Özkaya, A., Sarıgöz, O., Demir, A. ve Bozak, A. (2023). The achievements levels of elementary school students in the science curriculum on the substance and its nature: an analysis through the revised Bloom's taxonomy. *Uluslararası Türkçe Edebiyat Kültür Eğitim Dergisi, 12*(3), 1415-1434.

*Uluslararası **T**ürkçe **E**debiyat **K**ültür **E**ğitim Dergisi Sayı: 12/3 2023 s. 1415-1434, TÜRKİYE*

Research Article

THE ACHIEVEMENTS LEVELS OF ELEMENTARY SCHOOL STUDENTS IN THE SCIENCE CURRICULUM ON THE SUBSTANCE AND ITS NATURE: AN ANALYSIS THROUGH THE REVISED BLOOM'S TAXONOMY

Abdulkadir ÖZKAYA*

Okan SARIGÖZ**

Abdulkadir DEMİR***

Ahmet BOZAK****

Geliş Tarihi: 09.08.2023 ***Kabul Tarihi: 02.09.2023***

Abstract

The current study aims to determine knowledge areas and cognitive process dimensions of the Revised Bloom Taxonomy of elementary school student achievements in the curriculum course unit of "The Substance and its Nature", as well as how the learning achievements are distributed across grade levels. The document review method, regarded to be one of the qualitative research methods, was used in the study. Accordingly, 52 achievements in the course unit of "The Substance and its Nature" were examined by the researchers. The reliability coefficient of the research data was determined as 0.73 which was considered to be enough for research reliability. The results of the study revealed that the most (35 learning achievements) achievements were emphasized in the conceptual knowledge dimension while the least achievements (1 item) was emphasized in the metacognitive knowledge dimension; the study also revealed that the most achievements (14 learning achievements) were emphasized in the application dimension while the least achievements (3 achievements) were emphasized in the analzing dimension.

Keywords: The science curriculum, the substance and its nature, curriculum achievements, revised Bloom's taxonomy.

* Dr. Öğr. Üyesi; Hatay Mustafa Kemal Üniversitesi, Eğitim Fakültesi, Fen Bilgisi Öğretmenliği Bölümü, kayakadir78@gmail.com.

** Doç. Dr.; Hatay Mustafa Kemal Üniversitesi, Eğitim Fakültesi, Eğitim Programları Bölümü, okan.sarigoz@gmail.com.

*** Yüksek Lisans Öğrencisi; Millî Eğitim Bakanlığı, abdulkadirdmrr8@gmail.com.

**** Doç. Dr.; Hatay Mustafa Kemal Üniversitesi, Eğitim Fakültesi, Eğitim Yönetimi Bölümü, abozok77@gmail.com.

ORTAOKUL ÖĞRENCİLERİNİN FEN BİLİMLERİ ÖĞRETİM PROGRAMI MADDENİN DOĞASI KONUSUNDAKİ BAŞARI DÜZEYLERİ: YENİLENMİŞ BLOOM TAKSONOMİSİ ÜZERİNDEN BİR ANALİZ

Öz

Bu çalışma, 2018 Ortaokul Fen Bilimleri Dersi Öğretim Programındaki "Madde ve Doğası" konu alanında yer alan kazanımların yenilenmiş Bloom Taksonomisinin bilgi ve bilişsel süreç boyutunun hangi basamağında yer aldığı ve sınıf düzeylerine göre nasıl bir dağılım gösterdiğini belirlemek amacıyla yapılmıştır. Çalışmada nitel araştırma yöntemlerinden biri olan doküman inceleme yöntemi kullanılmıştır. Araştırmanın amacına yönelik olarak araştırmacılar tarafından "Madde ve Doğası" konu alanıyla ilgili 52 kazanım incelenmiştir. Elde edilen verilerin güvenirlik katsayısı da hesaplanmış ve 0,73 olarak belirlenmiştir. Elde edilen verilere göre bilgi boyutunda; en fazla (35 kazanım) kavramsal bilgi boyutundaki kazanımlara yer verildiği, en az (1 kazanım) ise üstbilişsel bilgi boyutundaki kazanımlara yer verildiği; bilişsel süreç boyutunda; en fazla (14 kazanım) uygulama boyutundaki kazanımlar, en az ise (3 kazanım) çözümleme boyutundaki kazanımlara yer verildiği belirlenmiştir. Sonuç olarak, "Madde ve Doğası" konu alanında çözümleme dışındaki diğer üst düzey düşünme boyutlarına yeteri kadar yer verildiği görülmüştür.

Anahtar Sözcükler: Fen öğretim programı, madde ve doğası, öğretim programı kazanımları, yenilenmiş Bloom taksonomisi.

Introduction

Science education was created in order to enable students to get the achievements in the science curriculum via live experiences, and the skills and attitudes that students should reach by using their own abilities (Çepni, 2006). As a result, science education is expected to train the students who research, question, and have high problem-solving skills, as well as who are self-confident, able to communicate effectively, are able to involve in collaborative environments and learn science (MEB, 2006, 2013, 2018; Tatar, 2006; Yaşar & Duban, 2009). Science literacy covers the environmental knowledge, attitude, skills and behavior dimensions of individuals and should aim to ensure the active participation of individuals when faced with environmental problems (Altınok et al., 2020; Kalkan & Tunç, 2020; Roth, 1992).

Curriculum is a guide line that reveals for what purposes and how the content to be learned are to be handled (Çeken, 2022). The science teachers are expected to have scientific process skills while making their students gain these skills as well (Başar, 2021). In curricula, learning achievements reveal what the student are to know, what attitudes and skills they should get at the end of the program (Brooks et al., 2013). It is thought to be crucial for an effective learning that the teaching and assessment process as well as the learning achievements being clear, understandable and measurable (Dobbins et al., 2016). It is particularly important for developing countries that science education curriculums should meet the needs of the age and prepare individuals for the world of the future (Karalı et al., 2021). Hence, all education levels are reorganized in order to improve or develop students' thinking skills and achievements (Avcı et al., 2021; Güngör-Cabbar et al., 2020; Sağlamöz & Soysal, 2021; Yıldız-Bıçak & Bilir, 2023). The trainings activities that aim to gain scientific knowledge and skills are considered within the scope of science education (Elmas et al., 2022). It is crucial that curricula should provide opportunities for behavioral and affective learning as well as providing opportunities

for cognitive learning (Balkan-Yıkıcı & Atabek-Yiğit, 2023). Developing high-level cognitive skills such as analysis, synthesis, evaluation, association, abstraction with the qualities and methods of teaching (Özden, 1997; Sadler, 2004; Venville & Dawson, 2010); in addtion, the arrangement of the subjects in a way that will help to comprehend the nature of the subjects and relate them to learned topics are thought to be the important cornerstones that will carry the education system to the 21st century (Kalemkuş, 2021; Trilling & Fadeli, 2009). While teaching a subject creates a one-way communication channel, the evaluation of knowledge by the individuals through different methods such as experiencing and questioning strengthens the communication between the teacher and the students. In such a teaching perspective, it would be a great misconception to expect the individual to demonstrate cognitive skills such as analysis, synthesis and evaluation only by memorization, without learning how to think (Özden, 1997).

Education is an integrated process that aims to bring about permanent changes in the behavior of individuals, and a tool that enables individuals to analyze and organize their daily life skills. Education should not only be considered to transfer existing knowledge directly to individuals, but to develop methods that will enable it to be constructed in a questioning and consistent integrity in the process of acquiring knowledge (Kaptan, 1999). Education programs is expected to raise individuals who are critical, problem solvers, creative, thinkers, and realize the logical connections between cause and effect relationships. Taxonomies developed in the 1950s are important means in the historical process through which different schools are experienced to determine and realize the goals in education. In this historical process, the Bloom Taxonomy program still remains its importance today.

The constructivist program (Bloom et al., 1956) was an interactive learning process of knowledge and action, and depending on the subjectivity of perceptions of knowledge by individuals. This cognitive domain classification was used to make the objectives in the education program more understandable and observable. Moreover, that keeping the quality of education under control is considered to be possible by integrating Bloom's taxonomy into the education curriculum (Aktaş, 2017).

