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The investigation of middle school mathematics textbooks in terms of mathematics' connection to nature and science

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ABSTRACT
Effective education depends on various factors, with textbooks and courses being essential for preparing students for real life situations. Therefore, it's crucial that textbooks are thoughtfully developed and chosen. This study investigates how middle school mathematics textbooks approved by the Ministry of National Education for the 2021-2022 academic year address the connections between "Mathematics - Science" and "Mathematics - Nature." As a descriptive research study, it seeks to reveal the current state of these connections. Data was collected through document analysis, a qualitative research method. Within the scope of this study, eight middle school mathematics textbooks were examined, two from each grade level. The analysis was organized according to the curriculum, emphasizing science and nature themes, as identified through curriculum goals and educational literature.These themes were identified by examining the mathematics curriculum goals and literature on effective mathematics education and textbooks. The research found that while content associations with science and social sciences were somewhat adequate, they were lacking in nature and art. Additionally, connections to daily life were well-represented and designed to engage students. It is recommended that future efforts should aim to enhance textbook preparation to better align with contemporary educational needs.

INTRODUCTION

When we look at human history, we see that for centuries people have been trying to discover the mysteries of the universe and to master nature by understanding natural events (Yeniocak, 2019). In this effort, the key held by human beings has mostly been mathematics. No matter how primitive, almost every culture has developed some form of mathematics (Davis et al., 2020). Matematics, whose origins trace back to the unknown depths of ancient times, stands as one of the oldest and most cumulative branches of science, having reached across the globe, spanning Mesopotamia, China, Egypt, Ancient Greece, India, Islamic Geography, and Europe. (Baki, 2020).

Although mathematics emerged with simple needs based on counting, numbers and operations (arithmetic), it is seen that human efforts to understand nature, daily needs and developing science and technology have turned into very complex concepts, structures and forms, and mathematics has gone beyond what is seen in curriculum (Stewart, 2020). However, it has been observed that the abstract concepts and connections discovered by mathematicians sometimes find their place in nature, science, and technology years or even centuries later. The National Council of Teachers of

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Table 1
NCTM april math awareness themes by year

Year	Theme	Year	Theme
1986	Mathematics - The Foundation	2001	Mathematics and the Ocean
1987	The Beauty and Challenge of	2002	Mathematics and the Genome
1988	100 Years of American Mathematics	2003	Mathematics and Art
1989	Discovering Patterns	2004	The Mathematics of Networks
1990	Communicating Mathematics	2005	Mathematics and the Cosmos
1991	Mathematics - IT'S Fundamental	2006	Mathematics and Internet Security
1992	Mathematics and the Environment	2007	Mathematics and the Brain
1993	Mathematics and Manufacturing	2008	Math and Voting
1994	Mathematics and Medicine	2009	Mathematics and Climate
1995	Mathematics and Symmetry	2010	Mathematics and Sports
1996	Mathematics and Decision Making	2011	Unraveling Complex Systems
1997	Mathematics and the Internet	2012	Mathematics, Statistics, and the Data
1998	Mathematics and Imaging	2013	Mathematics of Sustainability
1999	Mathematics and Biology	2014	Mathematics, Magic, and Mystery
2000	Math Spans All Dimensions	2015	Math Drives Careers

Mathematics (NCTM) has been celebrating April as "Mathematics Awareness Month" since 1986 in order to increase awareness of the usefulness of mathematics in our lives and in society (Ernest, 1996). When we look at the themes of this month in the Table 1, which is celebrated at the national level, we see that mathematics follows a course that touches on daily life and its connection with different disciplines. The themes of "Mathematics Awareness Month" between 1986 and 2015 are given in the table below (ASA, 2023).

One of the main goals of mathematics education in NCTM's (2000) educational standards and Ministry of National Education (MEB) (2013) curriculum goals is mathematical connections. Özgen (2016) describes mathematical connection as (p.2) "It is the process and skills of establishing connections between mathematical concepts and operations involving extensive cognitive processes, learning domains (algebra, numbers, geometry, etc.), different representations (verbal, algebraic, tabular, visual, equations, graphs, concrete models, etc.), as well as other disciplines and daily life". Connecting mathematics to everyday life and conveying applications to students with examples undoubtedly increases students' interest in mathematics and enables them to learn mathematics more meaningfully. (Olkun & Toluk-Uçar, 2006). The efficiency of the lesson will increase when teachers share the value and necessity of learning with students while teaching the subjects and explain how they will use what has been learned in daily life. Because providing a relevant answer to the question 'why are we learning this?' during the educational process will motivate students more. (Evcim, 2010).

The rapid developments in the current digital age are influencing every field, including the field of education. One of the objectives of education and training activities is to prepare individuals for their present and future lives in a more equipped and knowledgeable manner. Therefore, in the education process it is crucial to educate individuals who understand the purpose of the information learned, where it will be useful, and most importantly, how to relate this knowledge to everyday life. In the modern world, scientific research, complex economic connections, and advanced technology are all based on mathematical knowledge. Due to the universality of mathematics, teaching it to students is seen as a necessity of life (Gür, 2020). When examining studies related to the history of mathematics, it is evident that the fundamental starting point of mathematics was to meet the basic needs of societies. However, the incredible rapid changes in science and technology in recent years, with mathematics being increasingly used in technology and other fields, consistently highlight the crucial role of mathematics, a fundamental element of daily life, in schools. Accordingly, this necessitates the organization of mathematics education and supplementary resources (Ayhan,

2006). This study seeks to answer the question of the extent to which science and nature themes are included in the examples found in mathematics textbooks. Because the examples in mathematics textbooks, the more intertwined with areas such as daily life, science, and nature, will generate greater interest among students and be more successful in ensuring permanence (Özgen & Bindak, 2018). Most importantly, it is expected that students, by obtaining answers to questions such as where we encounter what we learn in mathematics, and where it is useful, will go beyond seeing mathematics as just a subject and realize that mathematics is a part of our lives.

