



## SECONDARY SCHOOL STUDENTS' (11-14 YEARS) EFFECTIVE INPUT CHARACTERISTICS FOR MATHEMATICS, SELF-REGULATION SKILLS AND SELF-ESTEEM<sup>i</sup>

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### Abstract:

Based on Confucius' saying "A word may change your mind, an emotion may change your life and a person may change you", our emotions affect our learning if we take life as a process of learning. Some of our learning on which we are successful and unsuccessful are student characteristics. Effective properties are one of the characteristics of students. As Wang (2006) states, in terms of mathematics, effective factors related to mathematics lesson are effective on the importance given to mathematics and on the withdrawal from mathematics. Students strive to succeed if they have positive effective input characteristics. However, if they have negative effective characteristics, they may give up not being able to resist the challenges they face. The striving students determine the learning environment and conditions and can make arrangements. This result obtained by the students may sometimes turn out as they wanted, or on the contrary as an undesirable situation. In this case, self-esteem will come into play. Self-esteem is a concept related to the self-appreciation, ability to reveal their skills and knowledge, and success is important in the formation and development of self-esteem (Kohut, 1971). Hence, this study analyzes the effective input characteristics, self-regulation skills and self-esteem of secondary school students together. Among the screening models, general screening model was used in this study. The participants of the study consisted of 361 secondary school students (11-14 years) who study in the 5th, 6th, 7th and 8th grades of secondary schools in a city of Turkey in the spring term of 2017-2018 academic year. In the collection of data "Effective Input Characteristics for Math Scale" developed by Caliskan and Serce (2016), "Perceived Self-Regulation Scale" developed by Arslan and Gelisli (2015), "Self-esteem Scale" developed by Rosenberg (1965) and

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adapted to Turkish by Cuhadaroglu (1985) were used. Students' effective input characteristics towards mathematics, perceived self-regulation skills and self-esteem were evaluated according to gender, grade level, mathematics course achievement score, and parental attitude. It was determined that secondary school students' effective input characteristics for Math and self-regulation skills were higher than average; and self-esteem was average. Based on the findings of the research, suggestions were presented about effective input characteristics, self-regulation skills, and self-esteem for secondary school students.

**Keywords:** effective input characteristics, self-regulation, self-esteem, secondary school student, mathematics course

## 1. Introduction

*"...Did Cahit Arf, who said "Everyone wants to work in the field where they feel immortal. And I felt myself immortal in mathematics..."*, always love and succeed in Mathematics his entire life? The answer is indeed simple, of course not. He was also a child who did not like mathematics until the fifth grade (Kuzu, 2015). We can say that the process leading from a child who does not like mathematics to distinguished professorship in mathematics is related to the recognition of talents and self-belief. Therefore, we need to know the children. Because trying to educate children without knowing them is not only wrong but also a disrespect to them (Kurnaz, 2002). Children are individuals and, as with every individual, they think about their past experiences when they react to something. They try to remember how the events they experienced made them feel and what they meant. At this point, emotions begin to work (Gomleksiz ve Kan, 2012). Emotions can be a driving force when starting our actions. In the general objectives of the 2018 mathematics curriculum, we can say that some of the tasks expected from students are related to the state of emotions for the mathematics course (Ministry of National Education, 2018).

- They will develop a positive attitude towards mathematics with their experiences in learning mathematics and develop a self-confident approach to mathematical problems.
- They will value mathematics knowing that mathematics has a common value to humanity.

Students are highly affected by their emotions. Students' self-belief in mathematics course naturally affects student motivation, interest in the course and the level of commitment to the course (Kloosterman, 2002; McDonough and Sullivan 2014). As a matter of fact, students at a young age are willing to learn mathematics and enter into mathematical endeavors. At these ages, they have a positive mathematical belief (Cheeseman and Mornane, 2014). Students are aware of the need for effort and hard work to be successful in math course (Kocacan, 2018). Students who show interest in mathematics at younger ages and think that effort is necessary for success begin to feel anxiety in math course over time. Anxiety can lead to performance degradation.

