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EXAMINATION OF HIGH SCHOOL ENTRANCE SYSTEM (LGS) SCIENCE TEST "MATTER AND ITS NATURE" AND "PHYSICAL PHENOMENA" SUBJECT AREA EXAM QUESTIONS IN TERMS OF REVISED BLOOM'S TAXONOMY

LİSELERE GEÇİŞ SİSTEMİ (LGS) FEN BİLİMLERİ TESTİ "MADDE VE DOĞASI" İLE "FİZİKSEL OLAYLAR" KONU ALANI SINAV SORULARININ YENİLENMİŞ BLOOM TAKSONOMİSİ AÇISINDAN İNCELENMESİ

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Abstract

This research is a descriptive study that analyze the high school entrance(LGS) Science Test " Matter and Nature" and "Physical Phenomena" subject area exam questions according to the Revised Bloom's Taxonomy (RBT). Document analysis was used in the research, LGS exams held between 2018 and 2022 were examined and findings were obtained through descriptive analysis using the RBT matrix. As a result of the analysis, it was observed that 60% of the questions regarding RBT cognitive processes in the central exams between 2018 and 2022 were collected in the lower level domain level and 40% were collected in the higher level cognitive domain level. When the findings regarding the application of LGS questions to the RBT matrix are examined, they stand out most in the comprehension- factual knowledge (10 questions, 20%) and application- conceptual knowledge (10 questions, 20%) cells. Again in the matrix findings, it was found that no questions were asked about the relationship of the metacognitive knowledge level with other level of cognition. Based on the finding research various suggestions have been made regarding exam measurement criteria, educators' use of RBT and emergency pedagogy.

Keywords: LGS, Science, Revised Bloom's Taxonomy

Öz

Bu araştırma, Liselere Geçiş Sistemi (LGS) Fen Bilimleri Testi "Madde ve Doğası" ile "Fiziksel Olaylar" konu alanı sınav sorularının Yenilenmiş Bloom Taksonomisine (YBT) göre analizini ortaya koyacak betimsel bir çalışmadır. Araştırmada doküman analizi kullanılmış, 2018 - 2022 yılları arasında gerçekleştirilen LGS sınavları incelenmiş ve YBT matrisi kullanılarak betimsel analiz yoluyla bulgulara ulaşılmıştır. Analizler sonucunda, 2018–2022 yılları merkezi sınavlarda YBT Bilişsel süreçlerle ilgili olarak, soruların %60'ının alt düzey alan basamağında %40'ının da üst düzey bilişsel alan basamaklarında toplandığı gözlenmiştir. LGS sorularının YBT Matrisine uygulanmasına ilişkin bulgular incelendiğinde, en fazla Anlama – Olgusal Bilgi [10 soru, %20] ve Uygulama – Kavramsal Bilgi [10 soru, %20] hücrelerinde öne çıkmaktadır. Yine, matris bulgularında, üst bilişsel bilgi basamağının diğer biliş düzeyleriyle ilişkisi üzerine soru sorulmadığı bulunmuştur. Araştırmanın bulgularından hareketle sınav ölçme kriterlerive eğitimcilerin YBT kullanımına ilişkin ve olağanüstü hal pedagolojisi üzerine çeşitli öneriler sunulmuştur.

Anahtar Kelimeler: LGS, Fen Bilimleri, Yenilenmiş Bloom Taksonomisi

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1. INTRODUCTION

Education is defined as "the [process of] creating a permanent behavioral change in the desired direction in the individual" (Ayvacı & Türkdoğan 2010). The change in behavior included in the definition should be taken as an expression that includes mental processes, not just physical behavior in its concrete and visible sense. Based on this, the goal of the education approach is to raise individuals who learn and develop by applying what they have learned, rather than what is taught (Gündoğdu, 2022:1). Development towards using one's potential by gaining new attitudes, behaviors and skills, in a way, reveals the nature of the learning process.

