Review Article

Comparison of 5th to 8th Grade Mathematics Curricula in Turkey and Greece *

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Abstract

This study compares the Turkish secondary school mathematics curriculum and the 5-8th grades mathematics curriculum in Greece, which has an essential place in the history of mathematics in terms of their general structure and content (learning areas, sub-learning areas, achievements, and course hours). In this study, we have used the document analysis method and curricula as a data collection tool. As a result of the research, we have seen that although the Turkish mathematics curriculum is structured as a single document, the Greek mathematics curriculum has a detailed document covering the aims, general objectives, and basic concepts of the interdisciplinary approach. While primary school is 6 years and secondary school is 3 years in Greece, both are 4 years in Turkey. The number of achievements in the Greek mathematics curriculum is higher than in Turkey, but the course hours are less than in Turkey. In addition, sets, linear equations, and similarity learning areas are included in the Turkish curriculum, but not in Greece. Similarly, sub-learning areas such as Functions and Trigonometry are included in the Greek curriculum, but not in Turkey. In line with these results, it can be ensured that the mathematics course hours are different at each grade level, and the course hours increase as the grade level increases in the mathematics curriculum conducted in Turkey, as in the Greek mathematics curriculum. In addition, as in previous curricula, a broader curriculum including activities, educational materials, and mathematical illustrations that will contribute to students' understanding of the subject can be developed in line with re-achievements.

Keywords: Curriculum, comparative education, Turkey, Greece

1. INTRODUCTION

We see mathematics, which emerges from daily needs, in many places in nature. Nature has the best examples of mathematics, such as the number of petals of daisies, the seeds on pine cones being in two helixes intersecting each other, the ivy plant drawing a helix curve while climbing a tree. The dividing of the circumference of all circles by its diameter constantly is also an example by nature (Altun, 2015). Human beings have felt the need to use mathematics, which nature has wonderfully accommodated, for various historical reasons. Due to the flooding of the Nile River every year, the Egyptians' land borders deteriorated. The borders had to be redefined after the waters receded, and the Egyptians needed to use geometry. From such historical information, we understand that all of the developments in the pre-Ancient Greek period were the work of eastern cultures such as Sumer, Babylon, Egypt, India, and China. However, the contribution of Ancient Greek mathematicians to the present is an undeniable fact since the studies in the pre-Ancient Greek period were practically oriented, and no work could be found on the concept of proof. We know that although Babylon and Egypt influenced the ancient Greek mathematicians, they were not content with their inspiration and gave mathematics a new identity (Baki, 2014; Yıldırım, 1988). For this reason, the contribution of Greek mathematicians to the development of mathematics is enormous.

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Mathematics course in schools aims to enable students to take place in occupational groups in line with the needs of the society by developing students' mathematical culture and mathematical thinking skills, and this aim imposes essential responsibilities on mathematics course in all countries (Baki, 2006). There are various studies carried out in Turkey and the world for the development of the mathematics course, which has an essential place in the student's daily life and educational life. We think that the place of the curriculum, which is a determining factor in the quality of education, in these studies is valuable. A curriculum is a life system that includes all activities related to teaching a subject to students in or out of school (Demirel, 2015). In addition, education programs clarify the responsibilities that students and teachers will undertake and explain the subjects to be learned and how to learn them (Keskin & Yazar, 2020; Korkmaz, 2006). For this purpose, a curriculum is prepared specifically for each course to be taught. The effectiveness and quality of teaching depend on the curriculum and its practical implementation (Çelen, 2011).