Emotions are known to have a strong influence on mathematics achievement and continuity of performance (Ayob and Yasin, 2017; Khine, Al-Mutawah and Afari, 2015; Peixoto, Sanches, Mata and Monteiro 2017; Zainal, Harun and Lili, 2017). Emotional experiences may cause tasks to be easy or difficult, and performance to be high or low according to their power of influence (Holm, Hannula and Bjorn, 2017). Mathematics in itself can be difficult, complicated, boring or even more academic than others. However, in addition to this, if we can sustain enough eagerness to learn in math learning, we can get rid of these beliefs and old negativities (Middleton, Jansen and Goldin, 2016). The feeling of self-efficacy may also be important in this process. Because when students' self-efficacy are examined, it is seen that they found themselves to be less efficient (Sari, Arikan and Yildizli, 2017). We can think of self-efficacy as a degree of approaching to the desired performance. The mathematics heavily used in daily life is also required for many areas. All factors for Math achievement should be examined, and effective characteristics for Math should not be neglected (Kesici and Asilioglu, 2017). If the emotional input characteristics are positive, the students will eagerly try to face difficulties, but if the situation is the opposite, the student will give up and feel themselves inefficient. That the students give up, strive, love, feel anxiety, self-regulate can be considered as a psychological response. Many psychological reactions are given while learning mathematics (Tuncer and Yilmaz, 2016). Effective input characteristics are the source of learning motivation (Pantziara and Philippou, 2015). They are the combination of the student's interest, attitude and academic self for a course or learning units of that course (Bloom, 1998). Willingly or unwillingly, students develop a positive or negative attitude based on the course and its scope, and their experiences. They are either interested or not. When they are assigned a task, they either think that they will succeed the task or they do not trust themselves. These are the effective input characteristics of a student (Caliskan and Serce, 2016). In order for a student to learn well, the effective characteristics must be sufficient. The students need to have interest and believe that they will show enough strength and effort to overcome the difficulties if they are faced with any (Yavuz, 2006).

Bloom (1998) describes the academic self, which is defined as the degree of trust and confidence to succeed in an academic field, as the strongest component among effective input characteristics that create success. There are researches that determine the effective characteristics of students in mathematics achievement (Artino and Stephens, 2009; Attard, 2014; Birgin, Baloglu, Catlioglu and Gurbuz, 2010; Britner and Pajares, 2006; Caliskan and Serce, 2016; Demir, 2015; Keklik and Keklik, 2013; Grootenboer and Marshman, 2016; Guleroglu, 2017; Guzel and Berberoglu, 2010; Hannula, 2012; İlhan and Sunkur, 2013; Kesici and Asilioglu, 2017; Kocacan, 2018; Middleton, Jansen and Goldin, 2016; Miller and Mitchell, 1994; Oztop and Topbas, 2017; Pantziara, 2016; Pantziara and Philippou, 2015; Peklaj and Pečjak, 2011; Sari, Arikan and Yildizli, 2017; Sartawi, Alsawaie, Dodeen, Tibi and Alghazo, 2012; Skaalvik and Skaalvik, 2011; Smith and Sinclair, 2002; Uredi and Uredi, 2005; Yavuz, 2006). In order to achieve success in an academic field, one has to have goals and an effective plan, to control his self and to make evaluations when necessary and to be self-satisfied. These

properties are considered as self-regulation by Zimmerman (2002). Self-regulation and math achievement are related (Bouffard, Boisvert, Vezeau and Larouche, 1995; Kaufman and Baer, 2004; Kocacan, 2018; Montroy, Bowles, Skibbe and Foster, 2014; Nota, Soresi and Zimmerman, 2004; Pintrich and De Groot, 1990; Pintrich, 1990; Rijavec and Brdar, 2002; Surmeli and Unver, 2017; Tee, Leong and Rahim, 2018; Wang and Young, 2001; Uredi and Uredi, 2005; Wolters, 1999; Young and Vrongistinos, 2002). Being satisfied with one's self can be considered as believing in oneself and one's abilities. Students must have self-esteem for academic success (Sevik, 2014). Considering that academic success is a result of academic self, it can be said that self-esteem is also necessary for success (Cakmak, Sahin and Akinci Demirbas, 2017; Kabalci, 2008). Self-esteem also implies self-acceptance and self-appreciation as well as self-confidence and self-respect (Cuhadaroglu, 1986). According to Coopersmith (1967), individuals with high self-esteem are self-confident and optimistic, they have a high desire to succeed, they do not give up in the face of difficulties, they believe that they are important and useful for others, they are relaxed, flexible and open to new ideas, they are creative, researcher, and out-going.

When students achieve success, they strive to experience this feeling again. The level of effective input characteristics for Math, self-regulation skills, and self-esteem are important for success. In this respect, it is necessary to determine the level of the items that are important for Mathematics teaching. The aim of this study was to determine the effective input characteristics for Math, self-regulation skills and self-esteem of secondary school students. This is because we could not encounter any study that addresses these three variables which are thought to be related to one other when we look at the literature. Hence, in this study, effective input characteristics, self-regulation skills and self-esteem of secondary school students were examined together and it was determined that there was a significant relationship among them.

### **1.1 Purpose**

The aim of the study is to determine the effective input characteristics for Math, self-regulation skills and self-esteem levels of secondary school students. In line with this main objective, answers to the following questions were sought.

### **1.2 Sub-problems of the research**

1. What are the effective input characteristics of secondary school students for Math?
2. Do secondary school students' effective input characteristics for Math differ significantly according to gender, grade level, Math achievement score and parental attitude?
3. What is the level of self-regulation of secondary school students?
4. Do the self-regulation skills of secondary school students differ significantly according to gender, grade level, mathematics score and parental attitude?
5. What is the level of self-esteem of secondary school students?

