Table 5). We conducted an ANOVA to show whether the difference between the students' R-MARS and SRSS scores was statistically significant according to their mathematics achievement status (Table 6).

Table 6. *Results of ANOVA according to mathematics achievement status*

Scale		Sum of squares	df	Mean square	F	p	Significant differences	η^2
R-MARS	Between groups	46.322	4	11.580	16.690	.000	A-C, A-D, A-E, B-E, C-E, D-E	.3314
	Within groups	225.501	325	.694				
	Total	271.823	329					
SRSS	Between groups	4.412	4	1.103	1.942	.103	-	-
	Within groups	184.580	325	.568				
	Total	188.992	329					

Note. R-MARS: Revised Mathematics Anxiety Rating Scale; SRSS: Self-regulatory Strategies Scale; A: 0-44, B: 45-54, C: 55-69, D: 70-84, E: 85- 00

R-MARS scores demonstrated a significant difference according to mathematics achievement status, $F(4, 325) = 16.69$, $p<.05$, $\eta^2=.3314$ (Table 6). In other words, the students' levels of mathematics anxiety differ significantly by mathematics achievement status. We also calculated Cohen's d value from the ANOVA result (d=1.408) (Cohen, 1988). The d value greater than 1.00 was interpreted as large effect size (Lenhard & Lenhard, 2016). Based on Cohen's d and eta square (η^2) values, we interpreted that the effect of mathematics achievement on students' mathematics anxiety was large. Table 6 also demonstrates which groups had a significant difference in R-MARS scores at the end of Scheffe's test (Büyüköztürk, 2019). Therefore, we interpreted that as mathematics scores increased, mathematics anxiety decreased. SRSS scores did not demonstrate a significant difference by the mathematics achievement status, F(4, 325), p>.05 (Table 6).

The study's third sub-problem was "to investigate whether the students' levels of mathematics anxiety and their use of self-regulatory learning strategies are significantly related". We examined the correlation analysis results between R-MARS and SRSS scores and their sub-dimensions' scores in order to answer this question (Table 7).

Table 7. *Correlation analysis results between R-MARS and SRSS, and sub-dimensions' scores*

Variables		N	r	p
R-MARS	SRSS	330	.000	.999
R-MARS	SRSS Motivation regulation	330	-.089	.107
	SRSS Planning	330	**-.118**	**.033**
	SRSS Effort regulation	330	**.349**	**.000**
	SRSS Self-instruction	330	**.015**	**.784**
	SRSS Attention focusing	330	-.012	.831
	SRSS Highlighting strategy	330	.056	.312
	SRSS Summary strategy	330	-.045	.412
	SRSS Using additional resources	330	-.090	.101
SRSS	R-MARS Learning mathematics anxiety	330	-.043	.434
	R-MARS Mathematics evaluation anxiety	330	.072	.195

Note. R-MARS: Revised Mathematics Anxiety Rating Scale; SRSS: Self-Regulatory Strategies Scale

We concluded that there was no correlation between R-MARS and SRSS scores, r=.000, p>.05 (Table 7). An absolute value of correlation coefficient between 0.00 and 0.30 represents a low relationship; between 0.30 and 0.70 represents a moderate relationship; between 0.70 and 1.00 represents a high relationship, and correlation coefficient with a value of 0.00 represents no correlation at all (Büyüköztürk, 2019). When we examined relationship between the scales and the sub-dimensions, we found a moderately positive and significant relationship between R-MARS scores and SRSS Effort regulation dimension (r=.349, p<.05). Given the coefficient of determination (r^2=.1218), we said that 12% of the change in level of mathematics anxiety was due to use of effort regulation (Büyüköztürk, 2019). There was a low negative and significant relationship between R-MARS scores and SRSS Planning dimension (r=-.118, p<.05).

