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Evaluation of Middle-School 6th Grade Mathematics Curriculum

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Abstract

This study was carried out to determine the efficacy of the 6th grade mathematics curriculum implemented in 2018 in Turkey using Tyler's model of curriculum evaluation. The study used the survey model and the stratified sampling method. Schools included in the sample were divided into three levels, an "upper group", "middle group" and a "lower group" with regard to their level of success. The research was carried out with the participation of 266 students studying in these schools. The "Middle-School 6th Grade Mathematics Course Achievement Test" was used to determine the level of achievement of the objectives in the curriculum. In addition, the "Attitude Towards Mathematics Scale" was used to determine students' attitudes towards mathematics course. As a result of the research, in terms of the level of achievement of the objectives in the curriculum, it was determined that the students studying in the upper group schools were more successful than the students studying in the middle and lower group schools. Moreover, the upper group students' attitude scores regarding the mathematics course were significantly higher than the middle and lower group students' scores, although the middle group students' attitude scores were significantly higher than lower group students'.

Keywords: Curriculum Evaluation; Mathematics Education; Mathematics Curriculum; Attitude Towards Mathematics.

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INTRODUCTION

Mathematics, which is used in many fields, including the study of nature, various forms of technology, architecture, the construction industry, banking, scientific research, cartography etc., plays an important role in human life (Hodanova & Nocar, 2016). Mathematics can generally be defined as a scientific field of study in which quantitative relations, measurements, and operations are investigated and conducted using numbers and symbols (Yadav, 2017). The specific abstract aspect of mathematics leads to complexities in understanding it (Karagöz, 2010). Learning without understanding is one of the most important problems encountered in mathematics education (Fuson, Clements & Sarama, 2015). Learning by rote without any real comprehension means that individuals use their knowledge only to be successful in exams. However, for centuries mathematics has been used to solve the problems encountered in daily life (Baki, 2014). This is because mathematics is an important factor in everyone's life. According to Gravemeijer, Stephan, Julie, Lin and Ohtani (2017), the main aim of mathematics education should be to educate individuals who can use mathematics in their daily lives. An individual's use of mathematics in their daily life will make mathematics into an understandable, concrete skill for them. Arthur, Owusu, Asiedu-Addo and Arhin (2018) suggest that students' interest in mathematics depends on the ability of teachers to associate mathematics with daily life.

Countries that are aware of the importance of mathematics in life have placed special importance on mathematics education. Despite this, mathematics has been one of the courses most feared by students (Çoban & Torçuk, 2008). Students' fear of mathematics courses can only be eliminated if they are successful in their studies. Demir and Kılıç (2010) argue that the success of students in mathematics courses depends on the quality of education they received during these courses. The quality of education provided in mathematics courses can only be ensured with effective curriculums. But the effectiveness of any curriculum can only be determined after it has been evaluated. Gredler (1996) describes "curriculum evaluation" as a systematic study intended to obtain information about the effectiveness of a curriculum. The strengths and weaknesses of an education curriculum can only be determined by evaluating it (Tyler, 1949).

Mathematics education, which play an important role in how countries develop, have been rated by Turkish students as the most feared and most difficult course in the curriculum (Çeliköz & Duran, 2017). This situation has had a negative effect on the results obtained by Turkish students in international exams (PISA, TIMSS). The updates to the mathematics curriculum in Turkey have been a result of Turkish students' low marks in both national and international exams (Bulut, 2015). The most recent changes in the mathematics curriculum in Turkey were made in 2018. In this context, the mathematics curriculum was reorganized in 2018 both at elementary-school and middle-school level. In the updated mathematics curriculum, four learning areas (Numbers and Operations; Geometry; Measuring; Data Processing) were determined for the elementary-school level (1st – 4th grade). Five learning areas (Numbers and Operations; Algebra; Geometry and Measurement; Data Processing and Probability) were determined the middle-school mathematics curriculum (5th – 8th-grade).