Curriculums are regularly developed and rearranged worldwide (Lee, 2013). During these developments, knowing the content of the curricula of other countries can make various contributions. There have been various studies in comparative education in the literature for years (Abid, 2017; Böke, 2002; Demir, 2015; Erbilge, 2019; Kaytan, 2007; Sugandi, 2015). Comparative education studies help solve various problems by comparing education between countries. As is known, comparative education is defined as a discipline that helps to reveal the similarities and differences in the education systems of different cultures and countries and gives helpful advice about the education methods of people (Türkoğlu, 1998). After researching the facts and problems related to education through comparative education, they can be analyzed and resolved with a holistic perspective. It can contribute to the formation of theory by obtaining inferences from the results of a study on a particular subject in a country. In addition, with comparative education, the role of education in the current position of a particular country can be determined and it contributes to the understanding of the relationship between education and development (Türkoğlu, 1998). Comparing the curricula in the field of comparative education would be helpful for countries to see their deficiencies in their content and make the necessary arrangements accordingly. In the literature, many studies have been conducted on comparing mathematics curricula in many different countries and Turkey (Çetinbağ, 2019; Erbilgin & Boz, 2013). In these studies, many countries such as Singapore, South Korea, the United States of America, Canada, Finland, Japan, and Turkey have been compared with different aspects of mathematics curricula. However, no study has been found comparing the mathematics curriculum of Greece and Turkey, which hosted essential mathematicians in their history. Although this study is similar to the studies comparing the programs of different countries, it is also valuable because it is based on the comparison of the Greek mathematics curriculum, which has an important place in the history of mathematics to gain a theoretical qualification, with the Turkish mathematics curriculum. We think that comparing the mathematics curriculum currently being applied in secondary schools in Turkey (5th to 8th Grade) and the current Greek mathematics curriculum will contribute to the literature in revealing the similarities and differences of both countries. In this context, the research problem of this study is "What are the similarities and differences between secondary school 5^{th} and 8^{th} grade mathematics curriculum in Turkey and Greece?". Within the scope of this purpose, the sub-problems of the research are:

1. What are the general structures of the 5th to 8th grades mathematics curricula in Turkey and Greece?
2. What are the contents of the 5^{th} to 8^{th} grades mathematics curricula in Turkey and Greece?
   2.1. What are the data obtained from the comparison in terms of learning areas?
   2.2. What are the data obtained from the comparison in terms of sub-learning areas?
   2.3. What are the data obtained from the comparison in the context of achievements and course hours?

2. METHOD

2.1. Research Model

We have conducted document analysis on the existing curricula of Turkey and Greece in this study, which is comparative research. Document analysis includes the examination of written materials containing information about the case or cases that are aimed to be investigated (Yıldırım & Şimşek, 2013). According to O'Leary (2017), document analysis collects, reviews, queries, and analyzes various written text formats as the primary research data source. Within the scope of this research, we have used the document analysis method because we have collected data directly from the curricula and compared them.

2.2. Data Collection Tools

The research data collection tools are 5th to 8th grades mathematics curricula in Turkey and Greece. We have obtained curricula of Turkey and Greece from their official websites. Curriculum in Turkey is organized by the Ministry of National Education of the Republic of Turkey as separate documents for each course. The mathematics curriculum has been prepared as a single document for primary and secondary 1st to 8th grades (Ministry of National Education [MoNE], 2018). The curriculum is frequently updated, and the data presented in this study contains information for 5th to 8th grades in the 2018 curriculum. The Greek Mathematics Curriculum, on the other hand, is in two separate documents for primary schools and secondary schools. However, since these two different curricula are presented as a single document with the title of "Complete Compulsory Education," this document has been used in the research (Interdisciplinary Common Mathematics Curriculum Framework [ICMCF], 2003). We have examined the details in the document related to the 5th to 8th grades within the scope of the research.

2.3. Data Analysis

In the research, all parts related to the 5-8th grades mathematics curricula were translated into Turkish by the corresponding author who was born in Greece and studied there until university. She has been teaching mathematics in Greece since her graduate education. The teacher who is corresponding author knew Greek and Turkish checked the curriculum translated from Greek into Turkish. After the controls, we have analyzed all data related to the general structure and content of 5th to 8th grades mathematics curricula with the descriptive analysis technique in line with the research problems. In the descriptive analysis, data are summarized and interpreted according to predetermined themes. “Data are described systematically. These descriptions are interpreted, and some results are reached with the cause and effect relationship” (Yıldırım & Şimşek, 2013, p. 256).