6. Does the self-esteem of the secondary school students differ significantly according to gender, grade level, mathematics score, and parental attitude?
7. What is the relationship among the secondary school students' effective input characteristics for Math, self-regulation skills, and self-esteem?

## 2. Method

### 2.1 Research model

The research was designed as a descriptive research in the screening model. The screening model is a research approach that aims to describe a situation as it is which existed in the past or still continue to exist (Buyukozturk, Kılıc Cakmak, Akgün, Karadeniz and Demirel, 2011).

### 2.2 Sample

The valid and best way to select a representative sample is random sampling. In the sampling, if the sampling unit is an element, the process is called element sampling, and if it is a group, then it is called cluster sampling. The sample of the study was selected by random sampling method, and the sampling unit was determined by the cluster sample (Buyukozturk et al., 2011). A total of 361 secondary school students participated in the study. The sample consists of 185 female and 176 male students. The distribution of students by grade level is as follows: 5th Grade (N=108), 6th Grade (N=80), 7th Grade (N=91) and 8th Grade (N=92).

### 2.3 Data Collection Tools

Within the scope of the study, "Effective Input Characteristics for Math Scale" developed by Caliskan and Serce (2016), "Perceived Self-Regulation Scale" developed by Arslan and Gelisli (2015), "Rosenberg Self-Esteem Scale" adapted to Turkish by Cuhadaroglu (1986), and "Personal Information Form" prepared by the researches to determine the demographic features were used. "Effective Input Characteristics for Math Scale" is a 20-item scale with a single sub-dimension. Cronbach's alpha internal consistency coefficient of the scale is .94. In the study, Cronbach's alpha internal consistency coefficient of the related scale is determined as .95. The statements such as "I attend the Math course eagerly", "I can't wait for the Math course" and "I am happier in the Math course than in the others" are some of the example items included in the scale. "Perceived Self-Regulation Scale" is a 16-item scale composed of two sub-dimensions (being open, search) with a Cronbach's alpha value of .90. In the study, Cronbach's alpha value of the related scale is determined as .92. When the items in the scale are examined and compared to the concept of "self-regulation" in the literature, the scale was developed to measure the self-regulation skills of individuals. "I can easily learn a new subject" and "I can easily learn even the hardest subjects if I want to" are the example items of the "being open" sub-dimension of the scale whereas "I try to use different methods while learning a subject" and "I develop different ways to solve the problems I face with when learning a subject" are the examples from the "search"

sub-dimension of the scale. The scale was developed by Morris Rosenberg in 1965 as a self-esteem measurement tool for adolescents and adapted to Turkish by Cuhadaroglu (1986). The scale consists of 63 items and 12 sub-scales in total. The "Rosenberg Self-Esteem Scale" used in the study is composed of 10 items and the questions are scored by Guttman evaluation method. Evaluation is made according to the correct answer of each question. The questions 1, 2 and 3, the questions 4 and 5, and the questions 9 and 10 are evaluated together during the scoring. The questions 6, 7 and 8 are evaluated on their own. If the students marked any two of the first three questions, they get one point from this set. If they marked either of the questions 4 and 5, they will also get one point from this set. Questions 9 and 10 are also evaluated in the same way. Thus, the maximum score is 6 when the test taker gets points from all the questions. It is determined that 0-1 point is high, 2-4 points is average, and 5-6 points is low self-esteem level. Test-retest reliability of the self-esteem sub-scale is 75 (Cuhadaroglu, 1986). In this study, the scale's test-retest reliability is determined as 78. The statements such as "I have a positive attitude towards myself" and "I find myself as valuable as other people" are examples from the scale items.

## **2.4 Data Analysis**

The data obtained from the sample were analyzed by SPSS (Statistical Package for the Social Sciences) 22.0 package program. In the analysis of the data, it was examined whether the data were normally distributed or not in order to decide which statistical tests would be done. Kolmogorov Smirnov test results for the scale totals and all sub-dimensions of the "Effective Input Characteristics for Math Scale", "Perceived Self-Regulation Scale", "Self-Esteem Scale" were analyzed, and also Skewness values were found between +1 and -1 whereas Kurtosis values were between +2 and -1. The determined Skewness and Kurtosis values are acceptable limit values where it shows normal distribution according to Huck (2008) (Secer, 2015). Therefore, since the data in the research shows normal distribution; independent samples t-test and one-way analysis of variance (ANOVA) were applied to the data. In order to determine effective input characteristics for Math, self-regulation and self-esteem, frequency, arithmetic mean and standard deviation values were calculated. Pearson correlation analysis was made to determine whether there is a significant relationship between the three scales.

## **3. Findings**

In this section, the data collection tools and the findings obtained from the secondary school students are presented respectively as headings in line with the sub problems.

### **3.1 Findings related to the first sub-problem**

The analysis result of the "What is the level of effective input characteristics of secondary school students for Math?" sub-problem is given in Table 1.

