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| Research Article / Araştırma Makalesi|

Comparative Analysis of the 2018 and 2024 Science Curricula about Environmental Topics Based on Bloom's Taxonomy

2018 ve 2024 Fen Bilimleri Dersi Öğretim Programlarının Çevre Konuları Bağlamında BLOOM Taksonomisine Göre Karşılaştırmalı İncelenmesi[1]

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Keywords
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Anahtar Kelimeler
Fen eğitimi
2018 yılı Fen Bilimleri öğretim programı
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Abstract

Purpose: The aim of this study is to comparatively examine the science curricula of 2018 science course and The Century of Türkiye Education Model's science course according to Bloom's taxonomy in the context of environmental issues.

Design/Methodology/Approach: In the study, the document analysis method, which is one of the qualitative research data collection methods, was used. In the process of selecting the Science curricula published in 2018 and 2024 to be compared in the study, the Science Curricula approved by the Board of Education was taken as the data source. The data were analysed using the content analysis method.

*Findings: T*here were a total of 30 learning outcomes in the context of environmental issues in the 2018 science curriculum and a total of 61 learning outcomes in the 2024 science curriculum. In the 2024 science curriculum, it was noteworthy that the number of learning outcomes increased and learning outcomes were also included in the recall and evaluation stages. It is very important that the objectives in the "environment" subjects, especially in the application, analysis and evaluation stages, are more than the 2018 curriculum in order for individuals to transform their knowledge into behavior.

Öz

Çalışmanın amacı: Bu araştırmanın amacı 2018 yılı fen bilimleri dersi ve 2024 yılı Türkiye yüzyılı maarif modeli fen bilimleri dersi öğretim programlarının çevre konuları bağlamında Bloom taksonomisine göre karşılaştırmalı olarak incelenmesidir.

Materyal ve Yöntem: Araştırmada, nitel araştırma veri toplama yöntemlerinden biri olan doküman inceleme yöntemine başvurulmuştur. Veriler içerik analizi yöntemi kullanılarak analiz edilmiştir. 2018 ve 2024 yıllarında yayımlanan Fen Bilimleri dersi öğretim programları karşılaştırılarak değerlendirilmiştir.

Bulgular: 2018 yılı fen bilimleri dersi öğretim programında çevre konuları bağlamında toplam 30 kazanım, 2024 yılı fen bilimleri dersi öğretim programında toplam 61 kazanım olduğu tespit edilmiştir. 2024 yılı fen bilimleri dersi öğretim programında kazanım sayısının arttığı ve hatırlama ile değerlendirme basamaklarında da kazanımlara yer verildiği dikkat çelmiştir. "Çevre" konularında özellikle uygulama, analiz etme ve değerlendirme basamaklarındaki kazanımların 2018 yılı programına göre daha fazla olması bireylerdeki bilgilerin davranışa dönüşebilmesi için oldukça önemlidir.

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INTRODUCTION

Science education plays an important role in developing students' knowledge and skills about environmental issues. Curricula are the main tools that determine the scope and depth of the knowledge and skills that students should acquire in this process. In this context, science curricula have a critical importance in terms of how they address environmental issues and which cognitive objectives they focus on. The science curriculum is constantly updated in accordance with the needs of the age. While the curriculum creates a tendency towards scientific thinking in students, it also brings qualities such as gaining environmental awareness and using various disciplines together.

The 2024 Century of Türkiye Education Model is based on a holistic approach and aims to develop students in all aspects. It supports the multifaceted development of students in the context of frameworks such as skills framework, system literacy, and virtue-value-action model. The model aims to address the mental, emotional, physical, social and spiritual development of the student in a holistic manner by putting the human at the centre of education. In this model, one of the basic principles is to enable students to discover themselves and reveal their potential. For this purpose, flexible and free learning environments are created by considering the interests, needs and abilities of each student. With a student-centred and rights-based approach, an educational approach that encourages individuals to actively participate in learning processes is targeted. The Century of Türkiye Education Model has been shaped in line with the basic principles and objectives of the National Education Basic Law No. 1739. Curricula are structured in a complementary manner at preschool, primary and secondary education levels, and enable students to acquire basic level skills and competencies and prepare them for a profession, higher education and life in line with their interests and abilities (MoNE, 2024a).

The human-centred education approach, which is the basic philosophy of The Century of Türkiye Education Model, is also brought to the forefront in the Science Curriculum. This curriculum aims to raise well-equipped individuals of the future by focusing on individual responsibility, social-emotional development and the skills required by the age. The focus of the curriculum is to encourage students to become career-conscious in the field of science by developing their high-level thinking ability, scientific process skills, and ethical values. In this direction, the program aims to raise students as individuals who question, think critically, are sensitive to the environment, and exhibit scientific attitudes by encouraging them to active participation, cooperation, group work, and self-regulation. Raising individuals who are aware of the importance of digital transformation and who can adapt to changing technology are also among the main objectives of the program. Considering the range of skills determined by the Turkish Qualifications Framework, the program adopts a science teaching approach that includes 21st-century skills. While aiming for students to understand the nature of science, to comprehend the basic characteristics of scientists and to question the reliability of information sources, an interdisciplinary and transdisciplinary science teaching is planned. At the same time, it aims to raise individuals who are aware of sustainability and use resources efficiently in line with this awareness, who are sensitive to nature, who can create solutions to local and global environmental problems, and who will act with a sense of social responsibility and contribute to the development of the country (MoNE, 2024b).

