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Investigation of Mathematics Self-report Levels of Secondary School Students in Terms of Various Variables

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: In this study, mathematics self-report levels of secondary school students were examined in terms of gender, grade level and participation in Support and Training Courses (STC) were and the findings and suggestions were provided. For this purpose, the problem of the research consists of the question "Do the mathematics self-report levels of secondary school students show a significant difference in terms of some variables?"
Study Design: In the study, since a study was conducted to determine the mathematics self-report levels of secondary school students, the general survey model, one of the quantitative research methods, was preferred.
Place and Duration of Study: The study population of the research consists of 5th, 6th, 7th and 8th grade secondary school students in Afyonkarahisar in the 1st semester of the 2021-2022 academic year. While 298 participants were reached, in the preliminary examination of the data obtained from the reached sample, it was seen that 281 data sets were suitable for use.
Methodology: "Personal Information Form" was used to obtain information about the demographic characteristics of secondary school students, and "Mathematics Self-Report Inventory" developed by [5] to determine the levels of mathematics self-report. The descriptive analysis was used to determine self report levels of the participants; and the comparisons in terms of grade, gender and STC participation were made through t-test and ANOVA.

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Results: In terms of interest value sub-dimension, it is seen that the general level of the participants is "high" (X=27.66). In terms of usability sub-dimension, the general level of the participants is "high" (X=19.97). In terms of success value sub-dimension, the general level of the participants is in the "high" category (X=24.04). In terms of personal-value sub-dimension, the general level of the participants is in the "medium" category (X=13,73). The scale general score averages of the participants, on the other hand, are at a “high” level (X=85,41).
Conclusion: When the mathematics self-report levels of secondary school students and the scores obtained from the whole self-report scale were examined, it was determined that there was no significant difference in terms of the gender variable. There was a significant difference in the mathematics self-report levels of secondary school students in terms of grade levels. It has been determined that this difference is in favor of 5th and 6th grade students.

Keywords: Mathematics self-report; secondary school students; gender difference; grade difference.

1. INTRODUCTION AND LITERATURE REVIEW

Mathematics, which is a common denominator of all humanity, arising from the need to understand the world and beyond in which people live, is one of the cornerstones of the effort to explain events and find solutions to needs and problems; It is a means of expressing the visible with symbols and transforming creative thoughts into a tangible product. Mathematics, which confronts us with numbers, shapes, and problems in every corner of our daily life, is one of the main areas of the education system. In general, today's education system, critical thinking, interpreting information, understanding mathematics, adapting it to daily life, using the knowledge of problem solving, creative, who cares about original thinking; It aims to raise individuals who are productive, problem solvers, comprehend mathematics, interpret mathematical expressions, and have a critical point of view. In this context, the aims of the mathematics curriculum are to understand mathematical concepts and to use them in daily life, expressing their own thoughts and reasoning in the problem-solving process and gaining mathematical process skills [1]. For this reason, the importance of mathematics course has increased and the responsibility of raising individuals who can think critically, have problem-solving skills, and reflect what they have learned to daily life has come to the fore [2]. Accordingly, mathematics education, which makes our lives easier, opens the ways of thinking logically and rationally in order to cope with the problems we encounter in our daily life, enables us to evaluate the events encountered in a consistent, impartial and practical way, and adds color to our lives, has become both a necessity and a responsibility.