**Table 1:** Levels of Effective Input Characteristics of Secondary School Students for Mathematics

	N	$\bar{X}$	SD
Effective Input Characteristics for Math	361	56,936	13,469

“Effective input characteristics for Math” scale is a 4-point Likert-type scale which is graded from “strongly agree” to “strongly disagree”. For this reason, the highest 80 and the lowest 20 points can be obtained from this 20-item scale. Obtaining 50 points from this scale was determined as average score. In the study, effective input characteristics of secondary school students for Math ( $\bar{X}$ = 56.936; SD: 13,469) are seen to be above the average value.

### 3.2 Findings related to the second sub-problem

The analysis results of the “Do secondary school students’ effective input characteristics for Math differ significantly according to gender, grade level, Math achievement score and parental attitude?” sub-problem are given as headings, respectively.

### 3.3 Effective input characteristics for Math - gender

Table 2 shows the results of independent groups t-test to determine whether the effective input characteristics of secondary school students significantly differ based on gender variable.

**Table 2:** T-test Result of Secondary School Students’ Effective Input Characteristics for Mathematics Based on Gender

	Gender	N	$\bar{X}$	SD	Df	t	p
Effective Input Characteristics for Math	Female	185	56,183	12,705	359	-1,089	,277
	Male	176	57,727	14,222			

It was determined that there was no significant difference in terms of gender according to scores obtained from the entire effective input characteristics for Math scale [ $t(359)=-1,089$ ,  $p>.05$ ], and that the scores obtained by male students and female students were close to each other.

### 3.4 Effective input characteristics for Math - grade level

The result of the One-Way Analysis of Variance to determine whether the effective input characteristics of secondary school students for Math significantly differ based on grade level variable is given in Table 3.

**Table 3:** The Result of the One-Way Analysis of Variance (ANOVA) for Effective Input Characteristics of Secondary School Students for Mathematics Based on Grade Level

	Grade	N	$\bar{X}$	SD	Df	F	p	Meaningful Difference
Effective Input Characteristics for Math	5th grade	108	60,898	9,846	357	10,509	,000	5-7, 5-8, 6-7, 6-8
	6th grade	80	60,100	11,885				
	7th grade	91	52,197	14,936				
	8th grade	82	53,890	15,074				
	Total	361	56,936	13,469				

The total points obtained from the entire effective input characteristics scale for Math [F(357)=10,509, p<.05] are seen to differ significantly based on the grade level. According to the results of the Scheffe test performed to determine which groups have the significant difference based on the grade level, a significant difference was determined between 5th and 7th grades and 5th and 8th grades in favor of 5th. grade students, between 6th and 7th grades and 6th and 8th grades in favor of 6th grades.

### 3.5 Effective input characteristics for Math - Math achievement score

The result of the One-Way Analysis of Variance to determine whether the effective input characteristics of secondary school students for Math significantly differ based on math score variable is given in Table 4.

**Table 4:** The Result of the One-Way Analysis of Variance (ANOVA) for Effective Input Characteristics of Secondary School Students for Mathematics Based on Math Score

	Points	N	$\bar{X}$	SD	Df	F	p	Meaningful Difference
Effective Input Characteristics for Math	45-54	36	45,388	13,738	357	36,117	,000	45-54, 70-84
	55-69	66	52,181	12,451				45-54, 85-100
	70-84	121	54,256	11,510				55-69,85-100
	85-100	138	64,572	11,310				70-84,85-100
	Total	361	59,936	13,469				

It is seen that the points obtained from the effective input characteristics scale for Mathematics [F (357) = 36,117, p <.05] significantly differ according to the Math achievement scores. According to the results of the Scheffe test conducted to determine which groups have the significant difference, it is in favor of students with high grades among the scores of 45-54, 70-84; 45-54, 85-100; 55-69,85-100; 70-84,85-100.

### 3.6 Effective input characteristics for Math - mother's attitude

Table 5 shows the results of t-test to determine whether the effective input characteristics of secondary school students significantly differ based on mother's attitude variable.

**Table 5:** T-test Result of Secondary School Students' Effective Input Characteristics for Mathematics Based on Mother's Attitude

	Attitude	N	$\bar{X}$	SD	Df	t	p
Effective Input Characteristics for Math	Democratic	304	57,513	13,278	359	1,807	,072
	Authoritarian	57	53,982	14,273			

It was determined that there was no significant difference in terms of mother's attitude according to scores obtained from the entire effective input characteristics for Math scale [t(359)=1,807, p>.05]; however, students whose mother's attitude was democratic had higher scores.

### 3.7 Effective input characteristics for Math - father's attitude

Table 6 shows the results of t-test to determine whether the effective input characteristics of secondary school students significantly differ based on father's attitude variable.

**Table 6:** T-test Result of Secondary School Students' Effective Input Characteristics for Mathematics Based on Father's Attitude

	Attitude	N	$\bar{X}$	SD	Df	t	p
Effective Input Characteristics for Math	Democratic	301	57,651	13,241	359	2,206	,028
	Authoritarian	59	53,368	14,456			

According to scores obtained from the entire effective input characteristics for Math scale [ $t(359)=2,206$ ,  $p>.05$ ], a significant difference was determined. The significant difference is in favor of students whose father has a democratic attitude.