This study was carried out to evaluate the effectiveness of the middle-school 6th grade mathematics curriculum which was developed in 2018 and is still in use in Turkey. The literature has emphasized that majority of the previous research on mathematics curriculum has been based on obtaining opinions (Akça, 2007; Bolat Soycan, 2006; Bütün & Gültepe, 2016; Çetin, 2010; Demircioğlu, 2009; Eski, 2017; Güleş Dağlar, 2008; Gündoğdu, Albayrak, Ozan & Çelik, 2012). Previous studies, which were based on asking for opinions, were generally conducted using an interview (Avcu, 2009; Çelikel & Tanrıseven, 2017; Karakoç, 2019; Sargın, 2016) or a questionnaire/scale (Karagöz, 2010; Köksaldı, 2019; Sarıer, 2007; Uludağ, 2012). Furthermore, the majority of studies investigated the opinions of teachers (Bal & Dinç Artut, 2013; Budak & Okur, 2012; Kardaş, 2008; Orbeyi, 2007). In this regard, it can be stated that the majority of studies in the literature was not based on a curriculum evaluation approach and model. This study thus evaluates the middle-school 6th grade mathematics curriculum based on the "target-oriented curriculum evaluation

approach". The gains listed in the curriculum were accepted as objectives. As a result of this, it is thought that this study may contribute to the literature about mathematics education.

The strengths of the target-oriented curriculum evaluation approach are that it is simple, easy to understand, easy to follow, and easy to implement. There are many models in the literature on the target-oriented curriculum evaluation approach, but the most widely accepted and used model in education is "Tyler's model of curriculum evaluation" (Fitzpatrick, Sanders & Worthen, 2004). This study was based on that model. In Tyler's model, the aim is to test whether the objectives of the education curriculum have been achieved or not (Lewy, 1977). Tyler (1949) suggests that at least two assessments should be made to determine whether a objective has been achieved, and that the first one should be carried out before the training curriculum is implemented. This is because it is not possible to determine whether there has been a change in the students without determining the situation before the curriculum is implemented. In this study, two different evaluations were made to determine whether the objectives of the 6th grade mathematics curriculum had been reached. The first evaluation was made as a pre-test before the application was carried out and the second evaluation was made as a post-test after the application of the curriculum. In Tyler's model of curriculum evaluation, affective learning outcomes are as important as cognitive learning outcomes (Lewy, 1977). One of the main goals of the 6th grade mathematics curriculum is to ensure that students develop a positive attitude towards mathematics. In this context, the "Attitudes Towards Mathematics Scale" was used in the present study to monitor how effective the 2018 middle-school 6th grade mathematics curriculum was in helping students to develop a positive attitude towards mathematics. It is expected that the data obtained from this study will provide valuable clues both into how the mathematics curriculum can be updated, and into solving problems encountered in mathematics education.

The main objective of this research was to determine the effectiveness of the middle- school 6th grade mathematics curriculum using Tyler's model of curriculum evaluation. In line with this basic objective, answers were sought to the following research questions (RQ):

RQ1: To what extent were the objectives of the 6th grade mathematics curriculum achieved?

RQ2: Did the level of achievement of the objectives of the middle school 6th grade mathematics curriculum differ significantly between upper, middle and lower group schools?

RQ3: What are the attitudes of middle-school 6th grade students towards mathematics courses?

RQ4: Do the attitudes of the middle-school 6th grade students towards the mathematics course differ significantly between upper, middle and lower group schools?

METHOD

Research Design

In the present study, the middle-school 6th grade mathematics curriculum was evaluated using survey design based on Tyler's model of curriculum evaluation. The survey design is a research method in which detailed information about an event and facts are collected and the current situation is described and explained (Karakaya, 2014). In this study, in line with the information obtained from the students, the survey design was chosen to evaluate the current state of the middle-school 6th grade mathematics curriculum.