The experiences of individuals can be effective in their mathematical thinking and feelings towards mathematics [3]. The concept of mathematical self-report is also directly related to this issue. Self-report is the series of answers that an individual gives to questions about his/her own situation, feelings, thoughts, and beliefs [4]. Self-report is used to identify behaviors or features that cannot be directly observed. Self-report is information that cannot be accessed from other sources of information, and that cannot be accessed through the opinions of people in the immediate vicinity of the student, such as parents, teachers, peers. When we say mathematics self-report, students' opinions about their own competencies and learning characteristics come to mind. Self-report on mathematics and the course is a broad concept that includes the expectations of the individual, the value they attach to mathematics, the motivation for the mathematics lesson and the sense of achievement required for the mathematics lesson [5]. For this reason, since it is of great importance for individuals to be aware of their own thoughts in making improvements in mathematics education, it will be useful to conduct studies on self-report levels as according to social cognition theory, children with low mathematics self-concept and self-efficacy generally have high mathematics anxiety [6,7]. At this point, students' self-reports in mathematics will help us determine their interest in mathematics, their thoughts, whether they see it useful in daily life, their desire to succeed, and their expectation [8]. Thus, it will have a positive contribution to the determination of effective strategies for breaking the prejudices against the mathematics lesson and solving the problems encountered in learning mathematics.

It is important for students to have high self-report levels for effective learning since high self-report is related to individuals being aware of

their abilities, expressing their thoughts about themselves and making evaluations. Being aware of the thoughts of the student about the mathematics lesson, self-confidence, having a positive perspective on the lesson, and belief in being able to do it are indicators of the level of self-report. In this context, mathematics self-report; Believing that mathematics is meaningful is related to the individual's valuing mathematics, finding it useful, being interested in learning, being willing to be successful in mathematics, and being in expectation [3]. In the same way, avoiding prejudices against mathematics will play a key role in determining the reasons for the determination of solutions to problems in increasing the value, interest and expectation of success. In this context, determining the mathematics self-report levels of students will lead to a positive change in their reasoning and critical thinking skills, as well as their ability to communicate, to find mathematics more meaningful and to their perspectives on mathematics.

In this study, mathematics self-report levels of secondary school students were examined in terms of gender, grade level and participation in Support and Training Courses were and the findings and suggestions were provided. For this purpose, the problem of the research consists of the question "Do the mathematics self- report levels of secondary school students show a significant difference in terms of some variables?" and answers are sought for the following sub-problems:

1- What are the math self-report levels of secondary school students?
2- Do the math self-report levels of secondary school students differ significantly according to the gender variable?
3- Do the math self-report levels of secondary school students differ significantly according to the grade variable?
4- Do the mathematics self-report levels of secondary school students differ significantly according to the variable of participation in the Support and Training Course (STC)?

2. METHODOLOGY

In this study, since a study was conducted to determine the mathematics self-report levels of secondary school students, the general survey model, one of the quantitative research methods, was preferred. In the general survey model, it is the survey studies carried out on the sample representing the universe in order to generalize about a large universe consisting of many elements [9]. Among the reasons for widespread use of survey research are the features that describe, describe, reveal the events as they are, and provide the opportunity to generalize to the universe. Data is collected in order to determine the characteristics, ideas, thoughts, attitudes and tendencies of a large universe. It provides a quantitative or numerical explanation about the obtained data. In the survey model, data are obtained by using scale and interview methods [10].

2.1 Universe and Sample

The study population of the research consists of 5th, 6th, 7th and 8th grade secondary school students in Afyonkarahisar in the 1st semester of the 2021-2022 academic year; The sample consists of 298 secondary school students studying in 2 secondary schools in Afyonkarahisar city center and 2 secondary schools in İhsaniye district. While evaluating the adequacy of the sample number, it is stated that if the sample number is below 300, the number of items used to collect data should be at least 5 or 10 times [11]. In this context, since a 23-item scale was applied, the sample size of 298 was considered sufficient. In the preliminary examination of the data obtained from the reached sample, it was seen that 281 data sets were suitable for use, while the others could not be used due to missing answers and marking the same answer to all items. The frequency and percentage distributions of the demographic data obtained from the Personal Information Form used in the research are presented in Table 1.

2.2 Data Collection Tools

In the study, "Personal Information Form" was used to obtain information about the demographic characteristics of secondary school students, and "Mathematics Self-Report Inventory" developed by [5] to determine the levels of mathematics self-report. Detailed information on data collection tools is given below.