Science teaching based on sustainability is essential in raising conscious individuals for today's environmental problems and the solution to these problems. Environmental education plays an important role in ensuring environmental awareness, adopting a sustainable lifestyle and approaching environmental problems critically. Environmental education aims to transfer ecological knowledge to students, to develop an attitude towards the environment and to transform this attitude into behavior and environmental awareness (Erten, 2004). Environmental education, which has its origins in the 1960s, has been included in formal education in Türkiye since 1991 (Erol & Gezer, 2006). At the primary level, there are environmental subjects in life science, science and social studies courses (Alım, 2006).

Since 1968, when the curricula were analysed, environmental issues have become increasingly important. When the 1968 Science and Natural Sciences program is examined, it is seen that one of the aims of the curriculum is to enable students to adapt to the environment in which they live and to recognise the environment. In the 1992 Science and Natural Sciences program, the aims of the curriculum include the student's recognition, protection and love of the environment and perceiving the effects of human beings on the environment. In the 2000 Science and Technology curriculum, emphasis was again placed on knowing, loving and protecting the environment and being able to perceive the effects of humans on the environment (Dindar & Taneri, 2011). The aims of the 2005 Science and Technology program were to recognize environmental problems and understand their interactions with the environment (MoNE, 2005) (MoNE, 2005). The 2013 Science and Technology program aims to develop sustainable development awareness, gain knowledge about environmental science, and understand the relationship between humans and the environment (MoNE, 2013). When the 2018 science program was examined, the aims included gaining basic knowledge about environmental sciences, understanding the interaction between humans and the environment, and developing sustainable development awareness (MoNE, 2018).

The objectives and outcomes related to environmental issues in science curricula emphasise the importance of environmental education and aim to provide students with environmental awareness and sustainability consciousness. In this context, Bloom's

Taxonomy can be used to analyse environmental education objectives in a more systematic and structured way. This taxonomy is an effective tool for identifying and progressively analyzing objectives. It is classified into three basic areas: cognitive, affective, and kinaesthetic, and proceeds in a hierarchical order (Bloom, 1956). The cognitive domain, which is the main domain in which the learning outcomes in the curriculum are frequently found, is categorised as knowledge, comprehension, application, analysis, synthesis, and evaluation. The explanation of the cognitive domain stages of Bloom's taxonomy is as follows (Bloom, 1956):

1. Knowledge: Remembering and recognising previously learned information.

2. Comprehension: Not only remembering information, but also interpreting and making sense of it.

3. Application: The ability to use knowledge in different contexts.

4. Analysing: Separating information into its components and establishing a relationship between them.

5. Synthesis: Reorganisation and originalisation of information.

6. Evaluation: Assessing a situation according to a specific purpose and criterion.

While knowledge, comprehension, and application stages are defined as lower-level stages, analysis, synthesis and evaluation stages are defined as higher-level stages. Bloom's Taxonomy is one-dimensional and progresses cumulatively (Bloom, 1956). Bloom's taxonomy was revised by Anderson and Krathwohl (2001). The terminology of Bloom's taxonomy has also been revised. There are two different dimensions in the revised taxonomy. These are knowledge and scientific process. The knowledge dimension includes factual, conceptual, procedural, and metacognitive knowledge dimensions. The stages of the cognitive domain of the taxonomy are remembering, understanding, applying, analysing, evaluating and creating (Anderson & Krathwohl, 2001).

The cognitive domains of the new taxonomy are as follows (Anderson & Krathwohl, 2001, p. 39):

1. Knowledge; remembering and recalling information about the subject through long-term memory.

2. Comprehension; commenting, giving examples, classifying, summarising, making inferences, making explanations and formatting the information presented in words, writing or figures.

3. Application; being able to use or reveal operations by making and applying.

4. Analysing; analysing the data by breaking them down, determining the relationships of all parts with each other and the whole they form.

5. Synthesis; examining the data in general terms within the framework of certain criteria and making judgements based on the criteria.

6. Evaluation; forming a functional and harmonious structure by combining elements; creating a new system or structure through the processes of planning, producing and creating.

In the revised Bloom's Taxonomy, the cognitive domain becomes more dynamic. The "synthesis" stage was renamed as "creation" and became the highest stage of the cognitive domain. Thanks to this taxonomy, teaching strategies that focus on higher level thinking skills are focused. Students' critical thinking and problem-solving skills are strengthened, and the learning process becomes more meaningful (Krathwohl, 2002). In multidisciplinary fields, it enables not only the recognition of the factors related to the relevant subject but also the evaluation of the factors (Forehand, 2010).

Examining the curricula within the framework of the structural model provided by the Revised Bloom's taxonomy enables the enrichment and evaluation of the content of education and training both theoretically and practically. The revised Bloom's Taxonomy has two dimensions. In the horizontal dimension, knowledge, comprehension and synthesis stages in the old taxonomy were renamed and synthesis and evaluation stages were replaced. Conceptual, procedural, and factual knowledge types are included in the vertical dimension, and metacognitive knowledge types are added (Bümen, 2006).

A comparative analysis of the 2018 Science Curriculum and The 2024 Century of Türkiye Education Model Science Curriculum in the context of environmental issues can provide an understanding of which cognitive objectives are prioritised within the framework of Bloom's Taxonomy. In this direction, the capacity of the curricula to create environmental sensitivity and awareness can be evaluated and the effect of the curricula on raising sustainability awareness can be analysed. In addition, a comparative analysis of curricula can provide a perspective on how a transformation and change have taken place in environmental education and contribute to the guidance of future educational policies by taking into account today's changing world conditions.