In the education systems of developed countries, textbooks have always been an important source of information and auxiliary educational tools in the implementation of curriculum (Konak, 2018). Textbooks serve as companions that facilitate learning environment in which teachers in delivering lessons in a more systematic, planned manner without disrupting the coherence of the topics. Simultaneously, they empower students to revisit and self-learn the presented content at their own pace and in the desired amount whenever they wish (Sefa, 2009). It is seen in the research that textbooks, which serve as a bridge between the curriculum and the student and whose importance is clearly emphasized, need to be constantly studied and improved in order to reach the goals in curriculum (Küçükahmet, 2011). Therefore, studies and recommendations regarding the examination, evaluation, and development of these supplementary resources to equip students with process skills have gained significance. This research aims to reveal the extent to which the approach of implementing mathematics education by integrating it with other fields, as prescribed by the renewed mathematics curriculum in Turkey since 2005 and widely mentioned in the literature, is reflected in middle school mathematics textbooks. In addition, this research aims to make suggestions by seeking answers to the following research problems regarding these auxiliary resources, which are so valuable and useful for students and education:

1) To what extent are examples of the "mathematics - science" connections included in middle school mathematics textbooks?
2) To what extent are examples of the "mathematics – social sciences" connections included in middle school mathematics textbooks?
3) To what extent are examples of the "mathematics - art" connections included in middle school mathematics textbooks?
4) To what extent are examples of the "mathematics - nature" connections included in middle school mathematics textbooks?
5) To what extent are examples of the "mathematics – daily life" connections included in middle school mathematics textbooks?

METHODS

Research model

This study, conducted to determine the extent to which the connection between 'Mathematics - Science' and 'Mathematics - Nature' is addressed in middle school mathematics textbooks, is a descriptive research as it aims to present the current situation of the investigated problem. Data were collected through document analysis, using qualitative research methods within the scope of the study.

Data sources

The data source for the research is the middle school mathematics textbooks approved by the Ministry of National Education (MEB) and used in the academic year 2021-2022. In the scope of the study, a total of eight middle school mathematics textbooks, two from each grade level, were examined. At the Education Informatics Network (EBA) website, where approved textbooks are published, there are two textbooks for each of the 5th and 7th-grade levels, and three textbooks for each of the 6th and 8th-grade levels. Since there are two textbooks for both the 5th and 7th-grade levels, all of them were selected. As there are three textbooks for each of the 6th and 8th-grade levels, two of them were selected by assigning numbers and using simple random sampling method to create the data sources for the research.The books are given codes as 5KA, 5KB, 6KA, 6KB, 7KA, 7KB, 8KA and 8KB. In the research, the books were named with these codes and the codes were used only to shorten the names of the books. The numbers 5, 6, 7 and 8 in the coding represent the grade level,

the letter K represents the word book, and the letters A-B represent the expressions 1st textbook and 2nd textbook. Data sources were accessed in pdf format from www.eba.gov.tr.

Data collection

After determining the research method and design, the data collection and analysis process phases were implemented (Çelik et al., 2020). In qualitative research, data is collected through observation, interviews and documents (Kıral, 2020). In this study, data collection was carried out through document review. Which documents will be examined and which data will be collected are related to the research problem. Two main themes (science and nature) were created from eight mathematics textbooks selected within the scope of the research, by scanning the literature and taking the opinion of the relevant field expert, and data were collected by creating a checklist reflecting these two main themes as a data collection tool. The topics included in the checklist are presented in the order in the unit plan in the "Mathematics Course Teaching Program" published by the Ministry of National Education in 2018 (MEB, 2018).

Analysis of data

In qualitative research, data undergoes descriptive analysis and content analysis. In this study, data collected through a checklist were examined through descriptive analysis, and the findings were expressed numerically (in percentages). In the 'Science' theme, the connection of mathematics with the fields of 'Natural Sciences, Social Sciences, and Arts' was explored, while in the 'Nature' theme, the aim was to scan all content related to the reflections of mathematics in nature in the books. During data analysis, all content in the book was coded according to the categories in the checklist.

Validity and reliability of the research

Validity and reliability are important in terms of the credibility and acceptability of the results obtained within the scope of the study. Two important principles in the process are impartiality and reliability. If the data used in a study yields similar coding and analysis results when evaluated by another researcher under similar conditions, then the study is considered reliable and unbiased (Kıral, 2020). The existing study has extensively utilized literature at all stages, and all data relevant to the study has been presented with proper referencing. A thorough examination of the texts within the scope of document analysis is one of the elements that enhance validity. Additionally, for the 5KA textbooks used in the research, the coding process was determined collaboratively by the domain expert and the researcher in the initial coding phase. In the next stage, the researcher independently coded the contents of the designated textbooks. Differences between the domain expert and the researcher's codings were addressed through a reexamination, ensuring that the research was conducted with a shared perspective. In qualitative research, reliability is considered achieved when the reliability of coding is 90% or higher. In this study, to measure reliability, the concordance percentage formula developed by Miles and Huberman was utilized, resulting in a concordance percentage of 94%, ensuring internal reliability (Miles & Huberman, 1994). In this research, where data sources were determined using simple random sampling method, efforts were made to maintain the credibility of the study by presenting the content in the book as it is without alterations.

FINDINGS

In this part of the research, the findings regarding the extent to which the themes of "mathematics-science" and "mathematics-nature" are included in the eight selected middle school mathematics textbooks are presented in line with the sub-problems. In addition, in line with the findings obtained, an example from the textbooks related to each sub-problem is included.