### 3.8 Findings related to the third sub-problem

The analysis result of the "What is the level of self-regulation skills of secondary school students?" sub-problem are given in Table 7.

**Table 7:** Self-Regulation Skills of Secondary School Students

	N	$\bar{X}$	SD
Being Open	361	29,562	7,044
Search	361	28,027	7,668
Self-regulation	361	57,590	13,780

The highest 80 and the lowest 16 points can be obtained from the self-regulation scale. Obtaining 48 points from the scale was determined as average score. In the study, self-regulation skills of secondary school students ( $\bar{X}= 57.590$ ;  $SD:13,780$ ) were seen to be above the average value.

### 3.9 Findings related to the fourth sub-problem

The analysis results of the "Do the self-regulation skills of secondary school students differ significantly according to gender, grade level, mathematics score and parental attitude?" sub-problem are given as headings, respectively.

### 3.10 Self-regulation - gender

The result of the t-test, which was conducted to determine whether the self-regulation skills of the secondary school students differ significantly according to the gender variable, is given in Table 8.

**Table 8:** T-Test Result of Secondary School Students' Perceived  
 Self-Regulation Skills Based on Gender

	Gender	N	$\bar{X}$	SD	Df	t	p
Being Open	Female	185	30,194	6,457	359	1,753	,080
	Male	176	28,897	7,575			
Search	Female	185	28,789	7,793	359	1,942	,053
	Male	176	27,227	7,788			
Self-regulation	Female	185	58,98	12,804	359	1,978	,049
	Male	176	56,125	14,629			

When Table 8 is examined, the total scores obtained from the self-regulation scale [ $t(359) = 1,978, p < .05$ ] are seen to differ significantly based on gender in favor of female students. In the sub-dimensions of self-regulation scale, no significant difference was found in terms of gender.

### 3.11 Self-regulation - grade level

The result of the One-Way Analysis of Variance to determine whether the self-regulation skills of secondary school students significantly differ based on grade level variable is given in Table 9.

**Table 9:** The Result of the One-Way Analysis of Variance (ANOVA) for  
 Self-Regulation Skills of Secondary School Students

	Grade	N	$\bar{X}$	SD	Df	F	p
Being Open	5th grade	108	30,222	6,695	357	1,152	,328
	6th grade	80	30,050	7,127			
	7th grade	91	29,351	6,341			
	8th grade	82	28,451	8,063			
	Total	361	29,562	7,044			
Search	5th grade	108	29,611	7,111	357	2,408	,067
	6th grade	80	27,550	7,860			
	7th grade	91	27,648	6,952			
	8th grade	82	26,829	8,680			
	Total	361	28,027	7,668			
Self-regulation	5th grade	108	59,833	12,859	357	1,789	,149
	6th grade	80	57,600	13,800			
	7th grade	91	57,000	12,383			
	8th grade	82	55,280	16,027			
	Total	361	57,590	13,780			

The total points obtained from the sub-dimensions of the self-regulation scale “Being Open” [ $F(3,357)=1,152, p > .05$ ], “Search” [ $F(3,357)=2,408, p > .05$ ] and the entire scale [ $F(3,357)=1,789, p > .05$ ] are determined not to differ significantly based on grade level.

### 3.12 Self-regulation - Mathematics Score

The result of the One-Way Analysis of Variance to determine whether the self-regulation skills of secondary school students significantly differ based on Math achievement score variable is given in Table 10.

**Table 10:** The Result of the One-Way Analysis of Variance (ANOVA) for Self-Regulation Skills of Secondary School Students Based on Math Score

	Points	N	$\bar{X}$	SD	Df	F	p	Meaningful difference
Being Open	45-54	36	23,666	7,690	357	30,785	,000	45-54, 70-84
	55-69	66	27,000	6,445				45-54, 85-100
	70-84	121	28,528	6,814				55-69,85-100
	85-100	138	33,231	5,302				70-84,85-100
	Total	361	29,562	7,044				
Search	45-54	36	23,166	8,936	357	17,344	,000	45-54, 70-84
	55-69	66	26,015	7,280				45-54, 85-100
	70-84	121	26,909	7,247				55-69,85-100
	85-100	138	31,239	6,579				70-84,85-100
	Total	361	28,027	7,668				
Self-regulation	45-54	36	46,833	15,312	357	26,997	,000	45-54, 70-84
	55-69	66	53,015	12,610				45-54, 85-100
	70-84	121	55,438	13,050				55-69,85-100
	85-100	138	64,471	11,053				70-84,85-100
	Total	361	57,590	13,780				

The points obtained from the sub-dimensions of the self-regulation scale were “Being Open” [F(357)=30,785, p<.05], “Search” [F(357)=17,344, p<.05] and the entire scale [F(357)=26,997, p<.05] are seen to differ significantly based on Math achievement score. According to the results of the Scheffe test conducted to determine which groups have the significant difference, it is in favor of students with high grades among the scores of 45-54, 70-84; 45-54, 85-100; 55-69,85-100; 70-84,85-100.