Purpose of the Study

The aim of this study is to comparatively examine the science curricula of 2018 science course and the 2024 Century of Türkiye Education Model science course curricula according to Bloom's taxonomy in the context of environmental issues. In line with the main purpose of the research, answers to the following questions were sought:

1. How is the 2018 science curriculum distributed regarding the cognitive domains of Bloom's taxonomy in the context of environmental issues?

2. How is the distribution of the 2024 Century of Türkiye Education Model science curriculum in terms of the cognitive domains of Bloom's taxonomy in the context of environmental issues?

3. What is the comparative distribution of 2018 and 2024 science curricula in terms of cognitive domains of Bloom's taxonomy in the context of environmental issues?

METHOD/MATERIALS

In this section, information about the research model, data collection process, data analysis and validity and reliability of the study are presented.

Research Model

This study employs the document analysis method, which is a qualitative research data collection method. The document analysis method enables the researcher to access the data directly through documents without observation or interviews (Yıldırım & Şimşek, 2008). The stages followed within the scope of this method are as follows:

1. Documents suitable for the purpose of the research were obtained through the Presidency of the Board of Education.
2. Each curriculum was examined in detail and its originality was evaluated.
3. After the review, quotations were made from the necessary sections.
4. The collected data were analysed by content analysis method and evaluation procedures were carried out.
5. As a result, data were used (Çepni, 2018; Yıldırım & Şimşek, 2008).

Data Collection Tools

In document analysis, it is important that the documents used as data collection tools provide reliable and accurate information. Therefore, it is critical to refer to primary sources as much as possible (Creswell & Clark, 2017). Accordingly, in the research process, science curricula were used as primary data sources by collecting and examining written and visual materials. In the study, a comparison was made between the 2018 and 2024 Science curricula according to the revised Bloom's taxonomy. The selection of these programs was based on the Science Curricula approved by the Board of Education.

Figure 1. 2018 and 2024 Science Curricula

Analysing the Data

Data analysis was performed using the content analysis method. Content analysis involves creating certain codes and themes by looking for similarities in the data. These themes are then organised and interpreted in a meaningful way (Creswell, 2012). The content analysis process includes the following stages:

1. Identification of codes,
2. Creating themes by grouping similar codes,
3. Organisation of codes and themes,
4. Validity and reliability studies and calculation of frequencies,
5. Describing and interpreting findings (Denzin & Lincoln, 2005).

In this study, the cognition dimension of Bloom's taxonomy, which was renewed on the basis of "environment" topics in the content analysis process, was determined as the analysis criterion. The findings of the content analysis in the programs are presented in the form of tables. The researchers examined each program separately and created detailed tables according to Bloom's taxonomy cognition stages on the basis of "environment" topics. Inter-rater reliability calculation was performed for each stage, using the reliability = consensus / (consensus + disagreement) formula (Miles & Huberman, 1994). The reliability coefficient for the themes created by the two researchers was .89. The coders reached a consensus. Since this result shows that the reliability of the cognition stages of the revised Bloom's taxonomy is greater than .70, it is accepted to have high reliability (Yıldırım & Şimşek, 2008).

Validity and Reliability of the Study

The validity and reliability of this study were evaluated in detail. When evaluating validity, it is important to comprehensively address all aspects of the subject under investigation and to ensure data diversity (Yıldırım & Şimşek, 2018). In this study, primary data sources were accessed. The fact that the documents provide reliable and accurate information, and that they refer to primary sources as much as possible and verify the necessary points with the support of field experts played an important role in ensuring validity. In addition, the researchers presented the findings in detail. It is thought that the research findings can be generalised to similar studies and situations.

In order to ensure the reliability of the research, the researchers analysed the data separately and tried to minimise the differences in coding and categories. The researchers' being educators and their experience in curriculum development made a significant contribution to the conduct of the process, data collection and evaluation. It is thought that the diversity of the study group can provide an idea about the course of the research for those who will conduct similar research. The details of the research process and accessing the primary sources correctly by the researchers elaborated the data analysis process.

FINDINGS

In this section, the findings obtained in this research are presented respectively within the framework of the research questions. In this study, the extent to which the renewed Bloom's taxonomy cognition dimension of the "environment" subject was included in the 2018 and 2024 science (Grades 3-8) curricula.

1. Findings and Comments Related to the 2018 Science Curriculum

How is the 2018 science curriculum distributed regarding the cognitive domains of Bloom's taxonomy in the context of environmental issues? The results of the content analysis obtained for the sub-problem are given in Table 1.

Table 1. Findings on the Classification of the 2018 Science Curriculum "Environmental" Topics According to the Cognitive Domains of the Revised Bloom's Taxonomy

2018 Science Curriculum	Remember		Understand		Apply		Analyse		Evaluate		Create	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Grade 3	-	0	3	10	2	6,66	-	-	-	0	1	3,33
Grade 4	-	0	1	3,33	1	3,33	-	-	-	0	-	-
Grade 5	-	0	3	10	3	10	2	6,66	-	0	-	-
Grade 6	-	0	-	-	-	-	1	3,33	-	0	-	-
Grade 7	-	0	2	6,66	2	6,66	-	-	-	0	1	3,33
Grade 8	-	0	3	10	2	6,66	3	10	-	0	-	-
Total	**-**	**0**	**12**	**40**	**10**	**33,3**	**6**	**20**	**-**	**0**	**2**	**6,66**

When Table 1 was examined, it was determined that there were 30 objectives in the context of environmental issues in the 2018 science curriculum. It was seen that 40% of these outcomes were at the comprehension stage, 33.3% at the application stage, 20% at the analysis stage and 6.6% at the creation stage.