Findings related to the first sub-problem

Table 2 shows the findings and comments regarding the first sub-problem of the research, the extent to which examples of the "mathematics - science" connection are included in middle school mathematics textbooks. When Table 2 is examined, it is seen that in 75% of the achievements in the

Table 2

Findings on the connection between competencies in mathematics textbooks and science

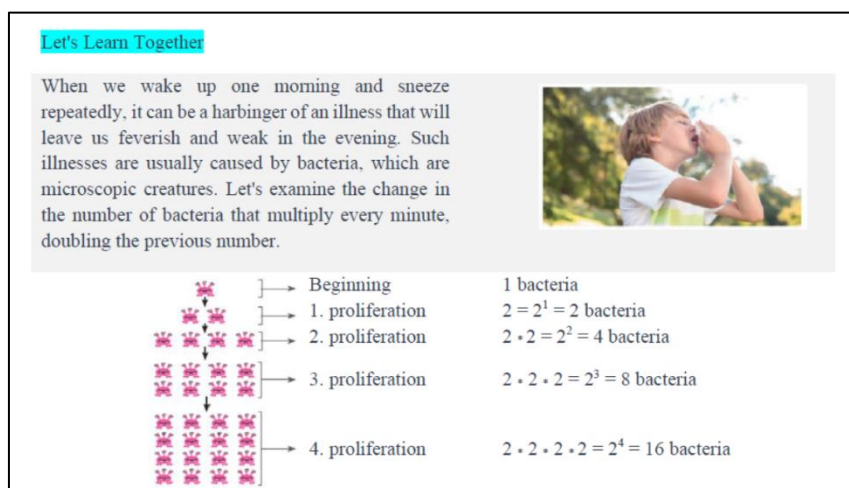| Book Code	5KA	5KB	6KA	6KB	7KA	7KB	8KA	8KB
Science	75%	16,6%	66,6%	80%	83,3%	50%	100%	25%

Figure 1. An example of the connection between "mathematics and science"

5KA coded textbook, 16.6% of the achievements in the 5KB coded textbook, in 66.6% of the achievements in the 6KA coded textbook, 80% of the achievements in the 7KA coded textbook, 83.3% of the achievements in the 7KB coded textbook, 50% of the achievements in the 7KB coded textbook, 100% of the achievements in the 8KA coded textbook, 25% of the achievements in the 8KB coded textbook included examples related to science. In addition, it is an important finding that the achievements in the books include at least one example containing the "mathematics - science" connection (Figure 1).

Findings related to the second sub-problem

Table 3 shows the findings and comments regarding the second sub-problem of the research, to what extent examples of the "mathematics - social sciences" connection are included in middle school mathematics textbooks. When Table 3 is examined, it is seen that 91.6% of the achievements in the 5KA coded textbook, 41.6% of the achievements in the 5KB coded textbook, 80% of the achievements in the 6KA coded textbook, 66.6% of the achievements achievements in the 6KB coded textbook, 83.3% of the achievements in the 7KA coded textbook, 66.6% of the achievements in the 7KB coded textbook, 100% of the achievements in the 8KA coded textbook, 50% of the achievements in the 8KB coded textbook include examples related to social sciences. In addition, it is an important finding that the achievements in the books include at least one example containing the "mathematics - social sciences" connection (Figure 2).

Findings related to the third sub-problem

Table 4 shows the findings and comments regarding the third sub-problem of the research, the extent to which examples of the "mathematics - art" connection are included in middle school mathematics textbooks. When Table 4 is examined, 33.3% of the achievements in the 5KA coded textbook, 16.6% of the achievements in the 5KB coded textbook, 33.3% of the achievements in the 6KA coded textbook, 6.6% of the achievements in the 6KB coded textbook, 33.3% of the achievements in the 7KA coded textbook, 16.6% of the achievements in the 7KB coded textbook, 33.3% of the achievements in the 8KA coded textbook, 8.33% of the achievements in the 8KB coded
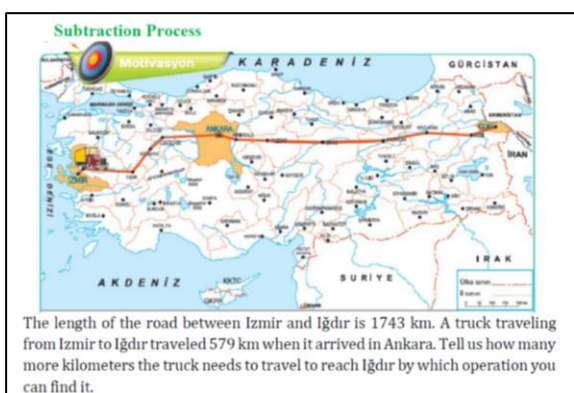
Table 3
Findings on the connection between competencies in mathematics textbooks and social sciences

Book Code	5KA	5KB	6KA	6KB	7KA	7KB	8KA	8KB
Social Sciences	%91,6	%41,6	%80	%66,6	%83,3	%66,6	%100	%50

Table 4
Findings on the connection between competencies in mathematics textbooks and art

Book Code	5KA	5KB	6KA	6KB	7KA	7KB	8KA	8KB
Art	%33,3	%16,6	%33,3	%6,6	%33,3	%16,6	%33,3	%8,33

Figure 2. An example of the connection between "mathematics and social sciences"
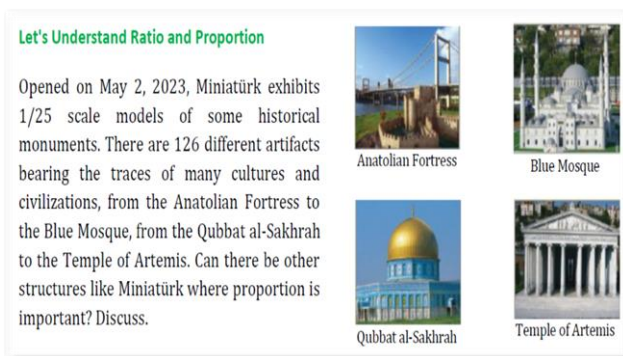
Figure 3. An example of the connection between "mathematics and art"

textbook include art-related examples. In addition, it is an important finding that the achievements in the books include at least one example involving the "mathematics - art" connection (Figure 3).