After determining the target behaviors that are desired to be acquired by the individual, the appropriate outcome statement is determined according to the student's level, and the teaching practice is started by following the teaching methods and techniques. It is aimed to obtain feedback and data about the level of achievement of the goal, in other words, the level of effectiveness, by evaluating after or during the educational and instructional process. Therefore, when determining the achievements in the curriculum, today's conditions, the physical and mental development of the student should be monitored, and the methods and techniques should be taken into consideration with care. In other words, when determining the achievements, they should be determined carefully and meticulously on the way to the individuals who are targeted to be trained, who will support their ability to adapt to change, make it easier for them to choose the right information, analyze the information and relate it to their daily life, and produce an output when necessary (Özcan & Kaptan, 2019; Tutkun & Okay, 2012).

1.1. Transition System to High Schools (LGS)

In Türkiye central exams are carried out by the Student Selection and Placement Center (ÖSYM) and the Ministry of National Education (MEB) in order to place students in the last year of their academic level [or after graduation] in a higher education institution (Oğuztekin & Bektaş, 2023).

Since 1999, the Ministry has been applying a central exam to place eighth grade students in higher education institutions (high schools). The scope of the exam and the principles regarding its application are shared with the students, exam applications are received, and the placement scores are calculated on a certain basis and the students are placed in schools based on their preferences. The High School Transition System (LGS) exam, which was initiated in 2018 to select students for these institutions during the transition from secondary school level to secondary education institutions, or as its full name in the exam booklet is "CENTRALIZED EXAM FOR SECONDARY EDUCATION INSTITUTIONS THAT WILL ADMIT STUDENTS THROUGH THE EXAM", continues to be implemented (Taşkın & Aksoy, 2021; Kaya, 2022).When the exam booklets are examined, while a total of 50 questions are asked in the Verbal Section of the LGS exam, 20 from Turkish, 10 from English, 10 from History of Revolution and 10 from Religious Culture and Ethics courses; in the Numerical Section, a total of 40 questions are asked, 20 from Mathematics and 20 from Science courses. In the exam, which is held in two sessions, students are given 75 minutes for the verbal part and 80 minutes for the numerical part. In the exam, students are asked questions that aim to measure skills such as reading comprehension, drawing conclusions, problem solving, interpretation, and critical thinking (MEB, 2022).

1.2. Revised Bloom’s Taxonomy

Since the first taxonomy was published, Bloom's Taxonomy has been revised and updated many times in academic circles and educational institutions, taking into account the advances, changes and developments in human thought and understanding of knowledge in

almost every learning field, program and teaching level (Erol & Kavruk, 2021). According to Marzano & Kendall (2006:9), there are more than twenty studies on the development of this revised taxonomy. Bloom's Taxonomy is a remarkable attempt to provide a practical tool for educators and a classification of goals and a more clearly understandable guiding framework than any other attempt to date.

However, over time, the taxonomy has been criticized and has witnessed various debates. Although it is considered nice and useful to point out the existence of different dimensions and areas from a one-dimensional perspective regarding the nature of learning, it is stated that the classification put forward by Bloom et al. cannot fully measure the high-level cognitive skills that are intended to be measured in curriculum based on the constructivist approach (Marzano & Kendall 2006). When looking at the need and justification for a renewed taxonomy, four main points are emphasized (Krathwohl, 2002). First, while the first version of the taxonomy provided very few examples of how to use and plan in education-training activities, the renewed taxonomy includes various application examples from many areas of education within the scope of application in teaching / teaching programming. Secondly, in the original taxonomy, high school and higher education levels were emphasized; however, it has been stated that the updated new taxonomy system will not be limited to higher education only, but will address all levels of education (Marzano &Kendall, 2006). Evaluation scale examples were also used to facilitate understanding as a different innovation. The inclusion of examples and instructions makes it clearer what kind of expectations to expect at each step/dimension of the taxonomy, in other words, what to expect from the student, and these expectations are highlighted with verbs/action expressions in the taxonomy. As a last change, it can be said that in the Revised Bloom's Taxonomy, more careful attention should be paid to understanding the importance of subcategories (Günaydın, 2018).