While conducting the data analysis of this study, we have determined the themes (sub-problems) by examining the Turkish and Greek curricula. In this context, we have decided to present the data in terms of the general structures and contents of the curriculum (learning areas, sub-learning areas, achievements, and course hours). Afterward, we have organized the data in line with these themes and compared the similar and different characteristics of the countries with the tables in the relevant parts.

2.4. Validity and Reliability

Validity is a concept that reveals whether the research is conducted in line with its purpose (Akerlind, 2012). However, validity in qualitative research is different from quantitative research. According to Yıldırım and Şimşek (2013), validity in qualitative research is the presentation of the research topic as it is without being changed by the researcher. In this case, to ensure validity in qualitative research, the researcher should be impartial throughout the research process and compare the findings impartially. The reliability of qualitative research reflects whether the results obtained are consistent with the research data (Merriam, 2009). To increase the validity and reliability of this study, we have meticulously examined the data, abided by the information given in the curricula of both

countries, presented the data impartially without any changes, and repeated the analyzes one month after the first analyzes for consistency. We have determined that the analyses made in the past period are compatible. The coding was done at different times by corresponding author and reliability was ensured by using the time factor.

3. FINDINGS

In this section, the findings obtained from the research are presented in line with the sub-problems. Within the scope of the research, we compared 5th to 8th grades mathematics curricula in Turkey and Greece in terms of general structures and contents (learning areas, sub-learning areas, achievements, and course hours).

3.1. Comparison of 5th to 8th Grades Mathematics Curricula in Turkey and Greece in Terms of General Structures

3.1.1. Similarities

- Students of both countries compared are faced with mathematics lessons starting from the first grade of primary school.
- We have grouped learning areas in the curricula of the two countries compared according to a specific order for each grade level.

3.1.2. Differences

- Primary and secondary school in Turkey is four years, while in Greece primary school is six years, and secondary school is three years.
- The Turkish mathematics curriculum is a single document created for primary and secondary schools, including Primary Education Institutions. However, the Greek mathematics curriculum is presented in two separate documents, as separate documents for primary and secondary schools and as a combined document for kindergarten, primary and secondary school covering compulsory education. There is also an extra document covering the aims, general objectives, and basic concepts of the interdisciplinary approach of mathematics teaching in Greece.
- The Turkish mathematics curriculum consists of 76 pages, while the Greek curriculum consists of 183 pages for primary school and 114 pages for secondary school. However, the combined Greek mathematics curriculum used in the research consists of 286 pages. In addition to the Greek curriculum, the document containing the aims and general objectives also consists of 56 pages.
- The Turkish mathematics curriculum gives the achievements as a list for each class, and there is an explanation under the achievement if it needs attention. On the other hand, the Greek curriculum gives the achievements according to the subject, activity, and educational material they correspond to in the table. In addition, as in the Turkish curriculum, there is no guidance explicitly given for that achievement.
- In the Greek mathematics curriculum, in addition to the activities indicated by numbers in the table (different from the Turkish mathematics curriculum), there are plenty of sample activities for group work that can be applied by bringing together various classes (for example, 5th and 6th grades together).

3.2. Comparison of 5th to 8th Grades Mathematics Curricula in Turkey and Greece in Terms of Contents

Content is one of the elements of the annual curriculum or the plans that teachers prepare daily. In this study, which is a comparative analysis, we have examined the content, learning areas, sub-learning areas, and achievements and course hours in three criteria. We have created tables according to these determined criteria and then interpreted the similarities and differences.

3.2.1. Comparison of 5th to 8th Grades Mathematics Curricula in Turkey and Greece in Terms of Learning Areas

There are five learning areas in the 5th to 8th grades mathematics curriculum in Turkey. These are Numbers and Operations, Algebra, Geometry and Measurement, Data Processing, and Probability (MoNE, 2018). Although the 5th and 6th grades are at the primary school level in the Greek mathematics curriculum, and the 7th and 8th grades are at the secondary school level, both levels consist of the same learning areas. These learning areas consist of Numbers, Algebra, Geometry – Space, Measurement, Statistics and Probability (ICMCF, 2003).

Table 1 presents the learning areas of the mathematics curricula in Turkey and Greece according to grade levels.