Target of Population and Sampling

The target population of the research was middle-school 6th grade students in one province of Turkey. The stratified sampling method was used to determine the sample. Middle schools were

divided into groups in terms of their success levels and schools were selected randomly from each group. In order to classify the schools in terms of success level, the middle schools in the province where the research was conducted were ranked using the average scores their students had obtained from the 2017 TEOG (Transition from Basic Education to Secondary Education). As a result of this ranking, the schools in the top 27% were selected as the "upper group", the schools in the bottom 27% were selected as the "lower group", and the schools between these two slices were selected as the "middle group". Thus, different school groups were included in the research sample according to their level of success. The sample of the study was 266 students. The number of students studying in each group is given in Table 1.

Table 1. Distribution of students according to the school groups

	Upper group	Middle group	Lower group	Total
Number of students	120	70	76	266

Data Gathering

Data were collected through using two different scales, the "Middle-School 6th Grade Mathematics Course Achievement Test" and the "Attitude towards Mathematics Scale".

"The Middle-School 6th Grade Mathematics Course Achievement Test" was designed by the researcher in order to determine the extent to which the objectives of the curriculum had been achieved. In this context, three questions were formulated for each of the 38 objectives in the "Numbers and Operations", "Algebra", "Geometry and Measurement" and "Data processing" learning areas. A total of 114 question items were prepared. Each multiple-choice question was based on the students' academic level and four possible answers were given. In order to assess the content validity of the achievement test, the opinions of the mathematics teachers, curriculum developers, and experts in mathematics education were obtained as to whether the prepared question items were in line with the objectives. Since there were many questions in the achievement test, it was divided into three sections, each containing 38 questions. The opinions of three experts were obtained for each section. The opinions of nine experts were obtained in total. The test was redesigned on the basis of their recommendations. To determine whether the questions in the achievement test were comprehensible for the students, six 6th grade students were divided into three groups. The achievement test forms consisting of 38 questions were read out to each group. Following feedback from the students, the question items were reorganized.

The final achievement test consisted of 114 items divided into four sections made up of 27, 27, 30, and 30 items respectively, taking into account the academic level of the students. The trial form of the achievement test was applied to 120 students in the 6th grade in four different sessions. The data obtained from the sessions were analyzed using the Iteman program. Difficulty and distinguish ability indices were calculated for each question item. The achievement test was finalized by selecting the most suitable item for each target from among the items with a medium difficulty level and a distinguish ability index above 0.30. The final test consisted of 38 items. The KR-20 reliability coefficient for the achievement test was found to be 0.84.

The "Attitude Towards Mathematics Scale" was applied to determine the attitudes of middle-school 6th grade students towards the mathematics course. This scale was developed by Önal (2013). The necessary permissions to use the scale were obtained via email from the researcher who developed it. The scale measures the attitudes towards mathematics courses using four subdimensions: "interest", "anxiety", "study", and "necessity". The scale has 22 items and is a five-point Likert-type scale. The observed Cronbach's alpha coefficient for the scale, which was developed with the participation of students studying in the 6th, 7th and 8th grades, was 0.90. The observed Cronbach's alpha coefficient for the "Attitude Towards Mathematics Scale" pre-test was 0.89. The observed Cronbach's alpha coefficient for the post-test was 0.90.

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Data Gathering Procedure

"The Middle-School 6th Grade Mathematics Course Achievement Test" was divided into two sections, each consisting of 19 questions based on the students' academic level. The test forms were applied as a pre-test in two different sessions before the curriculum was implemented. After the curriculum, the same test forms were reapplied as a post-test in two different sessions. "The Attitude Towards Mathematics Scale" was applied to the same student group in a single session as a pre-test before the curriculum and as a post-test after the curriculum.