According to Bloom, the individual is born with the mental equipments related to learning and starts his life via an unlimited learning capacity. However, the training process determines how much these equipments and limits can be used. For this reason, when appropriate learning environments are provided for children, they are able to learn almost anything within their interest facus. Bloom's Taxonomy argues that the educators can arrange the targeted learning in an order through simple to complex. The levels in such a classification are listed one after the other (Bloom, 1956).

Bloom argues three types of learning: cognitive, affective, and psychomotor. He divided these learning areas into sub-headings, taking their learning levels as a reference (Ayvacı & Türkdoğan, 2010). Accordingly, in such a progressive learning program, it is not possible to pass to the next learning stage without fulfilling the requirements of the previous level.

Bloom's Taxonomy, originally developed in 1956, was revised in 2001 to enable more educators to use education curriculums and contemporary developments in the field of teaching (Bümen, 2006). While the old taxonomy was at six levels (knowledge, comprehension, application, analysis, synthesis and evaluation), it was reconstructed in within in 2001 revised version, the synthesis, which reveals a new and original product or idea, was located at the top

level of the cognitive learning level (Anderson & Krathwohl, 2001). In this classification, the steps of remembering, understanding, and applying low-level thinking skills; high-level thinking skills have been expressed via the steps of analzing, evaluating and creating.

Programming the dropout from simple to complex also allows individuals to participate in the interaction while making the configuration more feasible to achieve a holistic assessment (Anderson & Krathwohl, 2001). Learning depending on instructions of different expectations, analysis of positive or negative results let efficient output of consumption as well.

When the contributions of Bloom's taxonomy considered, it enables to make scientific analyzes on the basis obtained, and education to be more improved while providing a different perspective to the organization of the education and training process. In other words, it facilitates the organization and development process on a certain scale, as well as the analytical evaluations at the educational scale. On the other hand, the taxonomy by Bloom was also argued to be in a single dimension and in a rather complecated form therefore it was insufficient to examine the achievements in the curriculum. For this reason, it is thought that it would be more beneficial to consider the achievements as knowledge and cognitive dimensions in order to have in-depth information about the achievements in the curriculum and to minimize the complexity of the curriculum (Anderson & Krathwohl, 2001; Tutkun & Okay, 2012; Zorluoğlu et al., 2016).

The table made for the simultaneous analysis of the achievements within two different dimensions was called the taxonomy matrix (Table 3). The knowledge dimension and the cognitive process dimension are inter related. While the student is at any stage of the cognitive process, he or she can use four different pieces of information in the knowledge dimension (Tutkun & Okay, 2012). In the taxonomy matrix, the vertical columns form the cognitive process dimensions and the horizontal columns the knowledge dimension levels (Tutkun & Okay, 2012). The classification created via this taxonomy matrix, it provides knowledge dimension sublevels convenience to curriculum development experts in terms of evaluation and planning of teaching during the application in terms of tutorials (Zorluoğlu et al., 2017).

1. Revised Bloom Taxonomy (RBT)

1.1. Knowledge Dimension

It is the classification that includes the knowledge achievements relevant to thinking skills. It consists of knowledge categories formed depending on scientific methods. These categories are; factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge. These subdimension of the knowledge dimension are formed according to the information given in Table 1.

Table 1. Information Dimension of RBT (Krathwohl, 2002; Şimşek, 2019)

Information Dimension	Sub-Dimensions
1.Factual Knowledge	*1.1 Knowledge on terminology*
	1.2 Knowledge on special details and elements
2.Conceptual Knowledge	*2.1 Knowledge on classifications and categories*
	2.2 Knowledge on principles and generalizations
	2.3 Knowledge on theories, models and structures
3. Procedural knowledge	*3.1 Knowledge of subject-specific skills and algorithms*
	3.2 Knowledge of subject-specific techniques and methods
	3.3 Knowledge of criteria for determining when to use appropriate procedures
4.Metacognitive	*4.1 Strategic knowledge*

knowledge	*4.2 Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge*
	4.3 Self-knowledge

1.2. Cognitive Process Dimension

The (RBT) consists of 6 steps similar to the old Bloom Taxonomy. The digit names have been changed and these digits have been converted to verb format in the RBT.

Table 2. Cognitive Process Dimension of RBT (Krathwohl, 2002; Şimşek, 2019)

Cognitive Process Dimension	**Sub-Dimensions**
1. Remembering	l.l *Recognizing*
	1.2 *Recalling*
2. Understanding	2.1 *Interpreting*
	2.2 *Exemplifying*
	2.3 *Classifying*
	2.4 *Summarizing*
	2.5 *Inferring*
	2.6 *Comparing*
	2.7 *Explaining*
3. Applying	3.1 *Executing*
	3.2 *Implementing*
4. Analzing	4.1 *Differentiating*
	4.2 *Organizing*
	4.3 *Attributing*
5. Evaluating	5.1 *Checking*
	5.2 *Critiquing*
6. Creating	6.1 *Generating*
	6.2 *Planning*
	6.3 *Producing*

1.3. The Usage of Taxonomy Table

Through the RBT Table, the practitioners benefiting from the taxonomy table will be able to;

- understand the achievements in the curriculum;

- have ideas and knowledge about how a curriculum should be;

- answer questions about learning and teaching;

- determine how the student will be evaluated in situations where teaching takes place.

In addition, they will be able to decide on the compatibility of the achievements, teaching activities and evaluation in the curriculum, have an idea about the usefulness of the curriculum, and evaluate the curriculum (Anderson & Krathwohl, 2001; Bümen, 2006).

The achivements in the curriculum are in the form of sentences and consist of two parts as verb and noun expression. In order to decide on the place of the achievement in the taxonomy, first of all, it is necessary to examine the achievement sentence. According to RBT, the verb expression of the achievements indicates the cognitive process dimension, and the noun expression indicates the knowledge dimension. However, it is difficult to find the place of the achievements in taxonomy since some achievements in the curriculum contain more than one verb expression or noun expression, (Anderson & Krathwohl, 2001). If the achievement includes more than one verb expression or noun expression, then the upper dimensional

expression should be chosen; If the achievement includes both application and assessment, the upper dimension assessment should be selected, or if both conceptual knowledge and procedural knowledge are included, the upper dimension operational knowledge should be selected and placed in the cell where the dimensions of the achievement intersect (Anderson & Krathwohl, 2010).

It is placed in the cell where the cognitive process bot of the achievement in the curriculum intersects and the row with the knowledge dimension (Amer, 2006; Bekdemir & Selim, 2008; Krathwohl 2002). For example, “Gives examples of commonly used fuels by classifying fuels as solid, liquid and gaseous fuels.” The verb phrase "give an example" in the achievement item is included in the understanding subdimension of cognitive process skills. It is thought that "Fuels, solid, liquid and gaseous fuels" enters conceptual knowledge in the information dimension. By looking at the data obtained, the code of this achievement is determined by finding the achievement in the taxonomy table as cell B2, the cell where the row with the conceptual information and the column with the understanding step intersect.

Table 3: Revised Bloom Taxonomy Matrix (Krathwohl, 2002; Anderson, 2005)

Knowledge Dimension	**Cognitive Process Dimensions**					
	1.Remembering	**2.Understanding**	**3.Applying**	**4.Analyzing**	**5.Evaluating**	**6.Creating**
A. Factual Knowledge	A 1	A 2	A 3	A 4	A 5	A 6
B. Conceptual Knowledge	B 1	B 2	B 3	B 4	B 5	B 6
C. Procedural Knowledge	C 1	C 2	C 3	C 4	C 5	C 6
D. Metacognitive Knowledge	D 1	D 2	D 3	D 4	D 5	D 6

The current study focus on to evaluate the elementary school achievements in the subject area of "The Substance and its nature" of the 2018 Science course curriculum in terms of the RBT.

The following questions were researched within the sub-dimension of the study.