Table 1. Demographics of the Sample

Gender	(f)	(%)	Grade	(f)	(%)
Female	117	41.6	5th	92	32.7
Male	164	58.4	6th	55	19.7
Total	281	100.0	7th	76	27
STC			8th	58	20.6
Yes	111	39.5	Total	281	100
No	170	60.5			
Total	281	100.0			

According to Table-1, out of 281 students participating in the study, 164 (58.4%) were boys and 117 (41.6%) were girls. Among the total number of participants, the fifth grade was the largest group according to the class variable (f=92; 32.7%). Next are the seventh grades (f=76; 27%), the eighth grades (f=58; 20.6%) and finally the sixth graders (f=55; 19.7%). While there were 111 (39.5%) students participating in STCs, 170 (60.5%) students did not.

2.2.1 Personal information form

In the study, a "Personal Information Form" structured in relation to the research variables was used to collect data about the demographic characteristics of secondary school students. In this form, the research data were collected by asking questions about the gender, grade level, participation in the Support and Training Course (STC) of the students participating in the study.

2.2.2 Mathematics self-Report inventory

“Mathematics Self-Report Inventory (MBI)” developed by [5] consists of 33 items and has 5 sub-dimensions. These sub-dimensions are “Interest Value”, “Usability Value”, “Success Value”, “Personal Value” and “Success Expectation”. It is a five-point Likert-type scale with a Cronbach alpha reliability coefficient of .87. The ratings were formed as “Strongly agree (SA)” (5), “Agree (A)” (4), “I am undecided (Und)” (3), “Disagree (D)” (2), “Strongly disagree (SD)” (1).

In line with the literature review and the opinions of the researcher who developed the inventory, the "expectation of success" dimension was excluded from the inventory on the grounds that it was not suitable for the 5th grade level; The 23-item version of the Mathematics Self-Report Inventory, which was arranged by subtracting the "achievement expectation" dimension, was applied. According to this, Cronbach's alpha reliability coefficients for each dimension of the 23-item inventory after the achievement expectation was removed; it was found α =0.899 for “interest value”, α =0.791 for “Usability value”, α =0.784 for “Success value” and α = 0.835 for “Personal value”.

2.3 Data Analysis

In order to decide on the tests to be applied, it is necessary to examine the characteristics such as the data obtained as a result of the normality tests, being in the minimum interval scale, and the effect on the dependent variable showing a normal distribution at every level of the investigated dimension [11]. For this reason, skewness and kurtosis coefficients were examined to see if the scale had a normal distribution and were presented in Table 2.

When the values in Table 2 were examined, it was seen that the distribution was normal. In examining the normal distribution of the data obtained in a research, the Skewness value is checked. The fact that the skewness coefficient is between “-1 and +1” values is an indicator of normality [11]. In the analysis, it was determined that the research data showed normal distribution and independent samples t-test and one-way analysis of variance (ANOVA) were applied.

Table 2. Normality Distribution of Data

Variable	N	Skewness		Kurtosis	
		Statistic	Std.	Statistic	Std.
Mathematics Self-Report	281	-.787	.145	1.732	.290

3. RESULTS AND DISCUSSION

3.1 Findings Related to the First Sub-Problem

The first sub-problem of the research, "What are the mathematics self-report levels of secondary school students? The results of the analysis for the answer to the question "are given in Table 3.

3.2 Findings Related to the Second Sub-Problem

Expressed as the second sub-problem of the research, "Do the math self-report levels of secondary school students differ significantly according to the gender variable?" The results of the independent samples t-test analysis performed to reach the answer to the question are given in Table 7.

3.3 Findings Related to the Third Sub-Problem

The third sub-problem in the study was "Do the math self-report levels of secondary school students differ significantly according to the grade variable?" The result of one-way analysis of variance (ANOVA) performed to answer the question is given in Table 8.