4. Discussion and Conclusion

We examined 11th and 12th grade students' R-MARS and SRSS scores and whether the scores differed by gender, grade level, and mathematics achievement in this study. We concluded that R-MARS scores indicated a significant difference by gender. We found that female students' R-MARS scores were higher than male students. Similarly, Devine et al. (2012), Luo et al. (2009), Süren (2019) and Uysal and Selışık (2016) found that students' mathematics anxiety scores demonstrated significant differences by gender. Devine et al. (2012), Luo et al. (2009) concluded that female students' levels of mathematics anxiety were higher than male students' levels. Süren (2019) and Uysal and Selışık (2016) found that male students had higher levels of mathematics anxiety. Contrary to our results, Dede and Dursun (2008), Dursun and Bindak (2011), Kurbanoğlu and Takunyacı (2012), Kutluca et al. (2015), and Koçer (2019) found that the students' levels of mathematics anxiety did not differ significantly by gender. Given that the studies examining mathematics anxiety according to gender found significant difference while others did not, we suggested that additional research should be conducted to determine whether mathematics anxiety differs by gender. To reduce mathematics anxiety, we suggested that gender-specific questions be included in the lesson and that attention be paid to contexts that may draw male and female students' attention to problematic situations to be selected. We concluded that SRSS scores demonstrated a significant gender difference in favor of female students. Similarly, Kirişçi and Köksal Konik (2016) also found a significant difference in favor of female students' use of self-regulatory learning strategies. Kocacan (2018) concluded that, unlike this study, the students' use of self-regulatory learning strategies did not demonstrate a significant difference by gender. From the results of this study and the results of the reviewed studies, we concluded that students' use of self-regulatory learning strategies differed significantly in favor of female students, but since there are few studies on the subject, we recommend more research on this topic.

When we examined the mean of R-MARS scores according to the grade level, we found that 11th grade students had higher mathematics anxiety than 12th grade students, and the scores demonstrated a significant difference by grade level. Kurbanoğlu and Takunyacı (2012) and Koçer (2019) found results similar to our results. In these studies, it was concluded that as grade level increased, mathematics anxiety decreased. Similarly, according to Dursun and Bindak (2011), eighth grade students had significantly higher mathematics anxiety than students in other grades. On the other hand, Dede and Dursun (2008) and Luo et al. (2009) found that mathematics anxiety did not differ significantly by grade level. Consequently, we suggested that additional research should be conducted to determine whether mathematics anxiety differs by students' grade levels. When we examined SRSS scores, we concluded that 12th grade students' use of self-regulatory learning strategies was higher than 11th grade students' use, and their SRSS scores differed significantly by their grades.

When we examined whether R-MARS and SRSS scores differed by mathematics achievement status, we observed a significant difference in R-MARS scores according to students' mathematics achievement status. In contrast, SRSS scores did not demonstrated a significant difference by mathematics achievement status. Dursun and Bindak (2011), Ergene (2011), Koçer (2019), Kutluca et al. (2015) also found differences in students' levels of mathematics anxiety according to mathematics achievement status. Kutluca et al. (2015) concluded that an increase in mathematics achievement resulted in a decrease in mathematics anxiety.

We also examined the relationship between students' level of mathematics anxiety and use of self-regulatory learning strategies in this study. We concluded that there was no significant relationship between R-MARS and SRSS scores. When we examined the relationship between the scales and sub-dimensions, we concluded that there was a moderately positive and significant relationship between level of mathematics anxiety and SRSS Effort regulation dimension. We found a negative and low significant relationship between level of mathematics anxiety and SRSS Planning dimension.

5. Suggestions

This study was limited to the 11th and 12th grade students' level of mathematics anxiety and use of self-regulatory learning strategies in three different high schools, in the west of Turkey. Similar studies can be conducted at different grade levels in secondary and higher school levels, especially at different grade levels at the high school level. Students' levels of mathematics anxiety and their use of self-regulatory learning strategies can be examined in the distance learning period that took place after the COVID-19 pandemic process. After studies to increase use of self-regulatory learning strategies, it can be examined whether level of mathematics anxiety change. In addition, studies can be conducted to examine different causes of mathematics anxiety in students. Guidance studies can be organized to reduce students' mathematics anxiety. In addition, studies can be organized for them to improve self-regulatory learning strategies. Teachers can also be trained to reduce their students' mathematics anxiety and how they can improve their students' self- regulatory learning skills.

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