Findings related to the fourth sub-problem

Table 5 shows the findings and comments regarding the fourth sub-problem of the research, the extent to which examples of the "mathematics - nature" connection are included in middle school mathematics textbooks. When Table 5 is examined, 50% of the achievements in the 5KA coded textbook, 16.6% of the of the achievements in the 5KB coded textbook, 40% of the of the achievements in the 6KA coded textbook, 26.6% of the of the achievements in the 6KB coded textbook, 50% of the achievements in the 7KA coded textbook, 41.6% of the of the achievements in the 7KB coded textbook, 41.6% of the of the achievements in the 8KA coded textbook, 16.6% of the achievements in the 8KB coded textbook included examples related to nature. In addition, it is an important finding that the achievements in the books include at least one example involving the "mathematics - nature" connection (Figure 4).

Findings related to the fifth sub-problem

Table 6 shows the findings and comments regarding the fifth sub-problem of the research, the extent to which examples of the "mathematics - daily life" connection are included in middle school mathematics textbooks. When Table 6 is examined, it is seen that in 75% of the achievements in the 5KA coded textbook, 16.6% of the achievements in the 5KB coded textbook, 66.6% of the
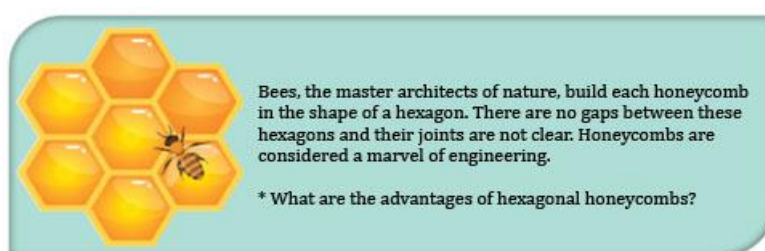
Table 5
Findings on the connection between competencies in mathematics textbooks and nature

Book Code	5KA	5KB	6KA	6KB	7KA	7KB	8KA	8KB
Nature	%50	%16,6	%40	%26,6	%50	%41,6	%41,6	%16,6

Table 6
Findings on the connection between competencies in mathematics textbooks and daily life

Book Code	5KA	5KB	6KA	6KB	7KA	7KB	8KA	8KB
Daily Life	%100	%100	%100	%100	%100	%91,6	%100	%100

Bees, the master architects of nature, build each honeycomb in the shape of a hexagon. There are no gaps between these hexagons and their joints are not clear. Honeycombs are considered a marvel of engineering.

* What are the advantages of hexagonal honeycombs?

Figure 4. An example of the connection between "mathematics and nature" contained in textbooks

Possible States of an Event

Ms. Melek bought 3 boxes of banana milk and 4 boxes of plain milk from the market. He put the cartons of milk in a cloth bag instead of a plastic bag. Ms. Melek will pick a box of milk at random from the bag to give one of the milks she bought to her daughter Aslı. Tell me which is more likely that the box of milk to be taken from the bag will be banana or plain.

In our daily lives, we use expressions such as "It may rain today.", "We will win the national football match tonight.", "The plane will leave on time." for situations whose outcome we are not certain about. We study the consequences of statements like this in the probability part of mathematics.

Figure 5. An example of the connection between "mathematics and daily life" contained in textbooks

achievements in the 6KA coded textbook, 80% of the achievements in the 6KB coded textbook, 83.3% of the achievements in the 7KA coded textbook, 50% of the achievements in the 7KB coded textbook, 100% of the achievements in the 8KA coded textbook, 25% of the achievements in the 8KB coded textbook included examples related to daily life. In addition, it is an important finding that the achievements in the books include at least one example involving the "mathematics - daily life" connection (Figure 5).

DISCUSSION

In this section, the two main questions of the study, "to what extent are the themes of mathematics-science and mathematics-nature reflected in the textbooks?" will be discussed critically in this section in the light of the findings of the study and in comparison with other studies in the literature.

In Turkey, when science is mentioned, natural sciences come to mind first and social sciences are ignored (İnce, 2019). On the other hand, within the scope of this study, the "Science" theme was not limited to natural sciences, and the extent to which the "Science, Social Sciences, and Arts" fields of study are related to mathematics was examined in eight textbooks approved by the Ministry of National Education. First of all, when the findings obtained in terms of mathematics-science connection levels are examined, it was observed that the lowest and highest connection levels were observed in the 5KB coded textbook (16.6%) and 8KA coded textbook (100%), respectively. When the 5th grade textbooks are evaluated in terms of their level of mathematics-science connections, there is a high rate of difference between the textbooks. While this rate was 75% in the 5KA coded textbook, it was 16.6% in the 5KB coded textbook. The reason for this high level of difference may be that the 5KB coded textbook focuses on intensive procedural teaching, while the 5KA coded textbook was prepared in line with the curriculum and taking into account the importance of connections with other disciplines (Arslan & Özpınar, 2009; Erbaş et al., 2014; Turna & Bolat, 2015; Özgeldi & Osmanoğlu, 2017; Özgen, 2019), which is widely emphasized in the literature. Similarly, a high rate of difference is observed in the 8th grade textbooks. In the 8KA coded textbook, there is a 100% level of mathematics-science connection, while in the 8KB coded textbook this rate is 25%. For this reason, it can be thought that the content of the 8KA coded textbook was prepared in line with the curriculum and by taking into account the importance of connections with other disciplines, which are widely emphasized in the literature. It can be thought that the proportionally high level of interdisciplinary connections in the 8KA coded textbook is due to the fact that middle school mathematics and science achievements are addressed from a holistic perspective and the increase in course content from the 5th to the 8th grades is also effective. It can be thought that the reason why the mathematics-science connection level is low in the 8KB coded textbook is that the focus is on examples of intensive operational practice for exams during the preparation of the book. It is noteworthy that the level of connection between mathematics and science in the 6th and 7th grade textbooks is 50% and above. The level of connection between mathematics and science, which is 66.6% in the 6KA coded textbook, is 80% in the 6KB coded textbook, 83.3% in the 7KA coded textbook and 50% in the 7KB coded textbook. Generally, while it is more likely for Mathematics to be correlated with the natural sciences in 6th and 7th-grade textbooks, only one study has been found in the literature that investigates this situation. Yeniterzi and Işıksal-Bostan's (2015) study titled "Examination of the connection between Mathematics and Science Lessons in the 7th Grade Mathematics Teacher's Guidebook" revealed that in the 7th-grade mathematics textbook, 47 concepts related to the natural sciences were identified, and it was found that 60% of these concepts contained information related to science. This indicates a similarity between our research findings and the findings of Yeniterzi and Işıksal-Bostan's study.