Scheffe test was used to determine between which classes there was a significant difference at the level of classes. If there is a difference between the sample numbers in the groups in multiple comparison tests, the Scheffe test, which accepts less errors, is preferred [11]. According to the results of the Scheffe test applied, a significant difference was determined in favor of the 5th grade students (X=30,260) in the comparisons made between the 5th and 7th grades and between the 5th and 8th grade students in the "Interest Value" sub-dimension. In comparisons made between 6th grade and 8th grade, a significant difference was found in favor of 6th grade students (X= 28,472). In the comparisons made between the 5th and 7th grades in the "Usability Value" sub-dimension, a significant difference was determined in favor of the 5th grade students. In the comparisons made between the 5th and 8th grades and the 6th and 8th grades in the sub-dimensions of "Success Value", a significant difference was found against the 8th grade. In the scale total, a significant difference was found in favor of the 5th grade students in the comparisons made between the 5th and 7th grades and the 5th and 8th grades.

3.4 Findings Related to the Fourth Sub-Problem

Expressed as the 4th sub-problem of the research, "Do the mathematics self-report levels of secondary school students differ significantly according to their participation in the Support and Training Course (STC)?" The results of the independent samples t-test analysis performed to reach the answer to the question are given in Table 9.

Table 3. Mathematics Self-Report-Interest Value Sub-Dimension Levels of Secondary School Students

Items	N	X̄	Sd	Result
IV1: Learning math is fun.	281	4.31	0.86	SA
IV2: If I see an article about mathematics in a newspaper or magazine, I would like to read it immediately.	281	3.56	1.09	A
IV3: I am interested in learning new topics related to mathematics	281	4.14	1.06	A
IV4: I look forward to the math lesson.	281	3.76	1.10	A
IV5: Mathematics arouses my curiosity.	281	3.74	1.16	A
IV6: I enjoy dealing with numbers.	281	4.14	2.56	A
IV7: I like solving math problems.	281	4.02	2.65	A
Interest Value	281	27.66	6.31	HIGH

As can be seen in Table-3, it is seen that the participants' interest values are at the level of "agree" (X=3.56-4.14) in five items and "strongly agree" in one item (X=4.31). In terms of this sub-dimension, it is seen that the general level of the participants is "high"

Table 4. Secondary School Students' Mathematics Self-Report-Usability Value Sub-Dimension Levels

Items	N	X̄	Sd	Result
UV8: Gaining new mathematical skills improves your creative thinking ability.	281	4.00	1.05	A
UV9: I find the mathematics course to develop intelligence.	281	4.22	1.02	SA
UV10: Mathematics helps me to solve daily life problems.	281	4.05	1.09	A
UV11: Mathematics is worth the effort as it will help me choose the profession I want.	281	3.91	1.03	A
UV12: I think that I will need mathematics at every stage of my life.	281	3.80	1.16	A
Usability Value	281	19.97	3.89	HIGH

As seen in Table-4, it is seen that the participants' levels of usability are at the level of "agree" (X=3.80-4.05) in four items and "strongly agree" in one item (X=4.22). In terms of this sub-dimension, the general level of the participants is in the "high" category

Table 5. Secondary School Students' Mathematics Self-Report-Success Value Sub-Dimension Levels

Items	N	X̄	Sd	Result
SV13: In math class. I work hard to be successful.	281	3.93	1.10	A
SV14: If I don't get at least 85 points on the math test. I will be disappointed.	281	3.83	1.26	A
SV15: Being at the level of an average student in mathematics makes me sad.	281	3.70	1.21	A
SV16: It is important for me to get high scores in math exams.	281	4.28	1.05	SA
SV17: I would like to be the most successful student in the class in mathematics.	281	4.31	0.99	SA
SV18: It is important for me to understand the difficult problems we see in math class.	281	3.99	1.10	A
Success Value	281	24.04	4.62	HIGH

According to Table-5, it is seen that the participants' levels of success values are "agree" (X=3.70-3.99) in four items and "strongly agree" in two items (X=4.28-4.31). In terms of this sub-dimension, the general level of the participants is in the "high" category

Table 6. Secondary School Students' Mathematics Self-Report and Personal Value Sub-Dimension Levels