### 3.13 Self-regulation - mother's attitude

The result of the t-Test, which was conducted to determine whether the self-regulation skills of the secondary school students differ significantly according to the mother's attitude variable, is given in Table 11.

**Table 11:** T-Test Result of Secondary School Students' Self-Regulation Skills Based on Mother's Attitude

	Attitude	N	$\bar{X}$	Ss	Sd	t	p
Being Open	Democratic	304	29,881	6,841	359	2,089	,037
	Authoritarian	57	27,750	7,920			
Search	Democratic	304	28,016	7,598	359	,015	,988
	Authoritarian	57	28,000	8,144			
Self-regulation	Democratic	304	57,898	13,539	359	1,071	,285
	Authoritarian	57	55,750	15,083			

According to the points obtained from the "Being Open" sub-dimension of self-regulation scale [ $t(359)=1.807, p<.05$ ], a significant difference was determined. The significant difference is in favor of students whose mother has a democratic attitude.

### 3.14 Self-regulation - father's attitude

The result of the t-Test, which was conducted to determine whether the self-regulation skills of the secondary school students differ significantly according to the father's attitude variable, is given in Table 12.

**Table 12:** T-Test Result of Secondary School Students' Self-Regulation Skills Based on Father's Attitude

	Attitude	N	$\bar{X}$	SD	Df	t	p
Being Open	Democratic	304	29,980	6,861	359	2,849	,005
	Authoritarian	57	27,105	7,622			
Search	Democratic	304	28,212	7,455	359	1,268	,206
	Authoritarian	57	26,807	8,755			
Self-regulation	Democratic	304	58,192	13,421	359	2,159	,032
	Authoritarian	57	53,912	15,262			

According to the points obtained from the "Being Open" sub-dimension of self-regulation scale [ $t(359)=2.849, p<.05$ ] and the entire scale [ $t(359)=2,159, p<.05$ ], a significant difference was determined. The significant difference is in favor of students whose father has a democratic attitude.

### 3.15 Findings related to fifth sub-problem

The analysis result of the "What is the level of self-esteem of secondary school students?" sub-problem is given in Table 13.

**Table 13:** Self-Esteem of Secondary School Students

	N	$\bar{X}$	SD
Self-esteem	361	2,141	,909

The highest 6 and the lowest 0 point can be obtained from the self-esteem scale. 0-1 point obtained from the scale is evaluated as high self-esteem, 2-4 points as average self-esteem and 5-6 points as low self-esteem. There is an inverse relationship between the total points obtained by secondary school students and their self-esteem levels. In the study, self-esteem of secondary school students ( $\bar{X}= 2.141;SD:.909$ ) are seen to be average.

### 3.16 Findings related to the sixth sub-problem

The analysis results of the "Do the self-esteem of secondary school students differ significantly according to gender, grade level, mathematics score and parental attitude?" sub-problem are given as headings, respectively.

### 3.17 Self-esteem - gender

The result of the t-Test, which was conducted to determine whether the self-esteem of the secondary school students differ significantly according to the gender variable, is given in Table 14.

**Table 14:** T-Test Result of Secondary School Students' Self-Esteem Based on Gender

	Gender	N	$\bar{X}$	SD	Df	t	p
Self-esteem	Female	185	2,129	,893	359	-,247	,805
	Male	176	2,153	,928			

According to the points obtained from the entire self-esteem scale [ $t(359)=-.247$ ,  $p>.05$ ] no significant difference was determined based on gender.

### 3.18 Self-esteem - grade level

The result of the One-Way Analysis of Variance to determine whether the self-esteem of secondary school students significantly differ based on grade level variable is given in Table 15.

**Table 15:** The Result of the One-Way Analysis of Variance (ANOVA) for Self-Esteem of Secondary School Students Based on Grade Level

	Grade	N	$\bar{X}$	SD	Df	F	p	Meaningful Difference
Self-esteem	5th grade	108	1,990	,859	357	2,997	,031	5-7
	6th grade	80	2,025	,899				5-8
	7th grade	91	2,296	,971				6-7
	8th grade	82	2,280	,878				6-8
	Total	361	2,141	,909				

The points obtained from the entire self-esteem scale [ $F(357)=2,997$ ,  $p<.05$ ] are seen to differ significantly based on the grade level. According to the results of the Scheffe test performed to determine which groups have the significant difference based on the grade level, a significant difference was determined between 5th and 7th, between 5th and 8th, between 6th and 7th, and between 6th and 8th grades in favor of lower grades.

### 3.19 Self-esteem - Math achievement score

The result of the One-Way Analysis of Variance to determine whether the self-esteem of secondary school students significantly differ based on Math score variable is given in Table 16.