The classification of the 2018 Science Curriculum "Environment" subject according to the cognitive domain of the renewed Bloom's taxonomy is given in Table 2.

Table 2. 2018 Science Curriculum "Environment" Topic Renewed Bloom Findings Related to the Classification of the Cognitive Domain of the Taxonomy According to the Acquisitions

2018 Science Curriculum	Remember	Understand	Apply	Analyse	Evaluate	Create
Grade 3	-	F.3.6.2.1. F.3.6.2.3 F.3.6.2.5.	F.3.6.2.2. F.3.6.2.6.	-	-	F.3.6.2.4.
Grade 4	-	F.4.6.1.2.	F.4.6.1.1.	-		-
Grade 5	-	F.5.6.1.1. F.5.6.2.1. F.5.6.3.1.	F.5.6.2.2. F.5.6.2.3. F.5.6.3.2.	F.5.6.1.2. F.5.6.2.4.	-	-
Grade 6	-			F.6.4.4.2.	-	-
Grade 7	-	F.7.4.5.1. F.7.4.5.3.	F.7.4.5.2. F.7.4.5.4.	-	-	F.7.4.5.5.
Grade 8	-	F.8.6.3.1. F.8.6.3.2. F.8.6.4.3.	F.8.6.4.1. F.8.6.4.2.	F.8.6.3.3. F.8.6.4.4. F.8.6.4.5.	-	-
Total	-	**12**	**10**	**6**	-	**2**

When Table 2 is examined, it is seen that the 30 objectives in the context of environmental issues in the 2018 science curriculum are numbered in detail. There are no learning outcomes in the recall and evaluation stage. The 2018 Science curriculum distribution of the objectives according to the cognitive domain according to the grades is given in Figure 2.

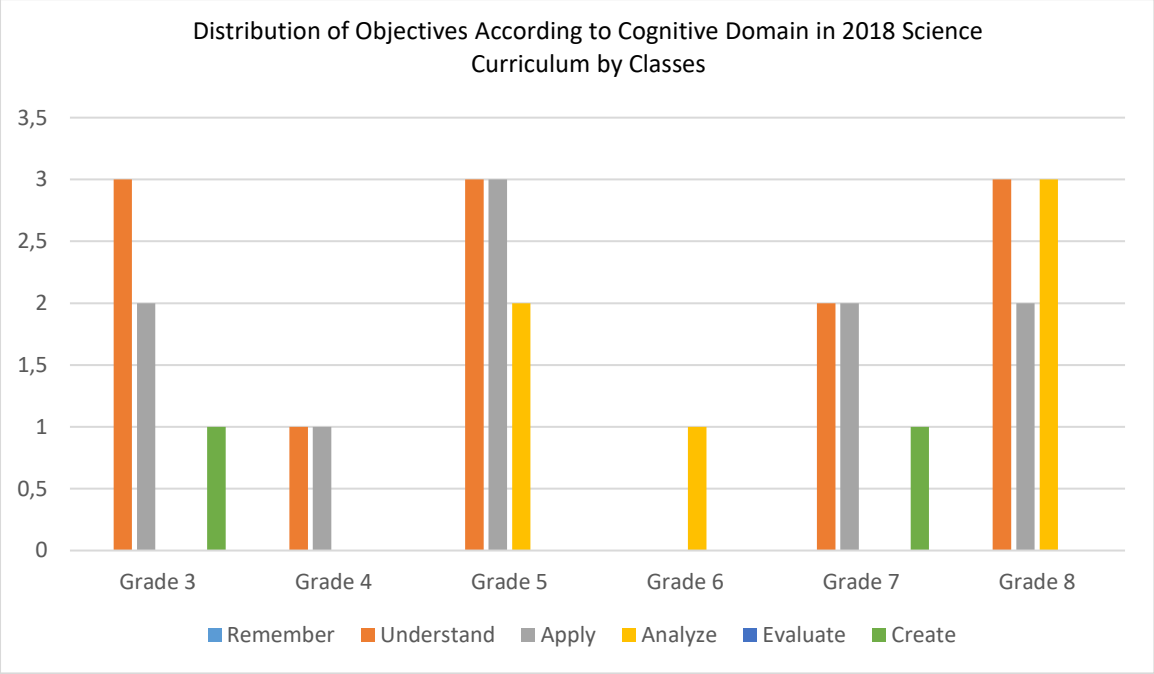

Figure 2. 2018 Science Curriculum Distribution of Outcomes According to Cognitive Domain by Grade

When Figure 2 is analysed, it is seen that there are no objectives at every stage in the cognitive domain at each grade level. In the 2018 Science curriculum, it is noteworthy that there is no objective in the evaluation stage.

2. Findings and Comments Related to the 2024 Science Curriculum

How is the distribution of the 2024 Century of Türkiye Education Model science curriculum in terms of the cognitive domains of the renewed Bloom's taxonomy in the context of environmental issues? The results of the content analysis obtained for the sub-problem are given in Table 3.