When examining the findings regarding the level of connection between mathematics and social sciences in textbooks, similar to the results related to natural sciences, it is observed that the lowest and highest levels of correlation are respectively in 5KB coded textbook (41.6%) and 8KA coded textbook (100%). When 5th-grade textbooks are evaluated among themselves in terms of the level of correlation between mathematics and social sciences, similar to what is observed in natural sciences, there is a significant difference, with high levels of variation. The reason for the significant difference in 5th-grade textbooks can be attributed to the intensive focus on procedural teaching in the preparation of the 5KB coded textbook, while the 5KA coded textbook is thought to have been prepared by taking into consideration the importance of connections with other disciplines emphasized in the curriculum and the literature (Arslan & Özpınar, 2009; Erbaş et al., 2014; Turna & Bolat, 2015; Özgeldi & Osmanoğlu, 2017; Özgen, 2019). Similar to the 5th grade textbooks, there are high differences in terms of mathematics-social science connection levels in the 8th grade textbooks. It is seen that the connection level, which is 100% in the 8KA coded textbook, remains at 50% in the 8KB coded textbook. Based on this, it can be evaluated that the content of the 8KA textbook was

prepared in line with the curriculum and by taking into account the importance of connections with other disciplines, which are widely emphasized in the literature. It can be thought that the emergence of a 100% intensive connection level in the 8KA coded textbook is effective in considering middle school mathematics and social science achievements from a holistic perspective and increasing the course content from the 5th grade to the 8th grade.

It can be thought that the reason why the level of connection is lower in the 8KB coded textbook is that the focus is on examples of intensive operational practice for the exam during the preparation of the book. The difference between connection levels in 6th and 7th grade textbooks is quite small. The mathematics-social science connection level, which is 80% in the 6KA coded textbook, is 66.6% in the 6KB coded textbook, 83.3% in the 7KA coded textbook and 66.6% in the 7KB coded textbook. In general, the level of mathematics-social science connection in 6th and 7th grade textbooks is 66.6% and above and can be said to be sufficient. It is noticeable that in mathematics textbooks, connections of mathematics with social sciences are made mostly by making use of the history of mathematics. Although there is no study in the literature directly on the connection between Mathematics and Social Sciences, there are studies on the use of history of mathematics in mathematics textbooks. Baki and Tümer (2013) "Use of History of Mathematics in 6th, 7th and 8th Grade Mathematics Textbooks", Erdoğan et al. (2015) "The Place of Mathematics History in Middle School Mathematics Textbooks: An Ecological Analysis", Mersin and Durmuş's (2018) "Use of Mathematics History in Middle School Mathematics Courses". When we look at their study titled "The Place in Your Books", it can be seen that the history of mathematics is generally not included sufficiently in the textbooks. In addition, the common point identified both in the research findings in the literature and in our own study is; the sections on the history of mathematics included in the textbooks are mostly included at the beginning of the unit and are intended to attract and motivate students' attention, rather than directing them to higher-level thinking skills.

When we look at the findings regarding the extent to which the field of art, which is the last topic discussed within the science theme, is included in mathematics textbooks, we encounter connections with a rate of 33.3% and below. While the lowest connection level is in the 6KB coded textbook with a rate of 6.6%, the highest rate is seen in the 5KA, 6KA, 7KA and 8KA coded textbooks with 33.3%. A very low level of connection is found in the 8KB coded textbook, with a rate of 8.33%, similar to the 6KB coded textbook. Similarly, low level connections are seen in 5KB and 7KB coded textbooks with a rate of 16.6%. Although there are numerous topics that can be related between the subfields of art such as music, painting, architecture, sculpture, and mathematics, it is observed that these subjects are given very little space in mathematics textbooks. The reason for the minimal coverage of the connection between mathematics and art in mathematics textbooks may be due to a bias suggesting that mathematics and art are two separate and distant fields. Although there are many studies in the literature examining the connection between mathematics and art, no direct study investigating the extent of the connection between mathematics and art in mathematics textbooks has been encountered. In his work titled "A Fundamental Point Where Science and Art Intersect: The connection between Mathematics and Music," Bora (2002) emphasizes the interconnectedness of mathematics and music by providing numerous examples related to the connection between mathematics and music. Koçak et al. (2014), in their study titled "Aesthetics and Mathematics," emphasize that the beauty of nature and the aesthetics of art can be expressed through mathematical concepts. While Doğan (2019) in his study "Utilizing Visual Arts in Geometry Achievements in Primary School Mathematics Topics" expresses the view that mathematics and art are seen as two separate fields, he also notes that mathematics is present within many themes used by artists. In his work titled "Mathematics as the Field of Fine Arts," Cereci (2012) mentions the idea that the philosophy of mathematics and the understanding of the universe form the basis of all art disciplines, stating that both disciplines reinterpret and convey nature. Duru and İşleyen (2005) state in their study "Mathematics and Art" that mathematics is not solely composed of abstract concepts and that mathematics has aspects related to other fields such as art.