1. What is the distribution of elementary school achievements in the subject area of "The Substance and its Nature" in Science Curriculum in the dimension of knowledge according to the RBT?

2. How are the elementary school achievements in the subject area of "The substance and its nature" in Science Curriculum distributed according to the cognitive process dimensions of the RBT?

3. How do the elementary school achievements in the subject area of "The Substance and its Nature" in Science Curriculum indicate a trend according to the RBT?

2. The Purpose

The study aims to analyze the elementary school achievements in Science Curriculum "The Substance and its Nature" subject area according to the RBT dimensions and to reveal the distribution of the elementary school achievements in the "The Substance and its Nature" subject area in the RBT.

3. Method

3.1. The Research Model

A qualitative study was conducted via using the document analysis method, which is one of the qualitative research methods. Document analysis method includes the examination and evaluation of written materials about the subject or field that is desired to be researched (Yıldırım & Şimşek, 2016). Additionally, document analysis has the advantages of obtaining various results by examining documents without the need to make observations and interviews about the research area and subject (Bowen, 2009).

The current study has analyzed 52 achievements in the subject area of "The Substance and its Nature" in the Science Curriculum, additionally examined the suitability of these 52 achievements according to the RBT through the document analysis method. The analysis was carried out by the help of a science education specialist and an academician from the field of curriculum development, and a Turkish education specialist for the examination of spelling and spelling rules. Experts independently expressed their views on which level the achievements should take place in terms of knowledge dimension and cognitive process dimension in the RBT. The achievements levels were examined via group focus and unanimously defined by the experts. Similarly, some achievements for which no consensus was reached were also defined via the joint evaluation of the experts. As a result of these evaluations, the achievements with consensus and disagreement between the researchers and the experts were determined, and the formula given below by Miles and Huberman (1994) was used to decide the reliability of the analysis using the data obtained. In order for the research to be reliable, according to the formula determined by Miles and Huberman is expected to be above 70% (Yıldırım & Şimşek, 2016). Accordingly, the study was observed to be reliable enough as the coding process of the study indicated that the agreement between the coders was 73%.

Reliability formula determined by Miles and Huberman;

The formula for percent agreement is $p=\frac{Cx100}{C+A}$. In the formula, p: Reliability coefficient, C: Number of achievements on which consensus was reached, A: Number of achievements on which consensus was not reached (Miles & Huberman, 1994).

3.2. Analysis of Data

The knowledge and cognitive dimensions were considered in the examination of the achievements. The results were coded according to the RBT matrix within Table 3. “Defines density.” “density” is divided into noun expression and “definitions” verb expression in order to determine the cell in which the achievement is included in the taxonomy matrix. While the noun expression is included in the factual knowledge dimension as it forms the basic part of the term knowledge and the subject, the verb expression "defines" is located in the remembering step. Since the cell where the factual knowledge and remembering steps intersect is A1, it is included in this cell.

Examples of the analysis of the achievements are as follows. In the learning achievement "Tells the basic structure of the atom and the fundamental particles in its structure", the noun phrase "the basic structure of the atom and the fundamental particles in its structure" was included in the conceptual dimension, while the verb phrase "says" was placed in cell B1 as it took place in the remembering step. In the achievement of "give examples of acids

and bases", "acids and bases" were included in the name expression and conceptual knowledge dimension, while this achievement was placed in cell B2, since "it gives examples" was included in the understanding level. Since the practice with higher skills was considered within the practice level and placed in cell B3. In the achievement of "Associate examples from daily life with expansion and contraction events", the expression "Expansion and contraction events from daily life" was included in the conceptual dimension while the verb phrase "associate" was placed in analying subdimension of cell B4. Similarly, since the noun phrase "domestic solid and liquid wastes" was diffirently clasified, the verb phrase "designs a project" was included in the creating subdimension within cell B6.

4. Results

Through the current study, 52 elementary school achievement achievements in the "The Substance and its Nature" Subject Area in the Science Curriculum were examined depending on the RBT, and the place of the achievements in the RBT matrix was determined. Additionally, the distribution of the data according to these dimensions and sub-dimensions in the RBT was carried out. In order to reveal the he distribution of the achievements in the subject area of "The substance and its nature" in a better way, the ratio of the data between the classes was determined and presented in the form of graphs.

Table 4: According to RBT, Learning Achievements for Elementary School Students in The Subject of "Matter and Its Nature"

Class /Grade	Achievement	Dimension
5th Grade	The students make inferences based on the data he obtained from his experiments that show that substances can change state with the effect of heat.	**C2**
	As a result of his experiments, the students determine the melting, freezing and boiling points of pure substances.	**C3**
	Explain the basic differences between heat and temperature.	**B2**
	Interpret the results by making experiments on heat exchange as a result of mixing liquids with different temperatures.	**B3**
	Discuss the results of the experiments by conducting experiments on the expansion and contraction of substances under the influence of heat.	**C5**
	Relate examples from daily life with expansion and contraction events.	**B4**
6th Grade	State that the substances have granular, void and mobile structures.	**A1**
	Compare the changes in the space between the particles of matter and the mobility of the particles depending on the change of state by experimenting.	**C2**
	Defines the concept of density.	**A1**
	Calculate the densities of various substances as a result of the experiments they designed.	**D3**
	Compare the densities of insoluble liquids by experimenting.	**B3**
	Compare the densities of the solid and liquid states of water and discusses the importance of this situation for living things.	**B5**
	Classify materials in terms of heat conduction.	**B2**
	Determine the selection criteria of thermal insulation materials used in buildings.	**B1**
	Develop alternative thermal insulation materials.	**B6**
	Discuss the importance of thermal insulation in buildings in terms of family and country economy and effective use of resources.	**B5**
	Classify the fuels as solid, liquid and gaseous fuels and gives examples of commonly used fuels.	**B2**
	Discuss the effects of the use of different types of fuels for heating purposes on humans and the environment.	**B5**
	Research and report the precautions to be taken regarding stove and natural gas poisoning.	**B3**
7th Grade	Tell the structure of the atom and its basic particles.	**A1**
	Question how the ideas about the concept of atom have changed from past to present.	**B5**

	State that the same or different atoms will come together to form a molecule.	**A1**
	Present various molecular models by creating.	**C3**
	Give examples by classifying pure substances as elements and compounds.	**B2**
	Express the names, symbols and some usage areas of the first 18 elements and common elements (gold, silver, copper, zinc, lead, mercury, platinum, iron and iodine) in the periodic system.	**B1**
	Express the formulas, names and some uses of common compounds.	**B1**
	Give examples by classifying mixtures as homogeneous and heterogeneous.	**B2**
	Prepare the solutions by using solvents and solutes encountered in daily life.	**C3**
	Determine the factors affecting the dissolution rate by experimenting.	**B3**
	Choose and apply the appropriate method among the methods that can be used for the separation of mixtures.	**B3**
	Distinguish between recyclable and non-recyclable materials in household waste.	**B4**
	Design a project for the recycling of domestic solid and liquid wastes.	**B6**
	Question the recycling in terms of effective use of resources.	**B5**
	Pay attention to waste control in its immediate surroundings.	**B3**
	Develop a project to deliver reusable items to those in need.	**B6**
8th Grade	Explain how groups and periods are formed in the periodic system.	**B2**
	Classify the elements as metals, semimetals and nonmetals on the periodic table.	**B2**
	Explain the differences between physical and chemical change by observing various events.	**B2**
	Know that the compounds are formed as a result of chemical reaction.	**A1**
	Express the general properties of acids and bases.	**B1**
	Give examples of acids and bases from daily life.	**B2**
	Use materials that can be reached in daily life as acid-base separators.	**B3**
	Make inferences by using the pH values of the acidity and alkalinity of the substances.	**C2**
	Observe the effects of acids and bases on various substances.	**B3**
	Take the necessary precautions regarding the dangers that may occur during the use of acids and bases as cleaning materials.	**C3**
	Offer the solutions for the prevention of acid rain.	**C6**
	Discover by experiment that the heating depends on the type, mass and/or temperature change of the substance.	**B6**
	Discover by experiment that the heat required to change state is related to the type and mass of the substance.	**B6**
	Interpret by drawing the state change and heating graph of substances.	**C2**
	Relate the heat exchange with state changes in daily life.	**B4**
	Research the development of the chemical industry in Turkey from past to present.	**B3**
	Explore the professions in the chemical industry and offers suggestions for new future professions.	**A6**