**Table 16:** The Result of the One-Way Analysis of Variance (ANOVA)  
 for Self-Esteem of Secondary School Students Based on Math Score

	Points	N	$\bar{X}$	SD	Df	F	p	Meaningful Difference
Self-esteem	45-54	36	2,777	,959	357	10,878	,000	45-54, 70-84
	55-69	66	2,303	,822				45-54, 85-100
	70-84	121	2,148	,971				55-69,85-100
	85-100	138	1,891	,780				70-84,85-100
	Total	361	2,141	,909				

The total points obtained from the entire effective input characteristics for Math scale [F(357)=10,878, p<.05] are seen to differ significantly based on the Math report card score. According to the results of the Scheffe test performed to determine the meaningful difference in terms of the Math report card score, the significant difference was found between 45-54, 70-84; 45-54, 85-100; 55-69,85-100 and 70-84,85-100 scores in favor of students with high scores.

### 3.20 Self-esteem - mother's attitude

The result of the t-Test, which was conducted to determine whether the self-esteem of the secondary school students differ significantly according to the mother's attitude variable, is given in Table 17.

**Table 17:** T-Test Result of Secondary School Students' Self-Esteem Based on Mother's Attitude

	Attitude	N	$\bar{X}$	Ss	Sd	t	p
Self-esteem	Democratic	304	2,111	,879	359	-1,450	,148
	Authoritarian	57	2,303	1,060			

According to the points obtained from the self-esteem scale [t(359)=-1,450, p>.05], no significant difference was found based on mother's attitude; however, students whose mother's attitude was democratic had higher self-esteem.

### 3.21 Self-esteem - father's attitude

The result of the t-Test, which was conducted to determine whether the self-esteem of the secondary school students differ significantly according to the father's attitude variable, is given in Table 18.

**Table 18:** T-Test Result of Secondary School Students' Self-Esteem Based on Father's Attitude

	Attitude	N	$\bar{X}$	SD	Df	t	p
Self-esteem	Democratic	301	2,109	,897	359	-1,704	,089
	Authoritarian	59	2,333	,969			

According to the total points obtained from the entire self-esteem scale [t(359)=-1,704, p>.05]; no significant difference was found based on father's attitude; however, students whose father's attitude was democratic had higher self-esteem.

### 3.22 Findings related to the seventh sub-problem

The analysis result of the “What is the relationship among the secondary school students’ effective input characteristics for Math, self-regulation skills, and self-esteem?” sub-problem is given in Table 19.

**Table 19:** The Relationship Among the Secondary School Students’ Effective Input Characteristics for Math, Self-Regulation Skills, and Self-Esteem

		Effective Input Characteristics	Self-Regulation Skills	Self-Esteem
Effective Input Characteristics	r	1	,506**	-,215**
	p		,000	,000
	N	361	361	361
Self-Regulation Skills	r	,506**	1	-,251**
	p	,000		,000
	N	361	361	361
Self-Esteem	r	-,215**	-,251**	1
	p	,000	,000	
	N	361	361	361

There is a positive and moderately significant relationship between the effective input characteristics for Math scale and the perceived self-regulation scale ( $r=.506$ ,  $p<.01$ ); a negative and lowly significant relationship between effective input characteristics for Math scale and the self-esteem scale ( $r=-.215$ ,  $p<.01$ ); a negative and lowly significant relationship between the perceived self-regulation scale and the self-esteem ( $r=-.251$ ,  $p<.01$ ).

## 4. Discussion-Conclusion and Suggestions

Even if it is difficult to explain what mathematics is, it is easy to say what it is not. First of all, mathematics is not all about calculations. Many people perceive mathematics as the ability to perform operations using numbers. This is similar to thinking that knowing the meaning of words and the rules of establishing a proper sentence is enough in order to express one’s feelings and thoughts (Umay, 2002). First of all, it is necessary to correctly understand the mathematics course, about which false beliefs have been going on hearsay for years. Individuals come to a number of judgments about any subject by the experiences they get. Judgments reveal the ideas of the individuals on what they perceive in the environment they reside in may lead to in the future (Uysal Kog, 2012). Not all of us may easily understand everything. This may be due to our current emotions or lack of knowledge. But this should not make the study we are putting an effort for difficult. It would not be right to call an area difficult which we have not truly tried to understand. Being successful in the Math course depends on the strength of emotions related to the Math course.

The results obtained in this study which analyzes the effective input characteristics for Mathematics course, self-regulation and self-esteem of secondary school students are listed below.