When examining the findings related to the inclusion of the mathematics-nature connection in mathematics textbooks, which is another focus of our study, we encounter low connection levels similar to the field of art. The lowest connection level is observed at 16.6% in the 5KB and 8KB coded

textbooks, while the highest connection level is 50% in the 5KA and 7KA coded textbooks. The 6KA coded textbook has a connection of 40%, and the 8KA and 7KB coded textbooks have closely similar connection rates of 41.6%. On the other hand, the 6KB coded textbook stands out with a low connection of 26.6%. Despite the existence of patterns in plants, the number of branches, movements of living beings, body structure, geometry of nature, ratios in nature, and many other connection related to the mathematics-nature connection, it is observed that there are very few connections in mathematics textbooks. Regarding the mathematics-nature connection, despite the presence of patterns in plants, the number of branches, movements of living beings, body structure, geometry of nature, ratios in nature, and many other connections, mathematics textbooks have very few connections related to this mathematics-nature connection. The reason for not allocating enough content in mathematics textbooks that encompasses the mathematics-nature connection might be the belief that, due to the abstract nature of mathematics, there cannot be physical reflections of mathematics in nature, and mathematics and nature are considered as two different fields. Although no direct study has been found in the literature regarding the extent to which mathematics-nature connection is covered in mathematics textbooks, it is observed that there are many studies in the literature examining the connection between mathematics and nature. In his work titled "Discussions on Logarithmic Connection Found in Our Nature," Tanyer (2016) provides examples of how the mathematical language (logarithm) is used to understand nature. Karakuş (2010), in his study "Introduction to Fractal Geometry with Fractal Card Activity," introduces students to fractal structures known as the geometry of nature, allowing students to create their own fractal structures and increase their awareness. Ayran and Aydın (2017), in their study "Mathematics and Nature," emphasize the importance of the connection between mathematics and nature by providing examples of the golden ratio and Fibonacci numbers encountered in nature. Arslan-Selçuk et al. (2009), in their study "Designing with the Golden Ratio: Φ Sequence in Nature, Architecture, and Structural Design," highlight the significant role of mathematics in nature, art, and architecture by giving examples related to the golden ratio.

When examining the findings related to the inclusion of the connection between mathematics and everyday life in textbooks, it is noticeable that these intensive connections are indeed present in the textbooks. In the context of everyday life, a significant level of connection is observed in the 7KB coded textbook, reaching 91.6%, and in other textbooks, a 100% connection level is achieved. This strong connection is attributed to the effective consideration of the curriculum and the requirements of the era during the preparation of textbooks. Furthermore, it can be stated that the omnipresence of mathematics in our daily lives, such as in shopping, holidays, meals, and games, contributes to the high level of these connections in textbooks. In the literature, there are numerous studies focusing on the connection between mathematics and everyday life. These studies generally encompass teacher and student perspectives on integrating mathematics into daily life. In the specific context of textbooks, it is found that there are similar findings indicating sufficient connections between mathematics and everyday life in the studies that investigate the integration of mathematics with daily life in mathematics textbooks. Konak's (2018) study titled "Examination of LYS Mathematics Questions and 11th-12th Grade Mathematics Textbooks in Terms of Language and Content" revealed that fundamental concepts related to topics were the most frequently used words in the units. Additionally, it was concluded that there was sufficient inclusion of words used in daily life in stories and example applications. Izmirilig's (2008) study, "Evaluation of Primary School Mathematics Textbooks and Student Workbooks from a Structuralist Perspective," found that the content included in textbooks was prepared in the context of daily life but lacked adequate instructional methods aligned with a structuralist perspective for students. In the study by Yeniterzi and Işıksal-Bostan (2015) titled "Examination of the 7th Grade Mathematics Teacher Guidebook in Terms of Integrating Mathematics and Science Lessons," it was found that 60% of the identified science concepts in the examined textbook were related to science and technology, while 40% included daily life examples related to mathematics. Özgeldi and Osmanoğlu's (2017) study, "Integration of Mathematics with Real Life: An Examination of Middle School Mathematics Teacher Candidates' Methods of Integration," emphasized the importance of the connection between mathematics and daily life. In Cankoy's (2002) study, "Views on Mathematics and Daily Life Course," it was expressed that there is

a need for a course on "Mathematics and Daily Life." Yenilmez and Uysal's (2007) study, "The Level of Elementary School Students' Ability to Relate Mathematical Concepts and Symbols to Daily Life," showed differences among students in terms of class level, mathematics achievement, and their ability to connect mathematics to daily life. Ilgar & Çağırgan-Gülten's (2013) study, "The Necessity and Importance of Teaching the Use of Mathematical Topics in Daily Life to Students," emphasized the importance of providing sufficient coverage of the connection between mathematics and daily life in mathematics textbooks and the need for books related to this integration. In the study by Ardıç et al. (2019) titled "The Level of Fourth Grade Students in Rural Areas in Relating Geometric Concepts to Daily Life," the importance of relating mathematics to daily life was discussed, and students' ability to relate geometric concepts to daily life was examined based on criteria such as gender, pre-school education, and mathematics achievement.