Table 1. Learning areas of the mathematics curricula in Turkey and Greece according to grade levels

Grade / Country	Turkey	Greece
5th Grade	Numbers and Operations Geometry and Measurement Data Processing	Numbers Algebra Geometry -Space Assessment Statistics Probability
6th Grade	Numbers and Operations Algebra Geometry and Measurement Data Processing	Numbers Algebra Geometry -Space Assessment Statistics Probability
7th Grade	Numbers and Operations Algebra Geometry and Measurement Data Processing	Numbers Algebra Geometry -Space Assessment Statistics Probability
8th Grade	Numbers and Operations Algebra Geometry and Measurement Data Processing Probability	Numbers Algebra Geometry -Space Assessment Statistics Probability

According to Table 1, while learning areas determined for 5th-8th grades in the mathematics curriculum of Greece exist for each Grade, the learning area of Algebra starts from the 6th Grade, and the learning area of probability starts from the 8th Grade in the mathematics curriculum of Turkey. The learning areas of both countries are similar to each other. However, although they are similar in content, the learning area of Numbers in the Greek mathematics curriculum is given as Numbers and Operations in the Turkish curriculum. While Measurement is also determined as a learning area in the Greek mathematics curriculum, it is combined with the Geometry learning area in the Turkish mathematics curriculum. In addition, Space is included in the Geometry learning area of the Greek mathematics curriculum. In addition, the Statistics learning area in the Greek mathematics curriculum and the Data Processing learning area in the Turkish mathematics curriculum are similar in content. However, it is named Data in the Greek mathematics curriculum and is located at a lower level of the Statistics learning area.

3.2.2. Investigation of Primary Education Mathematics Curricula in Turkey and Greece in Terms of Sub-Learning Areas

Table 2 presents the similarities and differences for the sub-learning areas in the Numbers and Operations learning area.

Table 2. Comparison of mathematics curricula in Turkey and Greece according to sub-learning areas in the numbers and operations learning area

Sub-learning Areas	Turkey	Greece
Natural number	X	X
Operations with Natural Numbers	X	X
Fractions	X	X
Operations with Fractions	X	X
Decimal Notation	X	X
Percentages	X	X
Factors and Multiples	X	X
Sets	X	
Whole Numbers	X	X
Operations with Whole Numbers	X	X
Rational numbers	X	X
Operations with Rational Numbers	X	X
Ratio	X	X
Ratio and Proportion	X	X
Exponential Expressions	X	X
Square Root Expressions	X	X

According to Table 2, after examining the sub-learning areas belonging to the Numbers and Operations learning areas, we see similarities between the two countries. The only difference in sub-learning areas between curricula in Turkey and Greece is that the subject of sets, which is in the 6th grade of the Turkish mathematics curriculum, is not included in the 5th to 8th grades of the Greek mathematics curriculum. The subject of sets is included in the 10th Grade in the Greek mathematics curriculum. Table 3 presents similarities and differences according to the sub-learning areas in the Algebra learning area.

Table 3. Comparison of mathematics curricula in Turkey and Greece according to sub-learning areas in the algebra learning area

Sub-learning Areas	Turkey	Greece
Algebraic Expressions	X	X
Equation	X	X
Linear Equations	X	
Algebraic Expressions and Identities	X	X
Inequalities	X	X
Functions		X

Examining the sub-learning areas belonging to the algebra learning area, we see that the students in the Turkish curriculum encounter this learning area in the 6th Grade, but the subject is covered in detail in the 8th Grade. However, there are sub-learning areas in the Algebra learning area starting from the 5th Grade in the Greek mathematics curriculum. Only a small part of the subjects in the Linear Equations sub-learning area, included in the Turkish mathematics curriculum, are briefly covered in Greece about functions. However, examining the Greek curriculum in detail, we see that the solution and detailed explanation of this type of equation is included in Equations and Linear Equation Systems in the 9th Grade high school level, the last year of secondary school. Therefore, in the Greek curriculum, the student comprehends the concepts of variable and slope in the previous class and learns the solution of linear equations in the next class.