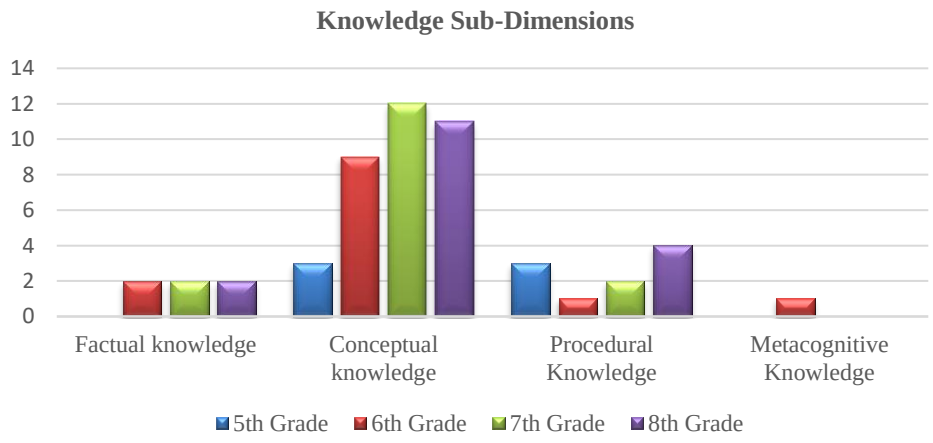

Figure 1: The Distribution of Elementary School Achievements According to Knowledge Sub - Dimensions in the Subject Area of the Science Curriculum "The Substance and Its Nature"

In Figure 1, the achievements belonging to the subject area of "The substance and its nature" were analyzed according to the knowledge sub-dimensions according to the RBT. Accordingly, within the subject area of "The substance and its nature", the metacognitive knowledge dimension got the least points (Figure 1). The most common knowledge dimension was observed to be the conceptual knowledge dimension. When Figure 1 evaluated, it is seen that the achievements in the subject area of "The substance and its nature" are not homogeneously distributed in the sub-dimensions of knowledge. In Figure 2, the distribution of information dimensions are proportionally displayed. Such a result also overlaps with the argument of Anderson and Krathwhol (2001) stated that the grade level increases, the achievements in the factual knowledge dimension should decrease, while the achievements in the procedural knowledge dimension should increase.

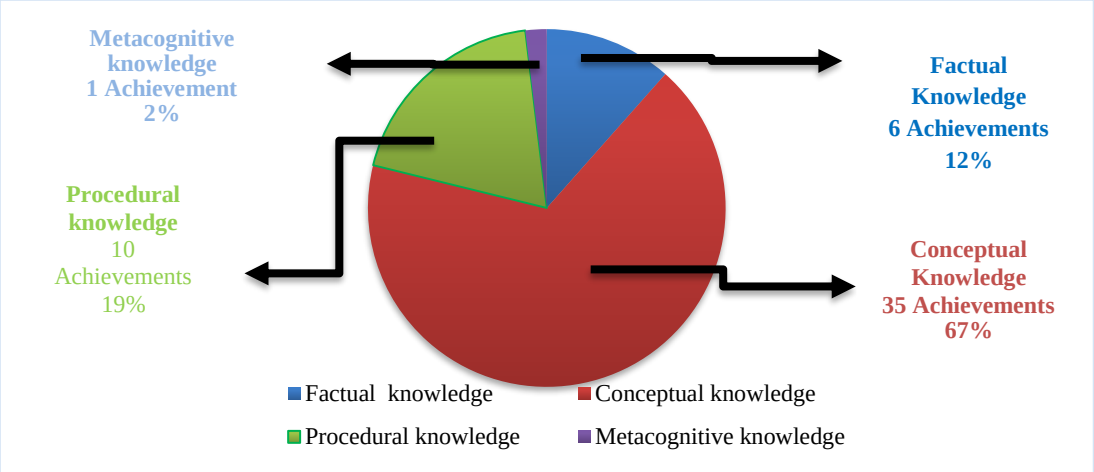

Figure 2: Percentage Distribution of Knowledge Sub-Dimensions of Elementary School Achievements in the Subject Area of the Science Curriculum "The Substance and Its Nature"

According to Figure 2. 7% of the learning achievements in the subject area of "The substance and its nature" were observed to be 67% conceptual knowledge (35 achievements), 19% procedural knowledge (10 achievements), 12% factual knowledge (6 achievements), and 2% of them was observed to be at the level of metacognitive knowledge (1 achievement).

The distribution of the achievements according to grade levels in the knowledge dimension is given in the line chart below.

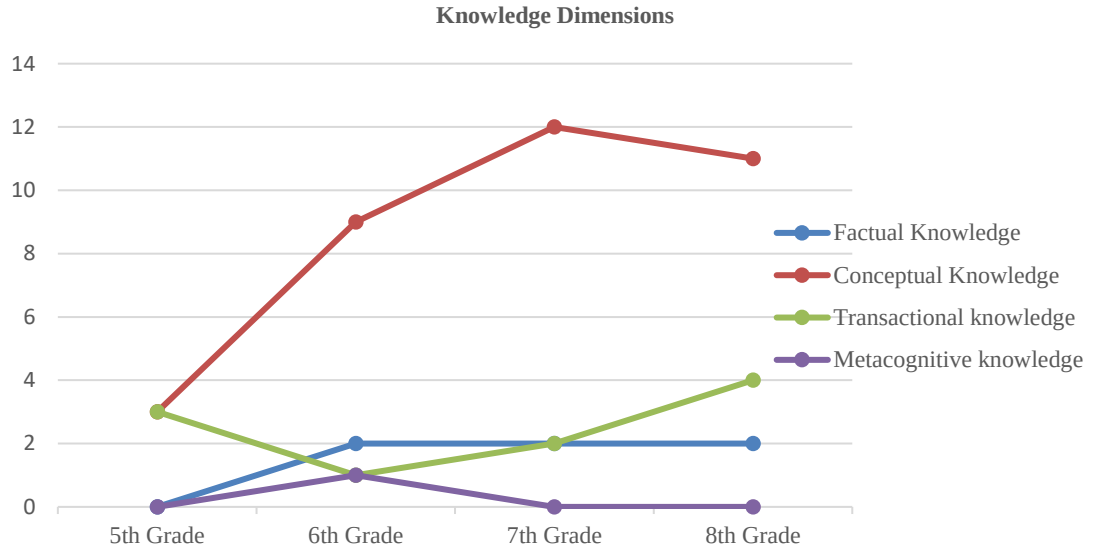

Figure 3. Distribution of Elementary School Achievements in the Subject Area of "The Substance and Its Nature" by Class Level in Knowledge Dimension

The graph in Figure 3 reveals the distribution of the knowledge sub-dimensions by the level of elementary school classes. When Figure 3 examined, the factual knowledge has increased as elementary school passes from the first level to the second level. Additonally it decreases after the second grade level as well. On the other hand, the number of achievements in the conceptual knowledge dimension increases until the 7th grade while it decreases in the 8th grade level. As the grade level increases, the achievements should take place at the metacognitive knowledge dimension or at a level close to the metacognitive knowledge dimension, and there should be a decrease in the number of achievements in the factual knowledge dimension (Anderson & Krathwohl, 2001). It was observed that the increase in the number of achievements in the higher-level knowledge dimensions was only in the procedural dimension, despite the increase in the grade level.