Table 3. Findings Related to the Classification of the "Environment" Topic of the 2024 Science Curriculum according to the Cognitive Domain of the Revised Bloom's Taxonomy

2024 Science Curriculum	Remember		Understand		Apply		Analyse		Evaluate		Create	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Grade 3	1	1,64	3	4,92	3	4,92	-	-	-	-	-	-
Grade 4	-	-	1	1,64	2	3,28	1	1,64	2	3,28	-	-
Grade 5	1	1,64	2	3,28	5	8,20	1	1,64	1	1,64	-	-
Grade 6	1	1,64	4	6,56	1	1,64	5	8,20	6	9,84	-	-
Grade 7	-	-	2	3,28	2	3,28	2	3,28	2	3,28	-	-
Grade 8	1	1,64	4	6,56	-	-	3	4,92	5	8,20	-	-
Total	**4**	**6,56**	**16**	**26,24**	**13**	**21,32**	**12**	**19,68**	**16**	**26,24**	**-**	**0**

When Table 3 was examined, it was determined that there were 61 learning outcomes in the context of environmental issues in the 2024 science curriculum. It was determined that 6,56% of these outcomes were in the recall, 26,24% in the comprehension, 21,32% in the application, 19,68% in the analysis, and 26,24% in the evaluation stage. There is no acquisition related to the creation stage. 2024 Science Curriculum "Environment" subject of the renewed Bloom's taxonomy cognitive domain of the renewed Bloom's taxonomy classification according to the objectives is given in Table 4.

Table 4. Findings Related to the Classification of the 2024 Science Curriculum "Environment" Subject According to the Gains in the Cognitive Domain of the Revised Bloom's Taxonomy

2024 Science Curriculum	Remember	Understand	Apply	Analyse	Evaluate	Create
Grade 3	FB.3.7.1.a	FB.3.7.1.c FB.3.7.2.b FB.3.7.2.c	FB.3.7.1.b FB.3.7.2.a FB.3.7.2.ç	-	-	**-**
Grade 4	-	FB.4.8.1.a	FB.4.8.1.b FB.4.8.1.c	FB.4.8.1.ç	FB.4.8.1.d FB.4.8.1.e	**-**
Grade 5	FB.5.7.1.1.a	FB.5.7.1.2.a FB.5.7.1.3.a	FB.5.7.1.1.b FB.5.7.1.1.c FB.5.7.1.1.ç FB.5.7.1.2.b FB.5.7.1.2.c	FB.5.7.1.3.b	FB.5.7.1.3.c	**-**
Grade 6	FB.6.7.1.1.a	FB.6.7.1.1.b FB.6.7.1.2.a FB.6.7.2.2.a FB.6.7.2.2.b	FB.6.7.1.1.c	FB.6.7.1.1.d FB.6.7.1.2.b FB.6.7.1.2.ç FB.6.7.2.1.b FB.6.7.2.2.ç	FB.6.7.1.1.ç FB.6.7.1.2.c FB.6.7.2.1.a FB.6.7.2.1.c FB.6.7.2.2.c FB.6.7.2.2.d	**-**
Grade 7	-	FB.7.7.1.1.b FB.7.7.2.1.a	FB.7.7.2.1.b FB.7.7.2.1.c	FB.7.7.1.1.a FB.7.7.2.1.ç	FB.7.7.2.1.d FB.7.7.2.1.e	**--**
Grade 8	FB.8.7.2.1.a	FB.8.7.2.1.b FB.8.7.2.2.b FB.8.7.2.4.a FB.8.7.2.4.b	-	FB.8.7.2.2.a FB.8.7.2.3.b FB.8.7.2.4.ç	FB.8.7.2.1.c FB.8.7.2.3.a FB.8.7.2.3.c FB.8.7.2.4.c FB.8.7.2.4.d	
Total	**4**	**16**	**13**	**12**	**16**	**0**

When Table 4 is examined, a detailed acquisition numbering of the 61 acquisitions in the context of environmental issues in the 2024 science curriculum is seen. There is no learning outcome in the creation stage. The distribution of 2024 Science Curriculum according to the cognitive domain of the objectives according to the grades is given in Figure 3.

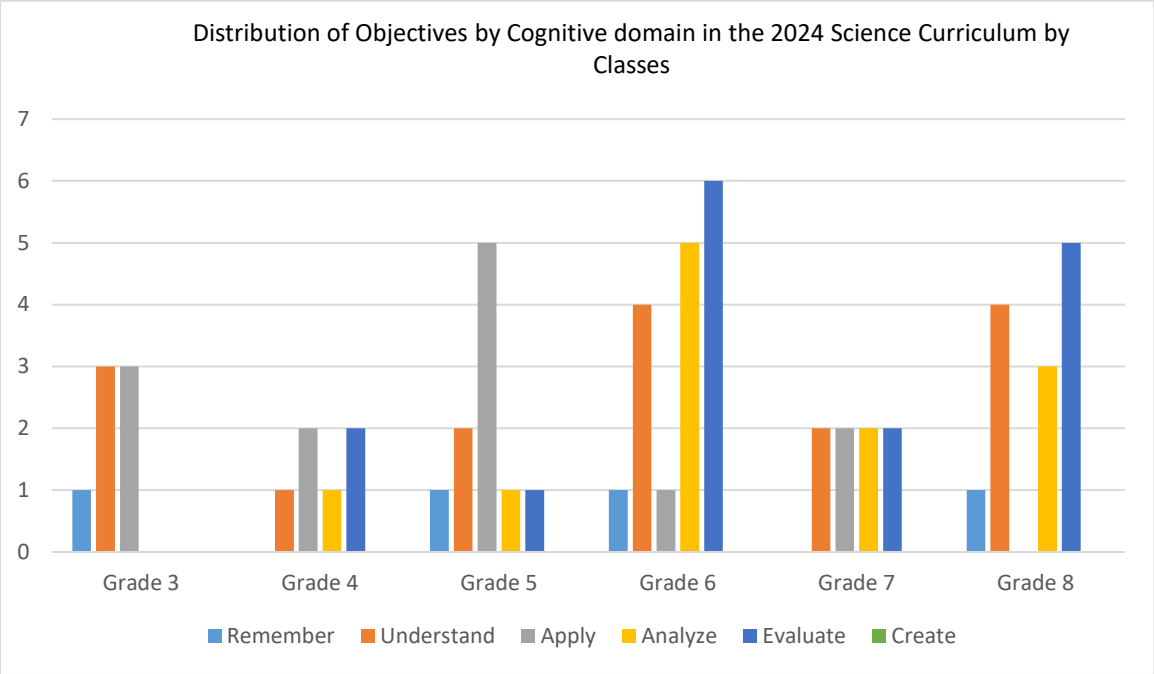

Figure 3. 2024 Science Curriculum Distribution of Outcomes According to Cognitive Domain by Grade