Data Analysis

Regarding RQ1, the percentage of correct answers foreach item in the achievement test was considered to determine the level of achievement of the objectives of the 6th grade mathematics curriculum. The criteria for reaching the stated objectives was determined as 0.75 (Baykul, 2010; Özçelik, 1981). In other words, the indication that a objective of the curriculum had been achieved was that at least 75% of the students had achieved it. Within the scope of the research, frequency values were calculated for the objectives with a level of at least 0.75 and above, and for objectives with a level below 0.75.

Regarding RQ2, one-way analysis of variance (Anova) was performed to determine whether there was a significant difference in between-groups level of achievement of the objectives of the middle-school 6th grade mathematics curriculum.

Regarding RQ3, the attitudes of the middle-school 6th grade students towards mathematics courses were determined from the mean scores of the pre-test and post-test applications. Items with negative statements were scored in reverse order. The dependent groups t-test was performed to determine whether there was a significant difference between the mean scores obtained as a result of the pre-test and post-test applications in the upper-, middle- and lower-group schools.

Regarding RQ4, the Anova test was conducted to determine whether the attitudes of the middle-school 6th grade students towards the mathematics course differed significantly between upper-, middle- and lower-group schools.

FINDINGS

Findings regarding RQ1

As a result of the pre-test and post-test applications, the extent to which each of the 38 objectives of the middle-school 6th grade mathematics curriculum had been achieved was determined. The distribution of the frequency values obtained for the targets with an achievement level of at least 0.75, and those with an achievement level below 0.75, are given in Table 2.

Table 2. Objective achievement levels

Upper group				Middle group				Lower group				All groups			
Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test	
.75≥	<.75	.75≥	<.75	.75≥	<.75	.75≥	<.75	.75≥	<.75	.75≥	<.75	.75≥	<.75	.75≥	<.75
-	38	38	-	-	38	22	16	-	38	-	38	-	38	1	37

In terms of pre-test results, Table 2 shows that in all three groups, none of the objectives of curriculum had been achieved at a level of 0.75 or above. The post-test results of the lower-group schools show that, as in the pre-test results, none of the objectives of the curriculum had been achieved at a level of 0.75 or above. It was observed that the students achieved 22 (58%) of the objectives of the

curriculum at a level of 0.75 and above in the middle-group schools. In addition, all 38 objectives of the curriculum were achieved at 0.75 and above in the upper-group schools. The post-test results of the all groups show that, just one of the objectives of the curriculum had been achieved at a level of 0.75 or above.

Findings regarding RQ2

The post-test scores was analyzed using Anova test in order to determine whether there was a significant difference between the groups in the achievement of the objectives of the middle-school 6th grade mathematics curriculum. The Anova test results are given in Tables 3 and 4.

Table 3. Descriptive statistics for curriculum objective achievement levels

Groups	n	$\overline{X}$ /38	sd
Upper Group	120	29.38	5.5
Middle Group	70	25.67	7.26
Lower Group	76	12.97	6.77

As can be seen in Table 3, students studying in the schools in the upper group had the highest mean score. The mean score of those in the upper-group schools was 29.38, while the middle groups' mean score was 25.67, and the lowest mean score was observed in the lower-group schools. The mean score of the lower-group schools was 12.97.

Table 4. Anova test results for curriculum objective achievement levels

Variance	SS	df	MS	F	p
Between-groups	12880.770	2	6440.385	158.664	.000
Within-groups	10675.515	263	40.591		
Total	23.556286	265			

Table 4 shows that there was a significant difference between the groups in terms of the achievement of the objectives of the middle-school 6th grade mathematics curriculum. The Scheffe test was conducted to determine which groups significant difference had occurred between. The Scheffe test results are given in Table 5.

Table 5. Scheffe test results for objective achievement levels

Groups	Average difference	
	Middle group	Lower Group
Upper group	3.70357*	16.40132*
Middle group		12.69774*

*p<0.05

Post hoc comparisons using the Scheffe test indicated that the level of achievement of objectives of the upper group was significantly different than those of the middle group and lower group. In addition, the achievement level of the middle-group schools was significantly different than that of the lower-group schools. Taken together, these results suggest that the level of the school groups has an effect on the level of achievement of goals.