1. The effective input characteristics for Math and self-regulation skills of the secondary school students who participated in the study were above the average value; and their self-esteem was average.
2. Secondary school students' self-regulation skills differ significantly based on gender in favor of female students; effective input characteristics and self-esteem did not differ significantly based on gender.
3. Secondary school students' effective input characteristics and self-esteem based on grade level differ significantly in favor of the lower grades whereas self-regulation skills do not differ significantly based on grade level.
4. The effective input characteristics for Math, self-regulation skills and self-esteem of secondary school students differ significantly in favor of those with high scores according to Mathematics achievement score.
5. Secondary school students' self-regulation skills differ significantly based on mother's attitude in "Being Open" sub-dimension and in favor of democratic attitude in the scale total; effective input characteristics for Math and self-esteem differ significantly based on mother's attitude.
6. Secondary school students' effective input characteristics for Math differ significantly in favor of students whose father has a democratic attitude while self-regulation skills show significant difference in "Being Open" sub-scale and scale total again in favor of students whose father attitude is democratic. There is no significant difference among the students based on father's attitude in terms of self-esteem.
7. In the study, the relationship between secondary school students' effective input characteristics for Math and self-regulation skills was found to be moderately significant while a negative relationship with low significance was found between self-esteem and both effective input characteristics for Math and self-regulation skills.

When the findings of the study related to effective input characteristics for Math are examined, the significant relationship between effective input characteristics for Math and Math achievement score shows the connection between performance and effective input characteristics. This finding obtained from the study is in line with many researches (Ayob and Yasin, 2017; Caliskan and Serce, 2016; İlhan and Sunkur, 2013; Khine, Al-Mutawah and Afari, 2015; Kesici and Asilioglu, 2017; Peixoto, Mata, Monteiro and Sanches, 2015; Sari, Arikan and Yildizli, 2017; Zainal, Harun and Lili, 2017). The research findings on the effective input characteristics based on gender contradict with the research findings of Sari, Arikan and Yildizli (2017) and Grootenboer and Marshman (2016). The research findings on the effective input characteristics for Math and parental attitudes are in contradiction with some researches in terms of the attitude of the environment and the emotions towards the Math course (Artino and Stephens, 2009; Attard, 2014; Birgin, Baloglu, Çatliloglu and Gurbuz, 2010; Britner and Pajares, 2006; Demir, 2015; Grootenboer and Marshman, 2016; Guleroglu, 2017; Hannula, 2012). There are studies with parallel findings since the research findings related to the level of self-achievement of effective input characteristics for Math are addressed as self-

perception of the individual (Middleton, Jansen and Goldin, 2016; Miller and Mitchell, 1994; Pantziara, 2016; Pantziara and Philippou, 2015; Peklaj and Pečjak, 2011; Sartawi, Alsawaie, Dodeen, Tibi ve Alghazo, 2012; Skaalvik and Skaalvik, 2011; Smith and Sinclair, 2002).

In the study, it was determined that female students had high self-regulation skills. This finding obtained based on shows parallelism with some research findings (Bauffard, Boisvert, Vezeau and Lorouche, 1995; Chatzistamatiou and Dermitzaki, 2013; Kocacan, 2018; Kaufman and Baer, 2004; Montroy, Bowles, Skibbe and Foster, 2014). In addition, there are researches in which there is contradictory research findings of self-regulation skills based on grade level (Bennet, 2014; Tee, Leong and Rahim, 2018; Tzohar, Rozen and Kramorski, 2014; Vandeveld, Keer and Wever, 2011). In these studies, it was determined that the self-regulation skills of the students were higher at younger ages. When self-regulation skills are evaluated from the perspective of parental attitudes, it was determined that self-regulation skills of the students with democratic parents were higher. In the researches where this finding is parallel (Alci, 2007; Azevedo, 2005; Barnard, Paton and Lan, 2010; Cleary and Zimmerman, 2004; Hofer and Yu, 2003; Nota, Soresi and Zimmerman, 2004; Metallidou and Vlachou, 2010), it is stated that self-regulation skills will be affected by parental attitudes or surrounding people.

When we consider self-esteem in the research and examine the findings based on gender, it was found in line with the research findings by Oksuz and Ayvali (2012) while in contradiction with the research findings of Kabalci (2008). In the studies conducted by Oksuz and Ayvali (2012) and Sancar (2016), the self-esteem of secondary school students did not differ significantly in terms of gender either. The finding of self-esteem based on Math achievement score is in line with the research findings of Aldan Karademir and Deveci (2018). In the study, that examines the self-esteem and sense of achievement of the primary school students (Aldan Karademir and Deveci, 2018), the research findings related to parental attitude contradict with our research findings.

In the study, the findings of the relationship among the effective input characteristics for Math, self-regulation and self-esteem of secondary school students are in conflict with the findings of Grootenboer and Marshman (2016).

Based on the findings of the research, the following suggestions are presented for further studies.

- Based on this research, a similar research can be created with students who study at different grade levels and research findings can be compared.
- By adding a qualitative dimension to the research, more in-depth information can be obtained from the students.
- Based on the effect of parental attitude on students, “developing a democratic attitude” studies can be performed on parents.
- In order to determine the emotional states of the students within the Mathematics course, teachers can conduct motivational studies with the students before and after the lesson (Math journal, my feelings box in anonymous course, a board of ‘For me, being successful in Mathematics is...’, etc.).

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