The patterns existing in the Patterns - Functions sub-learning area in the Greek mathematics curriculum are taught in 5th to 8th grades in the Turkish curriculum. In contrast, the functions are not included in the secondary school curriculum but the 10th Grade in the high school curriculum.

Table 4 shows the similarities and differences according to the sub-learning areas in the Geometry and Measurement learning area.

Table 4. Comparison of mathematics curricula in Turkey and Greece according to sub-learning areas in the geometry and measurement learning area

Sub-learning Areas	Turkey	Greece
Basic Geometric Concepts and Drawings	X	X
Triangles and Quadrilaterals	X	X
Triangles	X	X
Measuring Length and Time	X	X
Measuring Area	X	X
Geometric Objects	X	X
Angles	X	X
Lines and Angles	X	X
Circumference	X	X
Circumference and Circle	X	X
Measuring Liquid	X	X
Transformation Geometry	X	
Polygons	X	X
Views of Objects from Different Sides	X	
Congruence and Similarity	X	
Trigonometry		X

Investigating the sub-learning areas according to the Geometry and Measurement learning area, we see that the Parity and Similarity sub-learning area is not included in the grades under the scope of the research in the Greek curriculum and is in the 9th Grade high school level. In addition, the sub-learning areas of Transformation Geometry and Views of Objects from Different Aspects are not seen in the grades under the research in the Greek mathematics curriculum. These subjects are included in the Greek curriculum in high school 1st and 2nd grades. Unlike Turkey, Trigonometry is also included in the Greek mathematics curriculum while it is taught in the 9th Grade high school level in the Turkish curriculum. Table 5 gives the similarities and differences according to the sub-learning areas in the Data Processing learning area.

Table 5. Comparison of mathematics curricula in Turkey and Greece according to sub-learning areas in the data processing learning area

Sub-learning Areas	Turkey	Greece
Data Collection and Evaluation	X	X
Data Analysis	X	X

After comparing the sub-learning areas in the Data Processing learning area, we have seen a remarkable similarity between the two curricula. The subjects included in the Turkish curriculum are also available in the Greece curriculum. Pictograms (figure graph) and time graphs are taught in the Data sub-learning area in the Greece curriculum and the Turkish curriculum. In addition, the basic concepts of statistics are introduced under the title of Descriptive Statistics in the Data sub-learning area in the 8th Grade, which is the last year of the Greek curriculum included in the research. In this section, different from the Turkish curriculum, the concepts of frequency and relative frequency are introduced, and the histogram is included.

Table 6 gives the similarities and differences according to the sub-learning areas in the Probability learning area.

Table 6. Comparison of mathematics curricula in Turkey and Greece according to sub-learning areas in the probability learning area

Sub-learning Areas	Turkey	Greece
Probability of Simple Events	X	X

Probability is introduced earlier in the Greek mathematics curriculum than in the Turkish curriculum. Although the Probability of Simple Events sub-learning area is only included in the 8th Grade in the Turkish curriculum, the subject of Probability is included in the 5th, 6th and 7th grades in the Greek curriculum.

3.2.3. Comparison of 5th to 8th Grades Mathematics Curricula in Turkey and Greece in the Context of Achievements and Course Hours

We have compared the achievements in the 5th to 8th grades mathematics curricula of both countries based on the learning areas in the Turkish curriculum. We have arranged the achievements in the Greek mathematics curriculum according to the learning areas of the Turkish curriculum. When comparing the number of achievements of the relevant countries, we have stated them separately based on grades. We have shown the number of course hours in which the relevant achievements are taught in the table.

Table 7 gives comparisons of the number of achievements and the course hours corresponding to these achievements in the Numbers and Operations learning area based on the grades.

Table 7. The number of achievements and course hours in the numbers and operations learning area in Turkey and Greece

Grade	Turkey		Greece	
	Number of Achievements	Course Hours	Number of Achievements	Course Hours
5th Grade	33	108	23	62
6th Grade	32	101	13	60
7th Grade	25	98	30	38
8th Grade	16	50	9	8
Total	106	357	75	168

When analyzing the achievements in the Numbers and Operations learning area in the Turkish mathematics curriculum quantitatively, we see 106 achievements, 33 of which are in the 5th Grade, 32 in the 6th Grade, 25 in the 7th Grade, and 16 in the 8th Grade. There are 75 achievements, 23 of which are in the 5th Grade, 13 in the 6th Grade, 30 in the 7th Grade, and 9 in the 8th Grade in the Numbers and Operations learning area in Greece. The highest number of achievements and course hours in this learning area is in Turkey.