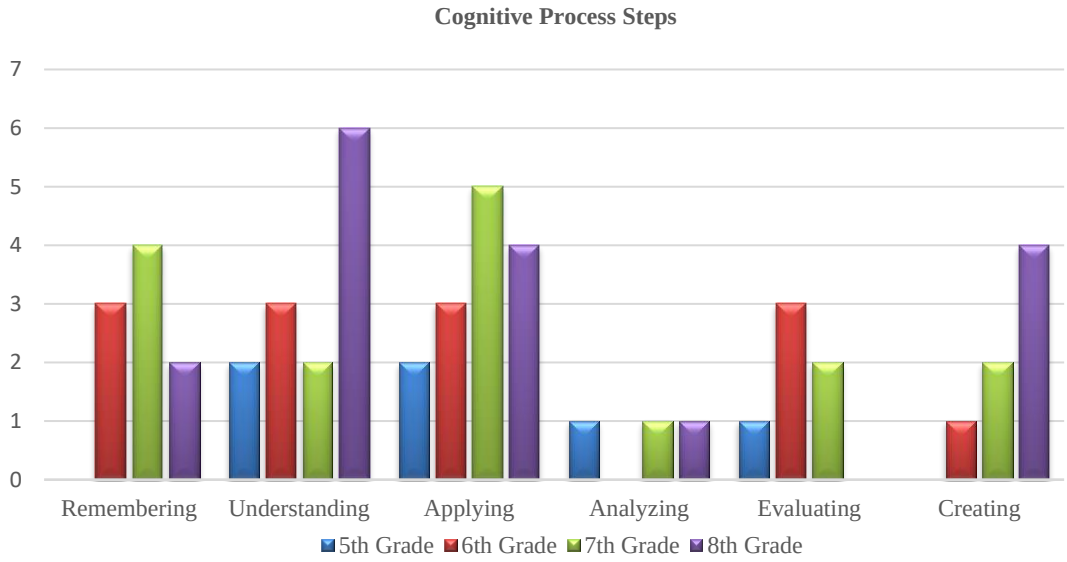

Figure 4: Distribution of Elementary School Achievements in the Subject Area of "The Substance and Its Nature" by Cognitive Process Dimension Sub-steps.

The evaluation of the achievements according to the cognitive process steps of the RBT is shown in the graphic in Figure 4. Accordingly, the applying and understanding levels got the highest score while the analzing level was observed to be at lowest level.

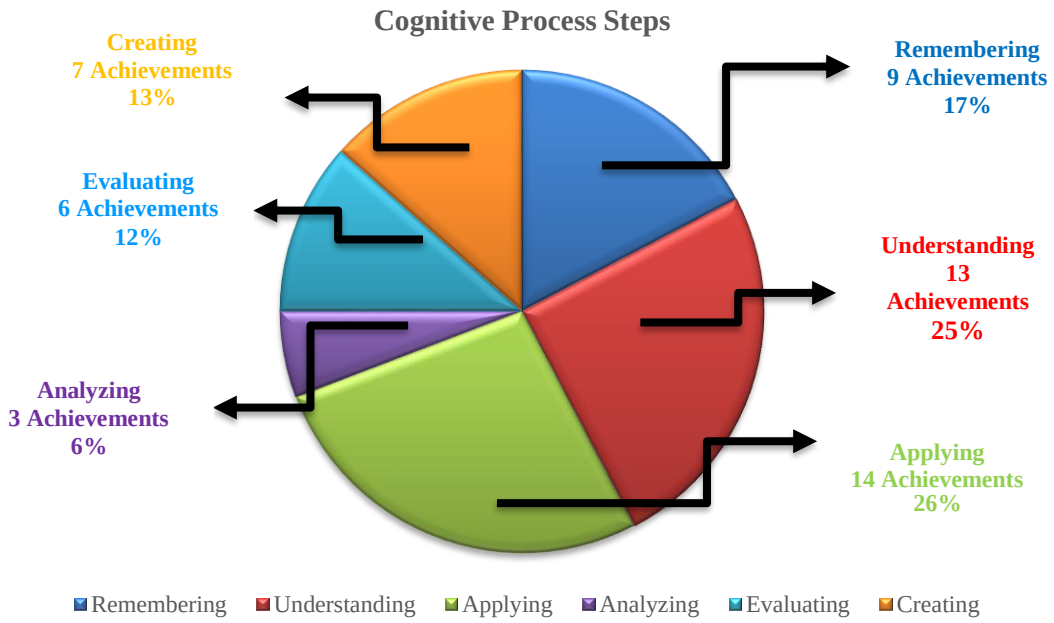

Figure 5: Cognitive Process Dimension Sub-Steps of Elementary School Achievements in the Subject Area of "The Substance and Its Nature"

26% of the elementary school achievements were observed to be within applying level (14 achievements), while 25% within understanding level (13 achievements), 17% within remembering level (9 achievements), 13% within creating level (7 achievements), 12% within evaluating level (6 achievements) and 6% within analzing level (3 achievements). The evaluation also revealed that 83% of the achievements was ofserved to be within the cognitive and understanding levels as seen above.

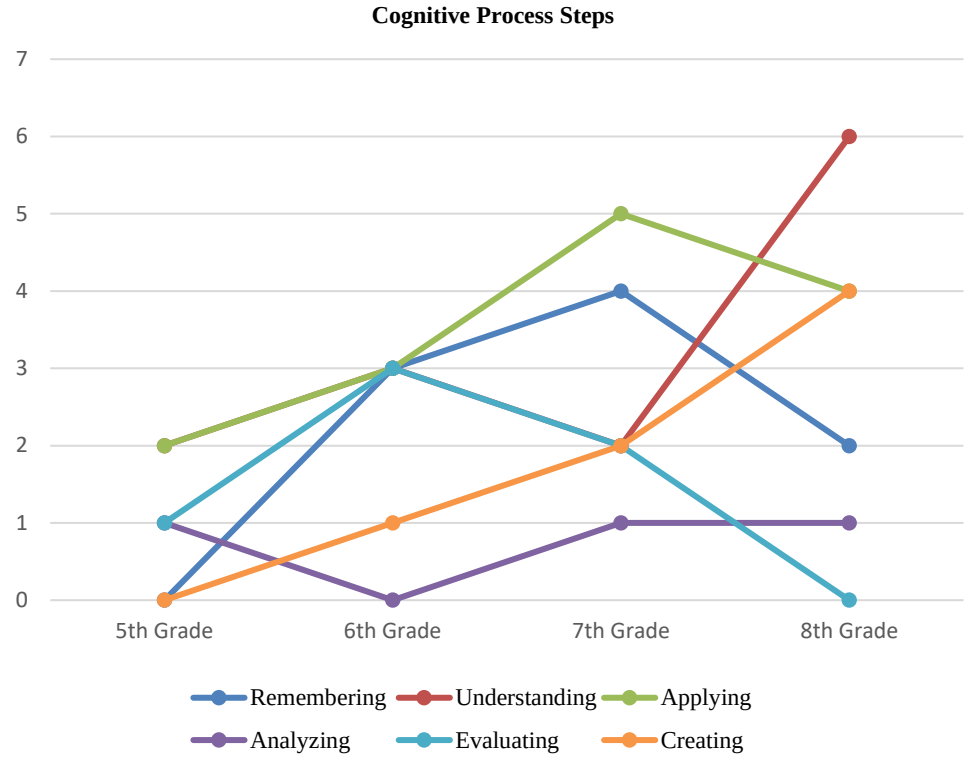

Figure 6: Distribution of Elementary School Achievements in the Subject Area of "The substance and its nature" by Grade Level in the Dimension of Cognitive Process

When the cognitive process levels examined, the number of achievements at the level of remembering was observed to decrease from the 6th grade while the the learning achievements within understanding and creating levels increase as the grade level increases.

Table 5: The Tendency of the Achievements According to the RBT

Cognitive Process Dimension / Knowledge Dimension	1.Remembering	2.Understanding	3.Applying	4.Analyzing	5.Evaluating	6.Creating	Total
A.Factual Knowledge	5	0	0	0	0	1	6
B.Conceptual Knowledge	4	9	9	3	5	5	35
C.Procedural Knowledge	0	4	4	0	1	1	10
D.Metacognitive Knowledge	0	0	1	0	0	0	1
Total	9	13	14	3	6	7	52

When Table 5 evaluated, the general trend of the achievements in the subject area of "The substance and its nature" was depicted within 52 achievements. Table 5 and graphics are lead the teachers how the subjects in the knowledge dimension to be taught according to the subdimensions of the cognitive process. Additionally, it was observed that the achievements in the subject area of "The substance and its nature" were not homogeneously distributed according to RBT.