Findings regarding RQ3

To determine the attitudes of the middle-school 6th grade students towards the mathematics course, the mean scores obtained from the pre-test and post-test applications for both the total and each sub-dimension of the attitude scale was calculated. To determine whether there was a significant

difference between the mean scores from the pre-test and post-test applications of the students studying at the upper, middle, and lower level schools, the dependent groups t-test was conducted. The t-test results are given in Table 6.

Table 6. Attitude levels t-test results

Groups			n	$\overline{X}$	sd	df	t	P
Upper group	Interest	Pre-test	120	40.68	8.02	119	-5.47	.000
		Post-test	120	44.25	4.31			
	Anxiety	Pre-test	120	18.35	4.8	119	-3.45	.000
		Post-test	120	19.69	3.85			
	Study	Pre-test	120	17.88	2.73	119	-3.02	.001
		Post-test	120	18.53	1.83			
	Necessity	Pre-test	120	13.4	2.25	119	-4.85	.003
		Post-test	120	14.31	1.28			
	Total	Pre-test	120	90.31	14.81	119	-6.06	.000
		Post-test	120	96.78	8.69			
Middle group	Interest	Pre-test	70	36.96	7.94	69	-7.86	.000
		Post-test	70	39.77	9.11			
	Anxiety	Pre-test	70	15.63	3.87	69	-4.78	.000
		Post-test	70	17.44	4.33			
	Study	Pre-test	70	15.27	3.03	69	-4.58	.000
		Post-test	70	16.87	3.22			
	Necessity	Pre-test	70	11.59	2.89	69	-3.21	.002
		Post-test	70	12.73	2.45			
	Total	Pre-test	70	79.44	12.50	69	-10.11	.000
		Post-test	70	86.81	15.65			
Lower group	Interest	Pre-test	76	34.66	7.18	75	-7.04	.000
		Post-test	76	36.61	8.43			
	Anxiety	Pre-test	76	14.86	4.28	75	-3.93	.000
		Post-test	76	15.58	4.93			
	Study	Pre-test	76	14.45	3.2	75	-3.85	.000
		Post-test	76	15.21	3.26			
	Necessity	Pre-test	76	10.37	3.35	75	-3.58	.000
		Post-test	76	10.89	3.58			
	Total	Pre-test	76	74.33	13.95	75	-7.75	.001
		Post-test	76	78.29	15.61			

As can be seen in Table 6, both the students' total attitude mean scores, and the mean scores they achieved in the "interest", "anxiety", "study" and "necessity" sub-dimensions increased significantly in all three school groups. Since the items with a negative statement in the scale were reverse-scored, the increase in the mean score in the "anxiety" sub-dimension indicates that "anxiety" decreased. The upper-group schools' mean score for "interest" increased from 40.68 to 44.25, their mean score for "anxiety" increased from 18.35 to 19.69, their mean score for the "study" increased from 17.88 to 18.53, their mean score for "necessity" increased from 13.4 to 14.31, and their total attitude scale mean score increased from 90.31 to 96.78. The middle-group schools' mean score for "interest" increased from 36.96 to 39.77, their mean score for "anxiety" increased from 15.63 to 17.44, their mean score for "study" increased from 15.27 to 16.87, their mean score for the "necessity" increased from 11.59 to 12.73, and their total attitude scale mean score increased from 79.44 to 86.81. The lower-group schools mean score for "interest" increased from 34.66 to 36.61, their mean scores for "anxiety" increased from 18.35 to 19.69, their mean score for "study" increased from 14.45 to 15.21, their mean score for "necessity" increased from 10.37 to 10.89, and their total attitude scale mean score increased from 74.33 to 78.29. In other words, in all school groups, students' interest in mathematics courses increased, their desire to study increased, their belief in the necessity of the course increased and their anxiety decreased. It can therefore be stated that the attitudes of the students in all the school groups towards mathematics courses changed in a positive way. It was observed that the schools in the upper group had higher scores than the middle- and lower-group schools, while the

middle-group schools had higher scores than the lower-group schools, both for the overall mean score and for the mean scores for the sub-dimensions.