CONCLUSIONS

Considering the findings obtained within the scope of the research, it was seen that associations with daily life were intensively included in mathematics textbooks, and it was concluded that associations with science and social sciences were partially sufficient, but the relationship between mathematics and the fields of nature and art was included very little. In addition, it was concluded that the connections included in the textbooks remained superficial connections rather than connections that directed students to higher-level thinking skills. As a result of the study conducted within the scope of the research, it is seen that procedural teaching is predominantly included in mathematics textbooks. Although mathematics education experts in the literature have repeatedly mentioned that mathematics can be learned meaningfully by associating it with daily life, its contributions to humanity and science, its reflections from nature and its historical story, and that mathematics can be learned meaningfully, it was observed that the textbooks we examined were written from a more formalist perspective. Students' questions like "Why do we learn this mathematics?" or "Where does it appear?" It was concluded that it could not adequately answer the questions. As a result of the study, it is seen that there are still some deficiencies in the preparation of textbooks based on the constructivist approach, and at the same time, it is seen that there are commercial concerns about the examination system.

In conclusion; Associating mathematics with daily life, science, nature and art in schools, explaining its contributions to humanity, cultural ties and telling its historical story will positively affect students' mathematical thoughts and enable students to learn mathematics more meaningfully. If we cannot introduce students to science, nature, art and real problems in this life in mathematics textbooks while providing mathematics education, we will continue to raise people who cannot see the background of the problems with the current education system and do not know what the purpose of the problem they solve is.

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AUTHOR'S DECLARATION

BIBLIOGRAPHY

Ardıç, F., Şengür, S., & Yenilmez, K. (2019). Kırsal bölgede öğrenim gören dördüncü sınıf öğrencilerinin geometrik kavramları günlük hayatla ilişkilendirme düzeyleri. Eskişehir Osmangazi Üniversitesi Türk Dünyası Uygulama ve Araştırma Merkezi (ESTÜDAM) Eğitim Dergisi (ESTUDAM Journal of Education), 4(2), 22-37.

Arslan Selçuk, S., Gönenç Sorguç, A., & Er Akan, A. (2009). Altın oranla tasarlamak: doğada, mimarlıkta ve yapısal tasarımda φ dizini. Trakya Univ J Sci, 10(2), 149-157.

Arslan, S., & Özpınar, İ. (2009). Yeni ilköğretim 6. sınıf matematik ders kitaplarının öğretim programına uygunluğunun incelenmesi. Çukurova Üniversitesi Eğitim Fakültesi Dergisi, 3(36), 26-38.

ASA. (2023, 12 1). Mathematics and Statistics Awareness Month. Diambil kembali dari American Statistical Association: https://ww2.amstat.org/mam/2022/index.html

Ayhan, G. G. (2006). İlköğretim II. kademedeki matematik öğretmenlerinin matematik öğretimiyle ilgili karşılaştıkları sorunlar. [Yüksek lisans tezi, Pamukkale Üniversitesi]. YÖK Tez Merkezi.

Ayran, A., & Aydın, N. (2017). Matematik ve doğa. Journal of Awareness, 2(3), 509-514.

Baki, A. (2020). Matematik tarihi ve felsefesi. Pegem Akademi. https://doi.org/10.14527/9786053649175

Baki, A., & Bütüner, S. Ö. (2013). The ways of using the history of mathematics in 6th, 7th and 8th grade mathematics textbooks. Elementary Education Online, 12(3), 849-872.

Bora, U. (2002). Bilim ve sanatın kesiştiği temel bir nokta: Matematik ve müzik ilişkisi. Uludağ Üniversitesi Eğitim Fakültesi Dergisi(15), 53-68.

Cankoy, O. (2002). Matematik ve günlük yaşam dersi ile ilgili görüşler. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, 2, hal. 939-944.

Cereci, S. (2012). Güzel sanatlar dalı olarak matematik. Batman Üniversitesi Yaşam Bilimleri Dergisi, 2(1), 88-100.

Çelik, H., Başer Baykal, N., & Kılıç Memur, H. (2020). Nitel veri analizi ve temel ilkeleri. Eğitimde Nitel Araştırmalar Dergisi, 379-406. https://doi.org/10.14689/issn.2148-2624.1.8c.1s.16m

Davis, P., Hersh, R., & Marchisotto, E. (2020). Tüm yönleriyle matematiksel deneyim. (S. Durmuş, & İ. Oben Eruçar, Penerj.) Nobel Akademik Yayıncılık.

Doğan, A. (2019). İlkokul matematik konularında geometri kazanımlarında görsel sanatlardan faydalanmak. Dalam M. F. Baran, & A. Eren (Penyunt.), Fen bilimleri ve matematik alanında araştırma ve derlemeler (hal. 5-29). Gece Akademi.

Duru, A., & İşleyen, T. (2005). Matematik ve sanat. Kazım Karabekir Eğitim Fakültesi Dergisi, 1(1), 479-491.

Erbaş, A. K., Çetinkaya, B., Alacacı, C., Kertil, M., Çakıroğlu, E., & Baş, S. (2014). Matematik eğitiminde matematiksel modelleme: Temel kavramlar ve farklı yaklaşımlar. Kuram ve Uygulamada Eğitim Bilimleri, 14(4), 1607-1627. https://doi.org/10.12738/estp.2014.4.2039

Erdoğan, A., Eşmen, E., & Fındık, S. (2015). Ortaokul matematik ders kitaplarında matematik tarihinin yeri: Ekolojik bir analiz. Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 42(42), 239-259. https://doi.org/10.15285/ebd.67242

Ernest, P. (1996). Popularization: Myths, massmedia and modernism. Dalam A. Bishop (Penyunt.), International handbook of research in mathematics education (hal. 785-817). Kluwer Academic Publishers. https://doi.org/10.1007/978-94-009-1465-0_24

Evcim, İ. (2010). İlköğretim 8. sınıf öğrencilerinin epistemolojik inanışlarıyla, fen kazanımlarını günlük yaşamlarında kullanabilme düzeyleri ve akademik başarıları arasındaki ilişki. Marmara Üniversitesi Eğitim Bilimleri Enstitüsü.