Conclusion and Discussion

The results of the study revealed that the elementary school achievements in the subject area of "The Substance and its Nature" of the Science Curriculum included 35 achievements in the conceptual knowledge dimension, 10 achievements in the procedural knowledge dimension, 6 achievements in the factual knowledge dimension and 1 achievement in the metacognitive knowledge dimension. In order for the teaching to be more efficient, the number of achievements in the metacognitive knowledge dimension should also be higher. However, the current study observed that there were insufficient achievements in metacognitive knowledge dimension. Therefore, study argues that it is necassary to reorganize the achievements in the subject area of knowledge and also increase the number of achievements in the metacognitive knowledge dimension.

In the analysis of the study within the cognitive process dimension revealed that the highest achievement score was in the applying level with 26%, the closest step was observed in understanding level with 25%, and the least achievement score was observed in the analzing level with 6%. (Figure 5). Anderson and Krathwohl (2001) also states that there are generally more achievements in the remembering, understanding and applying stages when the cognitive process levels of the learning achievements examined while less achievements are observed within the analzing level, the evaluating level, and the creating level. This statement does not mean that a large proportion of the achievements in the curriculum should be at the understanding level. It is observed that the achievements of the curriculum in the subject area of "The substance and its nature" were prepared by focusing on the application and understanding levels, and the achievements within the metacognitive subdimension were not edaquately enphasized.

In order for efficient learning and the transfer of knowledge into the daily life, the number of achievements in the applying, analzing, evaluating and creating levels should be increased (Mayer, 2002). When Figure 5 examined, 58% of elementary school achievements in the current curriculums are the cognitive process dimensions which were previously expressed by Mayer (2002). This indicates that it is at a sufficient level for an efficient learning to take place in the subject area of "The substance and its nature". However, for a better evaluation of the curriculum, it is also thought to be necessary to consider the grade levels to evaluate the general situation in more accurate way (Anderson & Krathwohl, 2010). When the grade levels in Figures 4 and 6 separately examined, it was observed that the levels of applying, analzing, evaluating and creating are higher than the levels of understanding and remembering at all grade levels. This situation is considered to be sufficient for meaningful learning at elementary school levels.

In order for the students to gain high-level skills, it is argued to be crucial to increase the number of achievements in metacognitive dimensions and to offer activities suitable for

such achievements (Aydın & Yılmaz 2010; Zorluoğlu et al., 2016). The current study revealed that the achievements aimed around increasing the higher level skills of the students were observed to be sufficient enough, but the number of achievements in the analzing level was observed to be inedequate (Figure 4-5). This situation indicates that the number of achievements to increase the students' deductional ability such as from whole to part as well as analzing ability in the subject area of "The substance and its nature" were not enough. Accordingly, the curriculum is thought to be re-planned, and the number of achievements in the analzing level should be increased so that the individual can analyze the results or divide the existing knowledge about the subject into parts.

In order for an effective learning, the achievements in the curriculum should differ according to the knowledge and cognitive processes (Anderson & Krathwohl, 2010). The results of the current study also revealed that the science program was edaquate as a simialar distinction was observed through the achievement differences of knowledge and cognitive processes.

References

Aktaş, E. (2017). Evaluation of the questioning skills of teachers candidates towards the different text types according to the renewed Bloom taxonomy. *Turkish Studies, 12*(25), 99-118. http://dx.doi.org/10.7827/TurkishStudies.12274

Altınok, M.A, Tunç, T., & Özcan, H. (2020). Comparative analysis of science education programs in the context of science-technology-society and environmental acquisitions from 1926 to the present. *Journal of Amasya University Faculty of Education, 9*(2), 230-257. https://dergipark.org.tr/tr/pub/amauefd/issue/58078/774030

Amer, A.A. (2006). Reflections of Bloom's revised taxonomy. *Electronic Journal of Research in Educational Psychology, 4*(8), 213-230. https://www.redalyc.org/pdf/2931/293123488010.pdf

Anderson, L.W., & Krathwohl, D.R. (Eds.). (2001). *Taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives.* Needham Heights, MA: Allyn & Bacon.

Anderson, L.W. (2005). Objectives, evaluation, and the improvement of education. *Studies in Education Evaluation,* 31, 102-113. https://doi.org/10.1016/j.stueduc.2005.05.004

Anderson, L.W., & Krathwohl, D.R. (2010). *A taxonomy for learning, teaching, and assessing.* Pegem Publication.

Arı, A. (2011). Finding acceptance of Bloom's revised cognitive taxonomy on the international stage and in Turkey. *Educational Sciences: Theory & Practice, 11*(2), 749-772. https://www.idealonline.com.tr/IdealOnline/pdfViewer/index.xhtml?uId=2015&ioM=Paper&preview=true&isViewer=true#pagemode=bookmarks

Avcı, F., Aslangiray, H., & Özyalçın, B. (2021). Analysis and evaluation of the learning outcomes of the 2018 science curriculum according to revised Bloom taxonomy in terms of subject and class level. *Trakya Journal of Education, 11*(2), 643-660. https://doi.org/10.24315/tred.689366

Aydın, N., & Yılmaz, A. (2010). The effect of constructivist approach on students' high-level cognitive skills. *Hacettepe University Faculty of Education Journal*, *39*(39), 57-68. http://efdergi.hacettepe.edu.tr/shw_artcl-459.html

Ayvacı, H.Ş., & Türkdoğan, A. (2010). Analysing science and technology course exam

questions according to revised Bloom taxonomy. *Turkish Journal of Science Education, 7*(1), 13-25. https://www.tused.org/index.php/tused/article/view/500/430

Balkan-Kıyıcı, F., & Atabek-Yiğit, E. (2023). Examining environmental acquisitions in science curriculum: A comparison of Brazil and Turkey. *Trakya Journal of Education, 13*(1), 593-605. https://dergipark.org.tr/tr/download/article-file/2229792

Başar, T. (2021). Analysis of the learning outcomes in the 2018 science course curriculum in terms of scientific process skills. *Erzincan University Journal of Education Faculty, 23*(1), 218-235. https://doi.org/10.17556/erziefd.756163

Bekdemir, M., & Selim, Y. (2008). Revised Bloom taxonomy and its apllication in algebra area. *Erzincan University Journal of Education Faculty, 10*(2), 185-196. https://dergipark.org.tr/en/download/article-file/67433

Bloom, B. (1956). *Taxonomy of educational objectives: Cognitive and affective domains.* New York: David McKay.

Bowen, G.A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40. https://doi.org/10.3316/QRJ0902027

Brooks, S., Dobbins, K., Scott, J.J.A., Rawlinson, M., & Norman, R.I. (2014). Learning about learning outcomes: The student perspective. *Teaching in Higher Education, 19*(6), 721–733. http://dx.doi.org/10.1080/13562517.2014.901964

Bümen, N.T. (2006). A revision of the Bloom's taxonomy: A turning point in curriculum development. *Education and Science, 31*(142), 3-14. http://egitimvebilim.ted.org.tr/index.php/EB/article/view/837

Çepni, S., & Ayvacı, H.Ş. (2006). Measurement and evaluation in science and technology education. S. Çepni (Ed.), *Science and technology teaching from theory to practice.* In, (pp. 229-248). Pegem Publication.