Findings regarding RQ4

Regarding RQ4, the post-test scores was analyzed using the Anova test in order to determine whether the middle-school 6th grade students' attitudes towards mathematics courses differed significantly between the groups. The Anova test results are given in Table 7.

Table 7. Attitude level Anova analysis

	Source of variance	SS	df	MS	F	p
Interest	Between groups	2837.616	2	1418.808	28.139	.000
	Within groups	13261.001	263	50.422		
	Total	16098.617	265			
Anxiety	Between groups	809.107	2	404.553	21.823	.000
	Within groups	4875.389	263	18.538		
	Total	5684.496	265			
Study	Between groups	518.172	2	259.086	35.705	.000
	Within groups	1908.399	263	7.256		
	Total	2426.571	265			
Necessity	Between groups	545.588	2	272.794	45.564	.000
	Within groups	1574.592	263	5.987		
	Total	2120.180	265			
Total	Between groups	16302.512	2	8151.256	48.534	.000
	Within groups	44171.142	263	167.951		
	Total	60473.654	265			

Table 7 shows that there was a significant difference between the total attitude scale mean scores of the upper, middle and lower groups and between the mean scores for each sub-dimension of the attitude scale. The Scheffe test was carried out to determine which groups significant differences had occurred between. The Scheffe test results are given in Table 8.

Table 8. Attitude level Scheffe test results

	Groups	Average difference	
		Middle group	Lower Group
Interest	Upper group	4.47857*	
	Middle group	7.64474*	3.166617*
Anxiety	Upper group	2.24881*	
	Middle group	4.11272*	1.86391*
Study	Upper group	1.65357*	
	Middle group	3.31447*	1.66090*
Necessity	Upper group	1.57976*	
	Middle group	3.41360*	1.83383*
Total	Upper group	9.96071*	
	Middle group	18.48553*	8.52481*

*p<0.05

As can be seen in Table 8, the upper-group students' attitude scores were significantly higher than middle- and lower-group students' scores, while the middle-group students' attitude scores were significantly higher than the scores of those in the lower group. In other words, compared to those in the lower-group schools, the upper-group school students had a greater interest in the mathematics course, more desire to study, a stronger belief in the necessity of the course and a lower level of anxiety. The attitudes of the students in the schools in the upper group were thus more positive than those of the students in the middle and lower groups. Likewise, the attitudes of the students in the

schools in the middle group were more positive than those of the students in the schools in the lower group.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This study, which aimed to determine the effectiveness of the middle-school 6th grade mathematics curriculum using Tyler's model of curriculum evaluation, obtained clues that the effectiveness of the curriculum was not at the same level in every school. In line with data obtained within the scope of the research, it can be said that the curriculum is implemented effectively only in the schools in the upper group. The objectives of the curriculum were reached at a level of 0.75 or more only in the schools in the upper group. While almost half of the objectives were reached at 0.75 or more in the middle-group schools, none of the objectives were reached at 0.75 or more in the lower-group schools. Similar findings were obtained by Şahan (2007) in a study evaluating the elementary school 3rd-grade mathematics curriculum. Compared to the schools in the middle and lower groups, the upper-group schools were determined to have been more successful in terms of achieving the objectives of the curriculum.

When the middle school 6th grade mathematics curriculum was evaluated across all groups, it can be said that the effectiveness of the curriculum was low. This is because the extent to which the objectives of the curriculum had been achieved was very low in terms of all the groups. Similar results were obtained in studies on mathematics curriculums implemented in previous years in the literature, and it was determined that there was a low level of achievements of the curriculum's objectives (Altındağ, 2017; Aslan & Çıkar, 2017; Pektaş, 2012). In countries like Turkey, in which centralized curriculums are implemented, it is expected that the objectives of the curriculum will be reached at a similar level in all schools nationwide.