Table 8 gives the comparison of the number of achievements and the course hourse corresponding to these achievements in the Algebra learning area based on the grades.

Table 8. The number of achievements and the course hours in the algebra learning area in Turkey and Greece

Grade	Turkey		Greece	
	Number of Achievements	Course Hours	Number of Achievements	Course Hours
5th Grade	-	-	9	9
6th Grade	3	10	12	9
7th Grade	7	30	13	13
8th Grade	13	55	32	38
Total	23	95	66	69

When analyzing the achievements in the algebra learning area of the Turkish mathematics curriculum quantitatively, we see that this learning area is not included in the 5th Grade, and there are a total of 23 achievements, including 3 achievements in the 6th Grade, 7 in the 7th Grade and 13 in the 8th Grade. On the other hand, there are 66 achievements, 9 of which are in the 5th Grade, 12 in the 6th Grade, 13 in the 7th Grade, and 32 in the 8th Grade in the Algebra learning area in Greece. Therefore, the number of achievements in the Algebra learning area in the Greek curriculum is higher than in Turkey. However, although the number of achievements is much higher in Greece, the allocated course hours for this learning area are lower than in Turkey.

Table 9 gives the comparison of the number of achievements and the course hours corresponding to these achievements in the Geometry and Measurement learning area based on the grades.

Table 9. The number of achievements and the course hours in the geometry and measurement learning area in Turkey and Greece

Grade	Turkey		Greece	
	Number of Achievements	Course Hours	Number of Achievements	Course Hours
5th Grade	20	62	32	36
6th Grade	19	58	25	35
7th Grade	12	37	11	32
8th Grade	16	51	16	47
Total	67	208	84	150

When analyzing the achievements in the Numbers and Operations learning area in the Turkish mathematics curriculum quantitatively, we see that there are 67 achievements, 20 of which are in the 5th Grade, 19 in the 6th Grade, 12 in the 7th Grade, and 16 in the 8th Grade. In Greece, there are 84 achievements, 32 of which are in the 5th Grade, 25 in the 6th Grade, 11 in the 7th Grade, and 16 in the 8th Grade in the Geometry and Measurement learning area. Thus, the number of achievements in this learning area is higher in the Greek curriculum. However, although the number of achievements in the Greek curriculum is higher, the Geometry and Measurement learning area is taught in more course hours in the Turkish curriculum.

The total number of achievements in the geometry and measurement learning area is 25.37% higher in Greece, but the corresponding course hours are 38.66% higher in Turkey.

Table 10 gives the comparison of the number of achievements and the course hours corresponding to these achievements in the Data Processing learning area based on the grades.

Table 10. The number of achievements and the course hours in the data processing learning area in Turkey and Greece

Grade	Turkey		Greece	
	Number of Achievements	Course Hours	Number of Achievements	Course Hours
5th Grade	3	10	5	6
6th Grade	5	11	4	7
7th Grade	4	15	15	9
8th Grade	2	12	8	7
Total	14	48	32	29

When analyzing the achievements in the Data Processing learning area of the Turkish mathematics curriculum quantitatively, we see that there are 14 achievements, 3 of which are in the 5th Grade, 5 in the 6th Grade, 4 in the 7th Grade, and 2 in the 8th Grade. In Greece, there are 32 achievements in total, 5 of which are in the 5th Grade, 4 in the 6th Grade, 15 in the 7th Grade, and 8 in the 8th Grade in the Data Processing learning area. As is seen, the highest number of achievements in this learning area is in Greece. However, the number of course hours corresponding to the total achievement numbers is higher in Turkey than in Greece.

The total number of achievements in the data processing learning area is 128.57% higher in Greece, but the corresponding course hours are 65.51% higher in Turkey.