In order to organize Bloom's taxonomy in a way that can classify the high-level cognitive skills required by student-centered humanist curriculum, the taxonomy prepared by Bloom was rearranged by Krathwohl et al. (2001). Ayvacı & Türkdoğan, 2010 especially emphasized that developments and new perspectives in cognitive psychology should be taken as basis, and the updated and modernized version of Bloom's Taxonomy was developed with a similar approach approximately fifty years later. In this new classification prepared in 2001, two different dimensions of the cognitive field come to the fore.

In the new taxonomy published in 2001, the cognitive domain was divided and rearranged into two dimensions: knowledge and cognitive process (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich et al., 2001; Krathwohl, 2002). The first dimension, the knowledge dimension, includes the nouns or noun phrases of the sentences included in the acquisition form in the curriculum.

In the new taxonomy, the knowledge dimension has been renamed as "Remember", the comprehension step as "Understand", the synthesis step as "Create", and the "Creation" step has been moved to the top and shown as the highest competence and skill.

The first stage of the cognitive dimension, 'Remember', is organized and defined under two subheadings. First, distinguishing and recognizing information using the information in long-term memory on the subject and then recalling the information for use is explained. The second stage is about understanding and includes seven subheadings. At this stage, it concerns competencies such as rewriting information about a subject, translating it, or providing the same expression with different words. The subheadings of interpretation, exemplification, classification, summarization, inference, comparison and explanation contribute to the understanding of information from a broad perspective.

2. METHOD

2.1. Research Model

This research, which aims to analyze the "Matter and Nature" and "Physical Phenomena" subject area questions asked in the Science Test in the High School Transition System (LGS) Exams, according to the Revised Bloom Taxonomy, is a descriptive study conducted with the survey model. Survey models are a form of research that aims to explain an existing situation (Karasar, 2007).

Within the scope of the research, questions related to the purpose were obtained through document analysis. Document analysis involves researching and examining written or visual sources/documents that can provide information about the phenomenon or facts intended to be investigated (Yıldırım & Şimşek, 2013). According to different sources (Bowen, 2009; Rapley (2018), document analysis can also be expressed as the process of re-examining, arranging, systematically examining electronic and/or printed materials and reporting the obtained data.

Data Collection and Analysis

In the study, the primary source was the 2018 Science Curriculum (Primary and Secondary School 3rd, 4th, 5th, 6th, 7th and 8th Grades) published by TTKB in 2018 (MEB, 2018). Sciences Course Curriculum was used.

A total of 33 achievements in this program, determined for the subject areas of 'Matter and Nature' and 'Physical Phenomena', which were determined as the subject areas of this research, were examined and RBT was classified according to both knowledge and cognitive process dimensions. The curriculum was accessed from the website http://ttkb.meb.gov.tr, the file was downloaded to the computer and saved for later use offline. In addition to the primary source used, other sources such as sources obtained as a result of literature review, reports published by national and international organizations, books, theses, articles and papers related to science education and RBT were also used for the literature, method and discussion sections.

In this research, where document analysis was used, the steps stated by Foster and recommended to be followed were followed (cited in Yıldırım & Şimşek, 2008, p. 193):

1- Accessing documents,

2- Researching / checking its originality,

3- Comprehension of documents,

4- Examining the data,

5- Using and analyzing data

2.2. Data Collection Tools and Analysis

Since the research was designed as a descriptive study, the 2018 Science Course Curriculum (Primary and Secondary School 3rd, 4th, 5th, 6th, 7th and 8th Grades) (MEB, 2018), which is the subject of the research, was prepared for 8th Grade Science Courses. After accessing the Course Curriculum, a matrix called "LGS Questions - Achievements - RBT Matrix" (ANNEX…) was created by the researcher, which included the subject area, exam year, target questions, relevant achievement and RBT Matrix, and was used as the basis for categorizing the data.

The relevant matrix was delivered to three different field experts (Academics in Dicle University Education Programs), who were selected as experts who have knowledge of the research subject and conduct academic studies on related subjects, the purpose of the research

was explained and a volunteer-based study was conducted. Field experts examined the questions separately and independently, processed and submitted them to the relevant matrix according to the knowledge and cognitive process dimensions, taking into account the criteria in the RBT table.The received forms were transferred to Microsoft Excel, and the results in terms of descriptive statistics, frequency and percentage were presented in tables, graphed and interpreted.