When Figure 3 is analysed, it is seen that there are no objectives at every stage in the cognitive domain at each grade level. In the 2024 Science curriculum, it is noteworthy that there is no outcome in the create stage. It is seen that the outcomes are mostly in the comprehension and evaluation stages.

3. Findings and Comments on 2018 and 2024 Science Curriculum

How do the 2018 and 2024 science curricula compare in terms of the cognitive domain of the revised Bloom's taxonomy in the context of environmental issues? The results of the content analysis obtained for the sub-problem are given in Table 5.

Table 5. Findings Related to the Comparison of 2018 and 2024 Science Curriculum "Environment" Subject According to the Cognitive Domain of the Revised Bloom's Taxonomy

Grade Level	Remember		Understand		Apply		Analyse		Evaluate		Create		Total	
	2018	***2024***	***2018***	***2024***	***2018***	***2024***	***2018***	***2024***	***2018***	***2024***	***2018***	***2024***	***2018***	***2024***
Grade 3	0	1	3	3	2	3	-	-	0	-	1	-	6	7
Grade 4	0	-	1	1	1	2	-	1	0	2	-	-	2	6
Grade 5	0	1	3	2	3	5	2	1	0	1	-	-	8	10
Grade 6	0	1	-	4	-	1	1	5	0	6	-	-	1	18
Grade 7	0	-	2	2	2	2	-	2	0	2	1	-	5	6
Grade 8	0	1	3	4	2	-	3	3	0	5	-	-	8	13
Total	**0**	**4**	**12**	**16**	**10**	**13**	**6**	**12**	**0**	**16**	**2**	**-**	**30**	**61**

When Table 5 is examined, it is seen that the environmental learning outcomes in the 2024 science curriculum are more numerous and at higher levels than the 2018 science curriculum. The distribution of 2018 and 2024 Science curricula outcomes according to the cognitive domain is given in Figure 4.

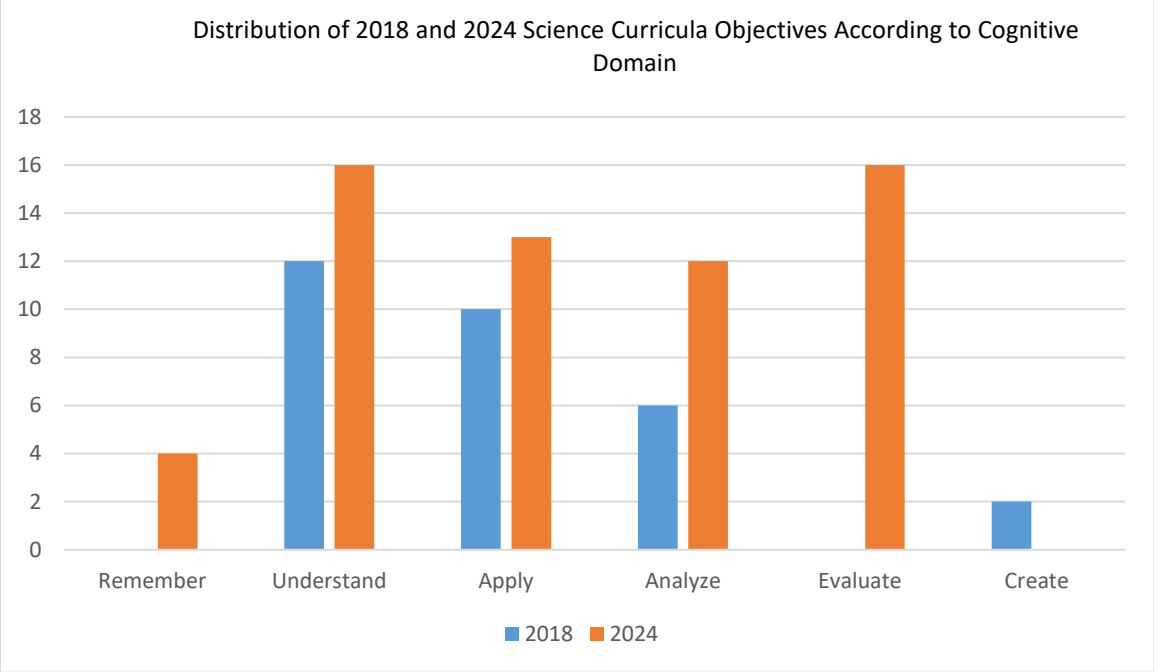

Figure 4. 2018 and 2024 Science Curricula Distribution of Outcomes According to Cognitive Domain

When Figure 4 is examined, it is seen that the learning outcomes in the context of environmental issues are included in the 2018 curriculum with fewer outcomes and in 4 stages (understanding, applying, analysing, creating), while they are included in 5 stages (remembering, understanding, applying, analysing, evaluating) in the 2024 curriculum.