Table 11 gives the comparison of the number of achievements and the course hours corresponding to these achievements in the Probability learning area based on the grades.

Table 11. The number of achievements and the course hours in the probability learning area in Turkey and Greece

Grade	Turkey		Greece	
	Number of Achievements	Course Hours	Number of Achievements	Course Hours
5th Grade	-	-	2	4
6th Grade	-	-	2	5
7th Grade	-	-	4	5
8th Grade	5	12	-	-
Total	5	12	8	14

When analyzing the achievements in the Probability learning area of the Turkish mathematics curriculum quantitatively, we see that the Probability learning area is not included in the 5th, 6th, and 7th grades. Still, it is included in the 8th Grade for the first time with 5 achievements. In Greece, there are 8 achievements, 2 of which are in the 5th Grade, 2 in the 6th Grade, and 4 in the 7th Grade in the Probability learning area. The highest number of achievements in this learning area is in Greece.

The total number of achievements in the probability learning area is 60% higher in Greece and the corresponding course hours are 16.66% higher in Turkey.

4. DISCUSSION AND CONCLUSIONS

This part of the research gives discussions and results in the context of the general structures and contents of the mathematics curricula (learning areas, sub-learning areas, achievements, and course hours).

Although the Turkish mathematics curriculum is structured as a single document for primary and secondary schools, the Greek mathematics curriculum also has an extra document covering the aims, general objectives, and basic concepts of the interdisciplinary approach and the curriculum covering compulsory education. In this case, we can say that the Turkish curriculum is more useful in

terms of application and analysis. However, we see that the Greek mathematics curriculum is more detailed when looking at the number of pages quantitatively. At the same time, these two countries differ in terms of primary and secondary school years. While primary school is 6 years and secondary school is 3 years in Greece, both are 4 years in Turkey.

Within the scope of the research, we have examined the curricula in terms of content under three main headings: learning areas, sub-learning areas, achievements, and course hours. After comparing the learning areas, we have determined five learning areas, namely Numbers and Operations, Algebra, Geometry and Measurement, Data Processing, and Probability, in the Turkish secondary school mathematics curriculum. On the other hand, there are six learning areas in Greece: Numbers, Algebra, Geometry – Space, Measurement, Statistics, and Probability. Although the numbers are different, we see that the contents of the learning areas overlap to a large extent. In his study examining mathematics curricula in Turkey, Canada, and Singapore, Karakaya (2021) found that a significant portion of the sub-learning areas was similar. While the learning areas determined for the 5th to 8th grades are found at each grade level in Greece's mathematics curriculum, the algebra learning area in the Turkish mathematics curriculum starts to be applied from the 6th Grade and the probability learning area from the 8th Grade. In a separate study, it may be helpful to examine the advantages and disadvantages of teaching algebra and probability in Turkey starting from the 5th Grade. At the same time, it can also be determined what kind of benefits teaching these subjects from the 5th Grade has in Greece.

We have also examined sub-learning areas in the context of learning areas given in the Turkish mathematics curriculum. We have created tables by adding the parts included in the Greek mathematics curriculum but not in the Turkish curriculum. As a result of these examinations, although the sub-learning areas are generally similar, we have identified some differences. For example, while the sets are taught in the Numbers and Operations learning area in the 6th Grade in Turkey, it is not taught in the 5th to 8th grades in Greece. We have determined that this subject is included in the Greek mathematics curriculum in the 10th Grade. Also, there is another difference in the Algebra learning area. In the Turkish curriculum, students encounter this learning area in the 6th Grade, but the subject is taught in detail in the 8th Grade. However, from the 5th Grade in the Greek mathematics curriculum, the sub-learning areas in the Algebra learning area are included at all grade levels under the research. Additionally, although the subject of Functions exists in the 5th to 8th grades mathematics curriculum in Greece, it is not taught in secondary school but in high school (10th Grade) in Turkey. We have also determined differences between countries in the subject of Functions, the sub-learning area in the Geometry and Measurement learning area. One of these differences is that the Parity and Similarity sub-learning area existing in the 5th to 8th grades in the Turkish mathematics curriculum is not included in the grades under the research in the Greek curriculum and is in the 9th Grade high school level. In addition, the sub-learning areas of Transformation Geometry and Views of Objects from Different Aspects are included in the Greek curriculum in high school 1st and 2nd grades. Unlike Turkey, the Trigonometry learning area is also included in the Greek mathematics curriculum while it is taught in the 9th Grade high school level in the Turkish curriculum.