Two possible comments can be drawn about the curriculum based on the low level of achievement of the objectives in the middle-group and lower-group schools. The first is that the mathematics curriculum may have been prepared only to appeal to students studying in the upper-group schools. In other words, the objectives of the curriculum were simply unattainable for all students. Given that a centrally implemented education curriculum should be accessible to all students regardless of their differences, this situation can be interpreted as demonstrating that the curriculum had not been well designed. According to İlhan and Aslaner (2019), the objectives included in the 2013, 2017, and 2018 middle-school mathematics curricula are generally similar. The literature related to the 2013 version of the 6th grade mathematics curriculum indicated that the teachers saw the objectives in the curriculum as being achievable for the students (Bal & Dinç Artut, 2013; Eski, 2017; Sargın, 2016). These findings from previous studies provide clues that the probability of the first possible comment is low.

A second possible comment is that the mathematics curriculum was implemented effectively only in the schools in the upper group. In other words, it is possible that the recommendations for a student-centered teaching-learning process included in the curriculum were only followed in the schools in the upper group. It can be stated that the teaching-learning process that occurred in the schools in the middle and lower groups was not suitable for curriculum. No matter how well a curriculum is prepared, it is not possible to attain its objectives if the teaching process is not that which is described in the curriculum. The effective implementation of the curriculum depends on the teachers who implement it. Ball, Hill and Bass (2005), argues that the quality of mathematics teaching is related to mathematics teachers' knowledge competencies. In this respect, the failure of the students studying in the middle- and lower-group schools may not only have been because the curriculum was not well designed: it can also be suggested that the curriculum was not implemented correctly in these schools. In other words, it can be said that the official program and the program implemented in schools do not match. The literature on mathematics curriculums implemented in previous years indicates that this comment is more likely to be true. In many studies, it was concluded that teachers did not teach mathematics in the way recommended by the curriculum, and that they used traditional

teacher-oriented methods such as direct instruction and the question-and-answer method (Altındağ, 2017; Aslan & Çıkar, 2017; Bal & Dinç Artut, 2013; Güleş Dağlar, 2008; Gündoğdu, Gündoğdu et al., 2012; Güneş & Baki, 2011; Hıdıroğlu & Tuncel, 2019; Köksaldı, 2019; Mercan, 2011; Özönder, 2011; Poyraz, 2019; Sargın, 2016; Şahan, 2007).

Apart from the curriculum, there may be many reasons why the students in the upper-group schools were more successful than the students in middle-group and lower-group schools. In line with the data obtained from the attitude scale, it can be said that one of the reasons may have been the amount of time students spent studying. When the mean scores for the "study" sub-dimension of the attitude scale applied within the study were examined, it was found that there was a significant difference in favor of the upper group. In other words, students in the upper-group schools may have studied more and spent more time on mathematics. Özer and Anıl (2011) argue that the most important variable affecting students' success in mathematics courses is the time they devote to learning mathematics. Similarly, Savaş, Taş and Duru (2010) found that success in mathematics courses was affected significantly by the time devoted to studying. Therefore, one of the reasons why students in the upper-group schools were more successful than the other students may have been the amount of time they spent studying.