Çeken, R. (2022). Semantic extention problem in Turkish science curriculum. *International Journal of Educational Sciences, 6*(2), 56-70. http://dx.doi.org/10.46762/mamulebd.1186464

Dobbins, K., Brooks, S., Scott, J.J.A., Rawlinson, M., & Norman, R.I. (2016). Understanding and enacting learning outcomes: The academic's perspective. *Studies in Higher Education, 41*(7), 1217–1235. http://dx.doi.org/10.1080/03075079.2014.966668

Elmas, R., Canbazoğlu-Bilici, S., Adıgüzel-Ulutaş, M., & Yalçın, S. (2022). An international perspective on science curricula: Identifying science teachers' views in private schools. *Bulletin of Educational Studies, 1*(1), 19-26. http://dx.doi.org/10.29329/bes.2022.480.03

Güngör Cabbar, B., Gültekin, S., Güneş, E., Aytaç, E., & Daşgın, F. (2020). Analysis of environmental achievements in 2018 science and biology courses curriculum according to the revised Bloom taxonomy. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 14*(1), 504-527. http://dx.doi.org/10.17522/balikesirnef.702537

Kalemkuş, J. (2021). Investigation of science curriculum learning outcomes in terms of 21st century skills. *Anadolu Journal of Educational Sciences International, 11*(1), 63-87. http://dx.doi.org/10.18039/ajesi.800552

Kalkan, Ö., & Tunç, T. (2020). A comparison of physics topics in middle school science curricula released between years 1924 and 2018. *Journal of Ihlara Educational Research, 5*(2), 294-326. https://doi.org/10.47479/ihead.807957

Kaptan, F. (1999). *Science teaching.* Milli Eğitim Basımevi.

Karalı, Y., Palancıoğlu, Ö.V., & Aydemir, H. (2021). Comparison of Turkey and Singapore primary school science programs. *Journal of İnönü University Education Faculty, 22*(1), 866-888. http://dx.doi.org/10.17679/inuefd.883126

Krathwohl, D.R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice, 41*(4), 212-218. https://doi.org/10.1207/s15430421tip4104_2

Mayer, R.E. (2002). Rote versus meaningful learning. *Theory into Practice, 41*(4), 226-232. https://web.mit.edu/jrankin/www/teach_transfer/rote_v_meaning.pdf

Turkish Ministry of National Education (MEB), (2006). Primary education science and technology lesson (6th, 7th and 8th grades) curriculum. http://ttkb.meb.gov.tr/program2.aspx

Turkish Ministry of National Education (MEB), (2013). Primary education institutions science course (3th, 4th, 5th, 6th, 7th and 8th grades) curriculum. https://ridvansoydemir.com/2013-fen-bilimleri-ogretim-programi/

Turkish Ministry of National Education (MEB), (2018). Science course (3rd, 4th, 5th, 6th, 7th, 8th) curriculum, Ankara. http://mufredat.meb.gov.tr/Dosyalar/201812312311937-FEN%20B%C4%B0L%C4%B0MLER%C4%B0%20%C3%96%C4%9ERET%C4%B0M%20PROGRAMI2018.pdf

Miles, M.B., & Huberman A.M. (1994). *Qualitative data analysis: An expanded sourcebook*. (2nd Edition). California: Sage Publications.

Özden, Y. (1997. *Learning and teaching.* Pegem Punlication.

Roth, C.E. (1992). *Environmental literacy: Its roots, evolution and directions in the 1990s.* ERIC Clearinghouse for Science, Mathematics and Environmental Education, Columbus, Ohio, USA.

Sadler, T. (2004). Informal reasoning regarding SSI: A critical review of research. *Journal of Research in Science Teaching, 41*(5), 513-536. https://doi.org/10.1002/tea.20009

Sağlamöz, F., & Soysal, Y. (2021). Exploration of 2018 primary and elementary sciences course teaching programs outcomes according to the revised Bloom taxonomy. *Journal of İstanbul Aydın University Education Faculty, 7*(1), 111- 145. https://doi.org/10.17932/IAU.EFD.2015.013/efd_v07i006

Şimşek, H. (2019). *Turkish teachers' opinions on realizability of renewed 5 th grade Turkish lesson curriculum outcomes (example of Kocaeli province).* Unpublished master's thesis. Sakarya: Sakarya University Institute of Educational Sciences.

Tatar, N. (2006). *The effect of inquiry-based learning approaches in the education of science in primary school on the science process skills, academic achivement and attitude*. Unpublished doctoral thesis. Ankara: Gazi University Institute of Educational Sciences.

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.

Tutkun, Ö.F., & Okay, S. (2012). An overview on Bloom's revised. *Sakarya University Journal of Education, 1*(3), 14-22. https://dergipark.org.tr/en/download/article-file/192275

Venville, G.J., & Dawson, V.M. (2010). The impact of a classroom intervention on grade 10 students' argumentation skills, informal reasoning, and conceptual understanding of science. *Journal of Research in Science Teaching, 47*(8), 952–977. https://psycnet.apa.org/record/2010-20931-003

Yaşar, Ş., & Duban, N. (2009). Students' opinions regarding to the inquiry-based learning approach. *Elementary Education Online, 8*(2), 457- 475.

https://earsiv.anadolu.edu.tr/xmlui/bitstream/handle/11421/11264/11264.pdf?sequence=1

Yıldırım, A., & Şimşek, H. (2016). *Qualitative research methods in the social sciences*. Seçkin Publication.

Yıldız-Bıçak, C., & Bilir, V. (2023). Evaluation of the information regarding scientists in the science textbooks from the teacher's perspective. *Journal of Mehmet Akif Ersoy University Faculty of Education,* 65, 487-511. https://doi.org/10.21764/maeuefd.1107010

Zorluoğlu, S.L., Kızılaslan, A., & Sözbilir, M. (2016). School chemistry curriculum according to revised Bloom taxonomy. *Necetibey Education Faculty Electronic Journal of Science and Mathematics Education, 10*(1), 260-279. https://doi.org/10.17522/nefefmed.22297

Zorluoğlu, S.L., Şahintürk, A., & Bağrıyanık, K.E. (2017). Analysis and evaluation of science course curriculum learning outcomes of the year 2013 according to the revised Bloom taxonomy. *Bartın University Journal of Faculty of Education, 6*(1), 1-15. http://dx.doi.org/10.14686/buefad.267190

Geniş Özet

Fen bilimleri eğitimi, fen bilimleri öğretim programında bulunan kazanımları öğrencilerin tecrübeleri sonucunda öğrenmelerini ve öğrencilerin kazanması gereken beceri ve tutumlarını, yeteneklerini kullanarak kazandırmak amacıyla oluşturulmuştur (Çepni, 2006). Bunun sonucunda araştıran, sorgulayan, problem çözme becerisi yüksek, kendisine güvenen, etkili iletişim kurabilen, işbirlikçi ortamlara dahil olan ve fen bilimleri öğrenen öğrenciler yetiştirmektedir (MEB, 2006, 2013, 2018; Tatar, 2006; Yaşar & Duban, 2009). Fen okuryazarlığı, bireylerde çevresel bilgi, tutum, beceri ve davranış boyutlarını kapsamakta olup, çevre sorunları ile karşı karşıya kalındığında bireylerin aktif katılımını sağlamayı amaçlamalıdır (Kalkan & Tunç, 2020; Roth, 1992). Öğretim programlarında, öğrenme çıktıları ile öğrencinin program sonunda neyi bilmesi, hangi tutumu kazanması ve ne gibi becerilere sahip olması gerektiği ortaya koyulur (Brooks vd., 2013). Öğrenme çıktılarının açık, anlaşılabilir ve ölçülebilir olması etkin bir öğrenme, öğretim ve değerlendirme süreci için önemlidir (Dobbins vd., 2016). Öğretimin nitelik ve yöntemleriyle analiz, sentez, değerlendirme, ilişkilendirme, soyutlama gibi yüksek düzeyde bilişsel becerilerini geliştirecek (Özden, 1997; Sadler, 2004; Venville & Dawson, 2010); konuların niteliğini kavramada yardımcı olabilecek ve öğrenilenleri nesnel dünya ile ilişkilendirecek bir biçimde düzenlenmesi eğitim sistemini 21. yüzyıla taşıyacak olan yapılanmanın önemli köşe taşlarından birini oluşturmaktadır (Kalemkuş, 2021; Trilling & Fadeli, 2009). Eğitim programlarının temel hedeflerinden biri, eleştiren, problem çözen, yaratıcı, düşünen, neden-sonuç ilişkileri arasında mantıksal bağlantıları fark eden bireyler yetiştirebilmek olmalıdır. Eğitimde hedeflerin belirlenmesi ve gerçekleştirilmesi için farklı ekollerin deneyimlendiği tarihsel süreçte 1950'li yıllarda geliştirilen taksonomiler önemli araçlardır. Bu tarihsel süreçte Bloom ve arkadaşlarının geliştirmiş oldukları Bloom Taksonomi'si program geliştirme tekniği günümüzde önemini korumaktadır.