DISCUSSION AND CONCLUSION

In this study, the distribution of the 2018 science curricula and the 2024 Century of Türkiye Education Model science curricula in terms of cognitive process dimensions according to the revised Bloom's taxonomy in the context of environmental issues was examined comparatively.

Discussion and results are organised according to the sub-problems of the research and explained below.

Discussion and Conclusion on the Distributions of the Cognitive Process Dimensions of the Revised Bloom's Taxonomy in the Context of Environmental Subjects of the 2018 Science Curriculum

According to the findings obtained from the study, the distribution of the cognitive domain of the revised Bloom's taxonomy in the context of environmental issues in the 2018 science curriculum was not equal. In the 2018 science curriculum, it was determined that 30 objectives were included in the context of environmental issues. It is seen that 12 of them are in the comprehension stage, 10 in the application stage, 6 in the analysing stage and 2 in the creating stage. It was determined that most objectives were in the comprehension stage. In terms of percentage, 40% of these objectives were found to be in the comprehension stage, 33,3% in the application stage, 20% in the analysis stage and 6,6% in the create stage.

It is noteworthy that the acquisitions involving higher-level thinking skills are quite low. In the curriculum, especially in the "Environment" subjects, it is essential to have more acquisitions at the application and higher levels for individuals to transform their knowledge into behavior. Considering the studies in the literature, it is understood that similar results are obtained. Güngör Cabbar et al. (2020), in their study in which they analysed the environmental acquisitions encountered by students in science and biology courses in 2018 according to the revised Bloom's taxonomy, revealed that the acquisitions were not homogeneously distributed and there were almost no acquisitions in the application stage.

In their study, Erten, Köseoğlu, and Gök (2022) revealed the similarities and differences in the objectives for environmental education at the 5th, 6th, 7th and 8th-grades in the science curricula of Türkiye (2018), Canada (2007) and the State of Nebraska in the United States of America (2011). In Türkiye's 2018 science curriculum, it was determined that the presence of objectives related to environmental education at each grade level was similar to Canada. However, it is also seen that the acquisitions in these subject areas are not in integrity with other acquisitions. According to the results of this research, Turkish Science Curriculum can be considered neither as adequate as Canadian Science Curriculum nor as inadequate as Nebraska. In this context, it is suggested that the Turkish Science Curriculum should be further developed in terms of environmental education.

These results of the study are similar to the results of the studies conducted by Tanrıverdi (2009), Cebesoy and Dönmez-Şahin (2010) in which the environmental issues of the 2005 Science curriculum were examined.

2024 Türkiye's Century of Education Model Discussion and Conclusion on the Distribution of the Cognitive Process Dimensions of the Revised Bloom's Taxonomy in the Context of Environmental Issues in the Science Curriculum

According to the findings obtained from the research, the distribution of the cognitive domain of the renewed Bloom's taxonomy in the context of environmental issues in the 2024 science curriculum was not homogeneous. In the 2024 science curriculum, it was determined that 61 learning outcomes were included in the context of environmental issues. Of these, it is seen that 4 learning outcomes are in the remembering, 16 learning outcomes are in the understanding, 13 learning outcomes are in the application, 12 learning outcomes are in the analysing, and 16 learning outcomes are in the creating stage. It was determined that the most learning outcomes were in the comprehension stage and the least in the creation stage. In the 2024 science curriculum, it was determined that 61 learning outcomes were included in the context of environmental issues. In terms of percentage, it was determined that 6.56% of these outcomes were in the recall, 26.24% in the comprehension, 21.32% in the application, 19.68% in the analysis, and 26.24% in the evaluation stage. There is no acquisition related to the creation stage. It is noteworthy that there are very few acquisitions involving high-level thinking skills and no acquisitions are included in the creation stage. In the curriculum, especially in the "Environment" subjects, it is essential to have more acquisitions at the application and higher stages for individuals to transform their knowledge into behavior.

When the studies in the literature are considered, it is understood that similar results are obtained. Gökdere (2005) found that secondary school students could not sufficiently understand some topics related to the environment and suggested that to solve this problem, education programs should be enriched with topics such as natural environment, energy resources, and environmental pollution, and students should be provided with various materials from their own environment. The lack of some topics and concepts may make it difficult for students to understand the environment comprehensively. Therefore, scientific data and research should be taken more into consideration in the development and updating of programs.

The 2024 Science Curriculum adopts a student-centred holistic education approach. This approach considers learning as a process that aims to develop students' scientific thinking and decision-making abilities. In this process, development areas complement each other to form a whole and each area affects the others, thus ensuring continuous and cumulative progress. One of these areas is "Sustainability-Based Science Teaching". Sustainability-based science teaching includes topics that aim to make students think about sustainability and gain life skills related to this concept. This approach aims to raise individuals who can use resources effectively, are sensitive to nature, have awareness of local and global environmental problems, can develop solutions and have cognitive awareness. In the science teaching process, individuals are encouraged to develop a sense of social responsibility and contribute to the development of the country by emphasising sustainability awareness. In addition, it is aimed to increase the entrepreneurship and productivity skills of individuals with the knowledge and experiences gained based on sustainability (MoNE, 2024a). The 2024 Science Curriculum aims to enable students to use natural resources effectively with sustainability awareness, to develop awareness on global citizenship and environmental ethics, and to act sensitively towards nature and environmental problems.