The time that students devote to studying mathematics depends on their interest in it and their belief in the necessity of this course, i.e., their attitude towards mathematics. In fact data obtained of attitude scale show that the middle-school 6th grade mathematics curriculum contributed positively to students' attitudes towards mathematics. The findings of this study show that the post-test results for all three school levels were significantly different than pre-test results. Similar results were obtained in the studies of mathematics curriculums used in previous years. Students' pre-test and post-test attitude scores were compared, and it was determined that there was a significant difference in favor of the post-test (Altındağ, 2017; Pektaş, 2012; Şahan, 2007). However, the findings obtained within the scope of the research indicate that the students' attitudes towards mathematics courses differed among the school groups. This study determined that the upper-group students' attitude scores were significantly higher than the middle- and lower-group students', and that the middle-group students' attitude scores were significantly higher than those of the lower groups. In other words, students studying in the schools in the upper group had a more positive attitude towards mathematics than students studying in the schools in the middle and lower groups. This may be one of the reasons why the level of achievement of the objectives of the 6th grade mathematics curriculum was different among the school groups. Many studies in the literature support this view. Previous studies concluded that there was a significant relationship between students' achievements in mathematics and their attitudes towards mathematics (Bhowmik & Roy, 2016; Kalın, 2010; Kesici & Aşılıoğlu, 2017; Kılıç, 2011; Kocakaya, Okuyucu, Öner & Uzunyol, 2018; Peteros, Columna, Etcuban, Almerino & Almerino, 2019; Savaş et al., 2010; Simegn & Asfaw, 2017; Yücel & Koç, 2011).

There are many reasons that may affect students' attitudes toward mathematics. One of these reasons might be their "anxiety" about the subject. In this study findings supporting this view were gathered. It was determined that the upper-group schools, which had the most positive attitude towards mathematics courses, were also the schools whose students had the lowest level of anxiety. On the other hand, it was determined that the schools in the lower group, which had the least positive attitude towards mathematics, were the schools in which the students were most anxious. Similar findings were obtained in other studies conducted in the literature. It was confirmed that there was an inverse relationship between students' attitudes towards mathematics courses and their anxiety about the subject (Kalın, 2010; Kılıç, 2011; Tuncer & Yılmaz, 2016). In terms of achieving the objectives of the curriculum, the upper group was the most successful school group, and the lower group was the least successful. Students' anxiety about mathematics might be one of the reasons for the difference between the groups in terms of achieving the objectives of the 6th grade mathematics curriculum. Many studies conducted in the literature have found a significant, inverse relationship between students' achievements in mathematics courses and their anxiety levels (Das, Halder & Bairagya,

2014; Demir & Kılıç, 2010; Kalın, 2010; Kesici & Aşılıoğlu, 2017; Kılıç, 2011; Puteh & Khalin, 2016; Shishigu, 2018).

Students' anxiety about mathematics is affected by many factors. In the study conducted by Özdemir, Sezginsoy and Şeker (2019), it was determined that students' anxiety towards mathematics was mostly related to teaching. Accordingly, it can be said that one of the factors that cause students to worry about mathematics courses is the "teacher". Şentürk (2010) and Koca (2011) found that satisfaction with the teacher affects students' anxiety about mathematics courses. Being satisfied with the teacher, in other words, having a positive attitude towards the teacher, will positively affect the attitudes of the students towards mathematics. If the student likes their teacher, they may like mathematics too. Many studies have concluded that teachers affect the attitudes of students towards mathematics courses both positively and negatively (Arıcı, 2013; Keklikci & Yılmazer, 2013; Koca, 2011; Sezgin, 2013; Şentürk, 2010). Considering the relationship between attitude and achievement, it can be said that being satisfied with their mathematics teachers will positively affect students' achievements in mathematics. Many studies in the literature provide results supporting this view (Cumhur, 2018; Çeliköz & Duran, 2017; Gün & Çavuş Erdem, 2014; Koca, 2011).

On the basis of the results of this study, it is recommended that the objectives of the middle-school 6th grade mathematics curriculum put into place in 2018 be reviewed in order to assess whether they are achievable for all students. In order for teachers to implement the teaching-learning process required by the curriculum, in-service training could be provided, or further training materials could be prepared. Suggestions could be made for activities to be added to the curriculum in order to better interest all students in mathematics and enable them to enjoy the course. This research was conducted solely with students in the 6th grade; similar curriculum evaluation studies could be conducted for other grades.

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