Araştırmanın Amacı

Bu çalışmada 2018 Fen Bilimleri Öğretim Programı "Madde ve Doğası" konu alanında yer alan ortaokul kazanımlarının yenilenmiş Bloom taksonomisi basamaklarına göre analiz edilip "Madde ve Doğası" konu alanında yer alan ortaokul kazanımların Yenilenmiş Bloom Taksonomisindeki dağılımı ortaya konulması amaçlanmıştır.

Araştırmanın Deseni

Bu araştırma nitel bir çalışma olup, nitel araştırma yöntemlerinin birisi olan doküman analizi yöntemi kullanılarak yapılmıştır. Doküman analizi yöntemi; araştırılması istenen konu ya da alan hakkındaki yazılı materyallerin incelenmesini değerlendirilmesini kapsamaktadır (Yıldırım & Şimşek, 2016). Doküman incelemesi araştırma yapılan alan ve konu ile ilgili gözlem ve görüşme yapmaya ihtiyaç duymadan doküman inceleyerek birçok sonuç elde edilmesi doküman analizinin avantajları olarak ifade etmek mümkündür (Bowen, 2009).

Bulgular

Araştırmada, "Madde ve Doğası" konu alanına ait kazanımların yenilenmiş Bloom taksonomisine göre bilgi alt boyutlarına göre analizleri yapılmıştır. "Madde ve Doğası" konu alanındaki kazanımlarda en az üstbilişsel bilgi boyutuna yönelik kazanımların yer aldığı belirlenmiştir. En fazla bilgi boyutunun ise kavramsal bilgi boyutunda olduğu belirlenmiştir. "Madde ve Doğası" konu alanında yer alan kazanımların bilgi alt boyutlarında homojen bir biçimde dağılmadığı belirlenmiştir. Ayrıca Anderson ve Krathwhol (2001)'e göre sınıf düzeyi arttıkça olgusal bilgi boyutunda yer alan kazanımların azalış, işlemsel bilgi boyutunda yer alan kazanımların ise artış göstermesi gerekmektedir. "Madde ve Doğası" konu alanında yer alan kazanımların bilgi alt boyutlarının ortaokul sınıfları düzeyinde dağılımına bakıldığında ortaokul birinci düzeyden ikinci düzeye geçerken olgusal bilgi artış göstermektedir. İkinci sınıf düzeyinden sonra ise azalışın yaşandığı belirlenmiştir. Kavramsal bilgi boyutunda yer alan kazanım sayısının ise 7. Sınıf düzeyine kadar artış gösterdiği 8. Sınıf düzeyine geçince ise azalış gösterdiği belirlenmiştir. Oysa sınıf düzeyi arttıkça kazanımların üstbiliş bilgi basamağında veya üstbilişsel bilgi basamağına yakın olan bir basamakta yer alması gerekir ve olgusal bilgi basamağında yer alan kazanım sayısında ise azalma olması gerekmektedir (Anderson & Krathwohl, 2001). Oysa araştırmada sınıf düzeyinin artmasına rağmen üst düzey bilgi basamaklarında yer alan kazanım sayılarındaki artışın sadece işlemsel basamakta olduğu görülmektedir. "Madde ve Doğası" alanındaki kazanımlar yenilenmiş Bloom taksonomisinin bilişsel süreç basamaklarına göre değerlendirilmesi yapılmıştır. Yapılan değerlendirmeler incelendiğinde en fazla kazanımın uygulama ve anlama basamağında yer aldığı belirlenmiştir. Grafiğe genel olarak bakıldığında çözümleme basamağında yer alan kazanım sayısının ise en düşük seviyede

olduğu belirlenmiştir.

Tartışma ve Sonuç

Yapılan değerlendirme sonucunda Fen Bilimleri Öğretim Programı "Madde ve Doğası" konu alanında yer alan ortaokul kazanımların 35 kazanımın kavramsal bilgi boyutunda, 10 kazanımın işlemsel bilgi boyutunda, 6 kazanımın olgusal bilgi boyutunda ve 1 kazanımın üstbilişsel bilgi boyutunda yer aldığı görülmektedir. Öğretimin daha nitelikli olabilmesi için üst düzey bilgi boyutunda yer alan kazanım sayısının fazla olması gerekmektedir. Fakat yapılan inceleme sonucunda üst düzey bilgi boyutunda yer alan kazanım sayısının az olması öğretimin niteliği bakımından yetersiz kaldığını göstermektedir. Bu bağlamda bu konu alanında yer alan kazanımların bilgi boyutu bakımından yeniden düzenlenip üst düzey bilgi boyutunda yer alan kazanımların sayılarının arttırılması gerekmektedir. "Madde ve Doğası" konu alanında yer alan kazanımların bilişsel süreç boyutunu dikkate alarak yapılan analizde en fazla kazanımın %26 ile uygulama basamağında yer aldığı, buna en yakın basamağın %25 ile anlama basamağı olduğu ve en az kazanımında %6 ile çözümle basamağında yer aldığı görülmektedir (Şekil 5). Anderson ve Krathwohl (2001) yapmış oldukları çalışmada, öğretim programında yer alan kazanımların bilişsel süreç basamaklarına bakıldığı zaman genellikle hatırlama basamağı, anlama basamağı ve uygulama basamağında daha fazla kazanım yer alırken; çözümleme basamağı, değerlendirme basamağı ve yaratma basamağında daha az kazanıma yer verildiğini belirtmişlerdir. Bu ifade programdaki kazanımların büyük bir oranının anlama basamağında bulunması gerektiği anlamına gelmemektedir. "Madde ve Doğası" konu alanında yer alan kazanımların uygulama ve anlama basamağına ağırlık verilerek hazırlandığı ve üst düzey basamaklarda yer alan kazanım sayılarına ise yeteri kadar yer verilmediği görülmektedir. Anlamlı öğrenmenin ve bilgilerin günlük hayata transferinin gerçekleşebilmesi için uygulama, çözümleme, değerlendirme ve yaratma basamağında yer alan kazanım sayılarının arttırılması gerekmektedir (Mayer, 2002). Şekil 5 incelendiği zaman mevcut program içerisinde yer alan Madde ve Doğası konu alanındaki ortaokul kazanımlarının %58'ini Mayer (2002)'in ifade ettiği bilimsel süreç boyutlar oluşturmaktadır. Bu durum "Madde ve Doğası" konu alanında anlamlı öğrenmenin gerçekleşebilmesi için yeterli düzeyde olduğunu göstermektedir. Fakat programın değerlendirilmesinde genel durumu daha sağlıklı değerlendirmek için sınıf düzeylerine bakmak da gerekmektedir (Anderson & Krathwohl, 2010). Şekil 4 ve 6 da sınıf düzeylerini ayrı ayrı bakıldığında uygulama, çözümleme, değerlendirme ve yaratma basamaklarının tüm sınıf düzeylerinde anlama ve hatırlama basamağından fazla olduğu görülmektedir. Bu durum ortaokul düzeylerinde anlamlı öğrenmenin gerçekleşebilmesi için yeterli olacağı düşünülmektedir. İncelenen kazanımlarda öğrencinin üst düzey becerilerini arttırmaya yönelik kazanımların yeteri kadar olduğu fakat çözümleme basamağında yer alan kazanımların sayısı çok az sayıda kazanım olduğu görülmektedir (Şekil 4-5). Bu durum ise öğrencilerin Madde ve Doğası konu alanında bütünden parçaya gitmesini ve konuyu irdelemesini arttıracak kazanım sayısının yeterli olmadığını göstermektedir.