One of the primary objectives of the 2024 Century of Türkiye Education Model is to provide students with literacy skills. One of these skills is sustainability literacy, which constitutes system literacy. According to the integration of system thinking in the common text, sustainability literacy is based on awareness, functionality and action. Based on awareness, understanding sustainability and sustainable development involves understanding sustainable and non-sustainable systems. Based on functionality, it includes analysing the components of sustainability and sustainable development, structuring sustainable and non-sustainable systems, discussing problems and issues related to non-sustainable systems. Based on the action, it includes creating/selecting/using tools that predict sustainable system behaviours, solving problems affecting the sustainability of systems, and transforming the solution proposals developed for the sustainability of systems into action. Sustainability literacy includes 8 integrated skills and 25 process skills (MoNE, 2024b). Science courses should integrate these literacy skills and present them to students.

In the 2024 Science Curriculum, the following planning was made by considering the subject content, specific days and weeks and learning environments while sequencing the units. In the 2024 Science Curriculum, the last units in the context of environmental issues are divided into “Sustainability” themes (MoNE, 2024a):

Grade 3 Unit 7: I Know the Soil, I Discover Agriculture and Grade 3 Unit 8: Journey to the Habitats of Living Things
Grade 4 Unit 8: Sustainable Cities and Communities
Grade 5 Unit 7: Sustainable Living and Recycling
Grade 6 Unit 7: Sustainable Living and Interaction
Grade 7 Unit 7: Sustainable Living and Energy
Grade 8 Unit 7: Sustainable Living and Material Cycles

In this context, to benefit from out-of-school learning environments, the last units, which coincided with the spring months, were organised to focus on sustainability and environmental issues. Within the framework of environmental issues, it is thought that providing appropriate time and environmental conditions will be effective in the acquisition of cognitive skills at the application stage.

Discussion and Conclusion on the Distribution of 2018 and 2024 Science Curriculum in terms of Cognitive Domain of the Revised Bloom's Taxonomy in the Context of Environmental Issues

According to the findings obtained from the study; it was seen that the distributions of the cognitive domain of the revised Bloom's taxonomy in the context of environmental issues in the science curricula of 2018 and 2024 were not homogeneously distributed. In the 2018 science curriculum, it was determined that there were a total of 30 objectives in the context of environmental issues and a total of 61 learning outcomes in the 2024 science curriculum. In the 2024 science curriculum, it was noteworthy that the number of learning outcomes increased and learning outcomes were also included in the recall and evaluation stages. It is crucial that the objectives in the "environment" subjects, especially in the application, analysis and evaluation stages, are more than the 2018 curriculum for individuals to transform their knowledge into behavior. In the 2018 program, there are no acquisitions in the context of environmental issues in the recall and evaluation stage, while it is an expected and desired result that the 2024 program includes acquisitions at this stage.

In the studies conducted to compare the environmental topics in the previous science curricula, the importance of including the acquisitions at the application and higher levels for environmental topics draws attention. In their study, Özata Yücel and Özkan (2013) compared the 2013 Science Curriculum with the 2005 Science and Technology Curriculum in terms of environmental topics. In the 2005 Science and Technology program, the time allocated to environmental topics was 15.56% (112 lesson hours) of the time allocated to all topics, while this rate was reduced to 14.89% (104 lesson hours) in the 2013 program. In the 2013 program, the gains related to the economical use of resources and recycling were increased, but it was seen that sample activities for the gains and suggested evaluation activities were removed.

Many studies reveal that students are inadequate in terms of environmental knowledge, their attitudes are not at the expected level, and they do not exhibit environmentally friendly behaviors (Erten, 2005). Education is the process of developing desired behaviors, and the acquisition of environmentally friendly behaviors, environmental knowledge, and the formation of positive attitudes towards the environment are closely related to curricula, which is one of the basic elements of the education process.

RECOMMENDATIONS

According to the results obtained in this study, various suggestions were made to practitioners, program developers and researchers:

Recommendations for practitioners:

This study compares the 2018 science course and the 2024 Century of Türkiye Education Model science course curricula were comparatively examined in terms of cognitive domain according to the revised Bloom's taxonomy in the context of environmental issues, methods, techniques, practices and activities that will increase students' environmental literacy levels should be included more.

At all levels of education, sustainable environmental education activities that will enable students to increase their environmental literacy levels can be included in in-school and out-of-school environments.

Recommendations for program developers:

To increase individuals' sensitivity towards the environment, it can be suggested that curricula should be updated in terms of experience and metacognitive stages.

One of the characteristics of virtuous individuals expressed in the common text of the 2024 Century of Türkiye Education Model science curriculum is to be environmentally sensitive individuals. An important stage to achieve this goal is to make environmental literacy an indispensable part of our lives.

In the 2024 Science Curriculum, 6 class hours are devoted to school-based planning that includes out-of-school learning activities. In this context, out-of-school learning environments can be planned for the environment.

Suggestions for researchers:

Environmental awareness of individuals can be analysed in terms of different socio-demographic variables. The effects of these variables on environmental awareness and the extent of this effect can be investigated.

Experimental studies can be conducted to support and monitor the development of environmental awareness on individuals.

Environmental awareness levels of students at primary, secondary, high school, and higher education levels can be examined, and comparisons can be made between these levels.

Environmentally friendly learning activities or modules that can be included in curricula can be developed.

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Examples of author contribution statements

Concept – E.B.Ö.; Design – E.B.Ö.; Supervision – E.B.Ö., M.S.; References –E.Y.; Data Collection and/or Processing – E.B.Ö., E.Y., M.S.; Analysis and/or Interpretation – E.Y., M.S.; Literature Review – E.Y., E.B.Ö.; Writing – E.B.Ö., E.Y., M.S.; Critical Review – M.S., E.B.Ö., E.Y.

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The study was conducted and reported with equal collaboration of the researchers.

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