Items	N	X̄	Sd	Result
PV19: No matter how hard I try; I cannot be successful in mathematics.	281	2.70	2.06	Ind
PV20: Symbols related to mathematics confuse me.	281	2.99	2.00	Ind
PV21: I find the math class boring.	281	2.40	1.77	D
PV22: I feel nervous and helpless while doing math homework.	281	2.67	2.05	Ind
PV23: I think that my level of understanding of mathematics is low compared to many of my friends.	281	2.97	2.01	Ind
Personal Value	281	13.73	5.14	Intermediate
Mathematics Self-Report (Total)	281	85.41	11.90	HIGH

According to Table-6, it is seen that the levels of the participants regarding the personal value sub-dimension are "undecided" (X=2.67-2.99) in four items and "disagree" in one item (X=2.40). In terms of this sub-dimension, the general level of the participants is in the "medium" category. The scale general score averages of the participants, on the other hand, are at a "high" level

Table 7. Independent Groups T-Test Results of Secondary School Students' Mathematics Self-Report Levels by Gender

	Gender	N	X̄	Sd	Df	T	P
Interest Value	Female	117	28.63	6.33	279	2.190	.02
	Male	164	26.96	6.23			
Usability Value	Female	117	21.13	3.51	279	4.356	.00
	Male	164	19.14	3.95			
Success Value	Female	117	24.95	4.41	279	2.832	.00
	Male	164	23.39	4.68			
Personal Value	Female	117	12.26	4.95	279	-4.159	.00
	Male	164	14.78	5.03			
Mathematics Self-Report (Total)	Female	117	86.99	11.12	279	1.886	.06
	Male	164	84.28	12.34			

As can be seen in Table 7, when the mathematics self-report levels of secondary school students are examined according to the gender variable according to the independent groups t-test, one of the sub-dimensions of the mathematics self-report scale is "Interest Value" [t (279) =2,190, p<.05], "Usability Value". " [t (279) =4.356, p<.05], "Success Value" [t (279) =2.832, p<.05], "Personal Value" [t (279) =4.159, p<.05] It is seen that the scores obtained differ significantly according to the gender variable. The said significant difference was in favor of female students, excluding the personal value sub-dimension. However, there is no significant gender difference in the total scores obtained from the whole mathematics self-report scale [t (279) =1.886, p> .05]

Table 8. One-Way Analysis of Variance (ANOVA) Results of Secondary School Students' Mathematics Self-Report Levels by Grade Level

	Grade	N	X̄	Sd	Df	F	*P*
Interest Value	5th	92	30.26	5.98	3-277	13.146	.00
	6th	55	28.47	4.97			
	7th	76	26.42	5.00			
	8th	58	24.39	7.62			
	Total	281	27.66	6.31			
Usability Value	5th	92	21.05	3.03	3-277	4.117	.00
	6th	55	19.96	4.42			
	7th	76	19.14	4.04			
	8th	58	19.36	4.05			
	Total	281	19.97	3.89			
Success Value	5th	92	12.90	5.39	3-277	4.029	.00
	6th	55	12.47	5.10			
	7th	76	14.81	4.64			
	8th	58	14.82	4.97			
	Total	281	13.73	5.14			
Personal Value	5th	92	25.02	3.93	3-277	6.236	.00
	6th	55	25.20	4.24			
	7th	76	23.38	4.79			
	8th	58	22.25	5.15			
	Total	281	24.04	4.62			
Mathematics Self-Report (Total)	5th	92	89.23	10.16	3-277	6.984	.00
	6th	55	86.10	11.62			
	7th	76	83.76	11.97			
	8th	58	80.84	12.87			
	Total	281	85.41	11.90			

"Interest Value" [F (3,277) =13,146, p<.05], "Usability Value" [F (3,277) =4,117, p<.05], "Success Value" [F (3,277) =4,029, p<.05], "Personal Value" [F (3,277) =6,236, p<.05], and total scores from the whole scale [F (3,277) =6,984, p<.05] differ significantly depending on the grade level