We have seen a remarkable similarity after comparing the sub-learning areas in the Data Processing learning area. The subjects included in the Turkish curriculum are also available in the Greece curriculum. Unlike the Turkish curriculum, we have observed that the pictogram graphic and the time graph are included in the Greek curriculum. In addition, we see that frequency, relative frequency, and histogram are included within the scope of Basic Concepts of Statistics at the 8th grade level in Greece.

As a result of comparing the sub-learning areas depending on the probability learning area, we have determined that the concept of probability is introduced earlier in the Greek mathematics curriculum than in the Turkish curriculum. Although the Probability of Simple Events sub-learning

area is only included in the 8th Grade in the Turkish curriculum, the subject of Probability is included in the 5th, 6th and 7th grades in the Greek curriculum. Thus, it is noteworthy that the subject of Probability is introduced at more expansive grade levels in the Greek curriculum.

We have seen that the achievements of the Turkish mathematics curriculum are given in order for each grade, and the details that need attention are given as explanations. On the other hand, the achievements of the Greek curriculum are given in tabular form according to the achievement, basic subjects, activity, and educational material. Under the title of basic subjects, there are basic subjects related to the achievement, while in the activity part, tips and activity examples related to the relevant acquisitions are included. In the section of educational material, we see there are directions based on the achievement. These directions sometimes show an example of a page number from the book and sometimes a material suggestion (e.g., square canvases, geographical maps, connecting cubes, tangram, and mirror). In addition, applications such as Word, Sketchpad, Cabri, and Geogebra that educators can use in the digital environment are also recommended in this section. In addition, there are illustrations that can be shown to students with various links (for example, URL5 and URL6). However, although such directions are emphasized in the Turkish mathematics curriculum, they are not explicitly included. After comparing the achievements quantitatively, we have determined that the number of achievements in Turkey is 215 and in Greece is 265. Looking at the total number of achievements in the compared grades (5, 6, 7, and 8), we have determined that the number of achievements in the Greek mathematics curriculum is higher than in Turkey. However, in many studies comparing the curricula of different countries, it has been stated that the number of achievements in Turkey is higher than in other countries (Çetinbağ, 2019; Kaytan, 2007).

We have also determined that the annual course hours of the countries compared differ. While 180 lesson hours are allocated for mathematics in Turkey, in Greece, 120 course hours are allocated for the 5th and 6th grades, determined as the primary school level, 101 for the 7th Grade, and 100 for the 8th Grade at the secondary school level. When examining the duration and the number of achievements together, we see that more time is given to teaching the achievements in Turkey. With a similar approach, Çoban (2011) stated that the subjects are repeated more and more details are given in the mathematics curriculum in Turkey. It shows that more time is given for teaching the subjects, namely the achievements. In addition, the duration of the lesson in Turkey is 40 minutes, while in Greece, the first lesson is 45 minutes, the other lesson hours are 40 minutes. Therefore, considering that the duration of a course is similar in both countries, we can say that mathematics is given more place in an academic year in Turkey.

In this context, we can make the following suggestions to researchers and program developers who want to work in this field:

- Comparative analysis of the textbooks taught within the Turkish and Greek curricula scope can be made.
- Within the scope of this research, we evaluated only 5-8th grades. A similar study can also be done in the 9-12th grades in Turkey and Greece.
- Comparative studies can be made between Turkish and Greek teacher training programs.
- In the Turkish mathematics curriculum, as in previous curricula, activities, educational materials, and mathematical illustrations that will contribute to students' understanding of the subject can be included in line with the re-achievements.
- In the Turkish mathematics curriculum, as in the Greek curriculum, activities can be offered for group work in which various classes can be brought together.

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