Gür, B. (2020). "Matematik belası" üzerine - Matematik felsefesinde köşe taşları. Nesin Yayıncılık.

İlgar, L., & Çağırgan Gülten, D. (2013). Matematik konularının günlük yaşamda kullanımının öğrencilere öğretilmesinin gerekliliği ve önemi. Sosyal Bilimler Dergisi.

İnce, F. (2019). Bilim felsefesinin başlıca sorunlarından biri olan matematik-bilim ilişkisi üzerine. [Yüksek lisans tezi, Maltepe Üniversitesi]. YÖK Tez Merkezi.

İzmirligil, G. (2008). İlköğretim matematik ders ve öğrenci çalışma kitaplarının yapısalcı yaklaşım açısından değerlendirilmesi. [Yüksek lisans tezi, Dokuz Eylül Üniversitesi]. YÖK Tez Merkezi.

Karakuş, F. (2010). Fraktal kart etkinliğiyle fraktal geometriye giriş. İlköğretim Online, 9(1), 1-6.

Kıral, B. (2020). Nitel bir veri analiz yöntemi olarak doküman analizi. Sosyal Bilimler Enstitüsü Dergisi, 170-189.

Koçak, Z. F., İşler, N., & Paşalı Atmaca, S. (2014). Estetik ve matematik.

Konak, Z. M. (2018). Lys matematik sorularının ve 11-12. sınıf matematik ders kitaplarının dil-içerik açısından incelenmesi. [Yüksek lisans tezi, Hacettepe Üniversitesi]. YÖK Tez Merkezi.

Küçükahmet, L. (Penyunt.). (2011). Konu alanı ders kitabı inceleme kılavuzu. Nobel Akademik Yayıncılık.

MEB. (2005). İlköğretim matematik dersi öğretim programı ve kılavuzu. Milli Eğitim Bakanlığı.

MEB. (2013). Ortaokul ve imam hatip ortaokulu matematik dersi (5-6-7-8.Sınıflar) öğretim programı. Milli Eğitim Bakanlığı.

MEB. (2018). Matematik dersi öğretim programı (ilkokul ve ortaokul 1,2,3,4,5,6,7 ve 8.sınıflar). Milli Eğitim Bakanlığı. Dipetik 3 10, 2022, dari https://mufredat.meb.gov.tr/Programlar.aspx

Mersin, N., & Durmuş, S. (2018). Matematik tarihinin ortaokul matematik ders kitaplarındaki yeri. Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 18(2), 997-1019. https://doi.org/10.17240/aibuefd.2018..-400746

Miles , M., & Huberman, A. (1994). Qualitative data analysis: An expanded sourcebook. Sage Publications.

NCTM. (2000). Principles and standards for school mathematics. National Council of Teachers of Mathematics.

Olkun, S., & Toluk Uçar, Z. (2006). İlköğretimde matematik öğretimine çağdaş yaklaşımlar. Ekinoks.

Özgeldi, M., & Osmanoğlu, A. (2017). Matematiğin gerçek hayatla ilişkilendirilmesi: ortaokul matematik öğretmeni adaylarının nasıl ilişkilendirme kurduklarına yönelik bir inceleme. Türk Bilgisayar ve Matematik Eğitimi Dergisi, 8(3), 438-458. https://doi.org/10.16949/turkbilmat.298081

Özgen, K. (2016). Matematiksel ilişkilendirme üzerine kuramsal bir çalışma. International Conference on Research in Education & Science, (hal. 235-245).

Özgen, K. (2019). Öğretmen adaylarının matematiği farklı disiplinler ile ilişkilendirme etkinlikleri tasarlama becerileri. İnönü Üniversitesi Eğitim Fakültesi Dergisi, 20(1), 101-118. https://doi.org/10.17679/inuefd.363984

Özgen, K., & Bindak, R. (2018). Matematiksel ilişkilendirme öz yeterlik ölçeğinin geliştirilmesi. Kastamonu Education Journal, 26(3), 913-924. https://doi.org/10.24106/kefdergi.413386

Sefa, A. (2009). 7. sınıf ilköğretim matematik ders kitabının; görsel, duyuşsal ve akademik yönden incelenmesi. [Yüksek lisans tezi, Selçuk Üniversitesi]. YÖK Tez Merkezi.

Stewart, I. (2020). Matematiğin kısa tarihi. (S. Sevinç, Penerj.) Alfa- Bilim Yayınları.

Tanyer, S. (2016). Doğamızda bulunan logaritmik ilişkiler ile doğrusallık tanımları üzerine tartışmalar. Bilim ve Ütopya, 2-10.

Turna, Ö., & Bolat, M. (2015). Eğitimde disiplinlerarası yaklaşımın kullanıldığı tezlerin analizi. Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 34(1), 33-55. https://doi.org/10.7822/omuefd.34.1.3

Ünsal, Y., & Güneş, B. (2004). Bir kitap inceleme çalışması örneği olarak MEB Lise 1.Sınıf fizik ders kitabının eleştirel olarak incelenmesi. Türk Eğitim Bilimleri Dergisi, 2(3), 305-321.

Yenilmez, K., & Uysal, E. (2007). İlköğretim öğrencilerinin matematiksel kavram ve sembolleri günlük hayatla ilişkilendirebilme düzeyi. Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 24, (2007) 89-(24), 89-98.

Yeniocak, O. (2019). Matematik nerede? Sokak Yayın Grubu.

Yeniterzi, B., & Işıksal-Bostan, M. (2015). 7. Sınıf matematik öğretmen kılavuz kitabının matematik ve fen derslerinin ilişkilendirilmesi açısından incelenmesi. İlköğretim Online, 14(2), 407-420. https://doi.org/10.17051/io.2015.31557