Table 9. t-Test Results of Secondary School Students' Mathematics Self-Report Levels by STC Participation

	STC	N	X̄	Ss	Sd	T	*P*
Interest Value	Yes	111	27.00	6.33	279	-1.422	.15
	No	170	28.09	6.28			
Usability Value	Yes	111	20.18	4.25	279	0.744	.45
	No	170	19.83	3.64			
Success Value	Yes	111	24.04	4.87	279	0.007	.99
	No	170	24.04	4.47			
Personal Value	Yes	111	13.58	5.39	279	-0.388	.69
	No	170	13.82	4.98			
Mathematics Self-Report (Total)	Yes	111	84.81	12.06	279	-0.674	.50
	No	170	85.80	11.82			

According to the independent sampling t-test performed according to Table 9, the mathematics self-report levels of secondary school students do not differ significantly according to the STC participation variable. Of all sub-dimensions of the mathematics self-report scale, "Interest Value" [t (279) =-1.422, p> .05], "Usability Value" [t (279) =0.744, p> .05], "Success Value" [t (279) =0.007, p> .05], "Personal Value" [t (279) =-0.388, p> .05] and the entire math self-report scale [t (279) =-0.674, p> .05] There is no significant difference between the scores obtained according to STC participation

4. CONCLUSION

According to the findings, the participants' mathematics self-report levels were high in interest, usability, success sub-dimensions and in general; it is seen to be at a moderate level in the personal value sub-dimension, and it is in line with the several studies in the literature [12-13], that similarly found that the mathematics self-report levels of secondary school students are sufficient.

When the mathematics self-report levels of secondary school students and the scores obtained from the whole self-report scale were examined, it was determined that there was no significant difference in terms of the gender variable; however, it is possible to see a contradictory result in the literature in which females have lower self-report [14]. Although the scores obtained from the sub-dimensions of the mathematics self-report inventory, "Interest Value", "Usability" and "Success Value" were in favor of female students, it was found out that there was a significant difference in favor of male students in the "Personal Value" sub-dimension. The reason for this difference in the sub-dimensions of the self-report level may be the higher interest of female students in lessons; however, it is possible to come across with an opposing situation in which females show higher anxiety towards mathematics [15].

While a significant difference was found out in the sub-dimensions of the mathematics self-report scale similar to several studies [12], it differs in the finding that there is a significant difference according to the mean scores of the whole scale. Besides, there was no significant difference in total score averages in terms of gender and the literature provides similar [5] and contradictory [16] results.

According to the findings, it was observed that there was a significant difference in the mathematics self-report levels of secondary school students in terms of grade levels. It has been determined that this difference is in favor of 5th and 6th grade students. It can be said that the level of mathematics self-report differs significantly in favor of the lower classes which is parallel with the results of the several studies conducted [5,12]. According to the findings of the study, the reason for the decrease in the level of mathematics self-report in the upper grades may be the change in mathematics course achievements in later grades and the stress experienced by the 8th grade students due to the High School Entrance Exam (LGS) for which they are prepared.

It was determined that the mathematics self-report levels of secondary school students did not show a significant difference according to the level of participation in the Support and Training Course. As a result of the research, it is seen that the arithmetic average of the mathematics self-report levels of the students who did not participate in the STC is higher than the other group who participated in the STC. It can be thought that arranging the courses after the weekday classes has a negative effect on this.

There are teachers who think that the courses are ineffective, that the students do not show enough attention, that there is a problem of absenteeism, that it is tiring and the efficiency is low because it is held after school lessons [17]. However, teachers generally have a positive opinion about support and training courses, and they have reached the opinions of teachers and students that the courses affect student motivation, interest, course performance, and academic success in a positive way [18].

As the literature explains that students' higher self-reported adaptability is an indicator for their higher mathematics engagement [19], it is important to support students in this aspect and increase their self-efficacies, for example by providing students with performance-based goals that might predict changes in academic self-concept [20].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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