2.3. Validity and Reliability

Validity and reliability are important points that need to be taken into consideration as two criteria regarding the acceptance and credibility of the results of qualitative research (Başle, 2016). However, validity and reliability approaches of quantitative and qualitative research also differ due to differences in perspective and research process (Yıldırım & Şimşek, 2013). In fact, some researchers (Houser, 2015; Krefting, 1991; Merriam, 2013) argue that it would be more accurate to use the expression "credibility" instead of "validity" in qualitative research. Consultation with experts is also a way to increase credibility.

In this research, which aims to analyze the "Matter and Nature" and "Physical Phenomena" subject area questions in the High School Transition System (LGS) Science Tests according to the Revised Bloom’s taxonomy, firstly the literature was scanned, Science teaching programs were accessed, and studies conducted on similar or similar subjects were summarized. First of all, access to the correct documents from reliable sources was determined as a priority, and for this purpose, the 2018 FBDÖP was downloaded from the website of the Ministry of National Education, Board of Education and Discipline, and this source was meticulously examined as the "primary source" in the analysis of the achievements. In addition, domestic and international studies and books related to the Revised Bloom’s Taxonomy, which constitutes the second title of the research, were also scanned, and a detailed explanation of the taxonomy was included in the section where the theoretical framework is presented.

As a dimension of increasing internal validity, it is important for researchers to evaluate objectively, independently of and away from their biases. The questions selected within the scope of this research were evaluated by experts [3 different experts] with an impartial and objective approach and were recorded in the matrices. According to Creswell (2003), possible errors such as handling insufficient, incorrect or irrelevant sources, failure to create themes and categories correctly, or misinterpretation of data are situations that risk credibility in qualitative research. In order to avoid these and similar situations, asking experts who have knowledge and experience in research and in qualitative research methods to be involved in the research or data analysis process is an appropriate choice in terms of both validity and reliability (Yıldırım & Şimşek, 2013).

Conducting a qualitative data analysis that is removed from individuality and the influence of prejudices is a very difficult situation, and in this case, achieving consensus among different coders/researchers regarding a data set stands as an important step and practice. This similarity and agreement consensus value is also seen as a sign that determines the reliability of qualitative research. In the Miles and Huberman analysis model, this similarity, which can also be called internal consistency and conceptualized as consensus between coders, is calculated with the formula below (Figure 1). According to the coding audit that ensures internal consistency, the consensus between coders is expected to be at least 80% (Patton, 2002; Creswell, 2003; Miles & Huberman, 1994).

[Reliability=Consensus/(Agreement+Disagreement)]

Figure 1. Miles and Huberman (1994) consensus formula

Using the calculation formula in Figure 1, the opinions of 3 different coders who are experts in their fields regarding the analysis of the "Matter and Nature" and "Physical Events" subject area exam questions asked in the High School Transition System (LGS) Science Test between 2018 and 2022 according to the Revised Bloom's taxonomy. Unity was calculated as 0.92. Since this value is above 0.80, which is expressed as the threshold value, it can be said that the codings are reliable.

3. FINDINGS

Findings regarding RBT of the questions in the subject areas of "Matter and its Nature" and "Physical Phenomena" asked in the central exams (LGS) held between 2018 and 2022

The sub-problem statement of the research is *"What is the distribution of the questions asked in the subject areas of "Matter and its Nature" and "Physical Events" according to the Revised Bloom's Taxonomy knowledge and cognitive process dimensions*? expressed in the form. To answer this question, the central examination (LGS) applied between 2018 and 2022 was examined, the questions were evaluated by experts in terms of the Revised Bloom's Taxonomy dimensions and were processed into data collection matrices.

3.1. Findings Regarding RBT Cognitive Process Dimension

The matrices collected by the researcher were examined and the exam questions falling into the subject areas of "Matter and Its Nature" and "Physical Phenomena" were analyzed separately in terms of knowledge dimension and cognitive process dimensions. Descriptive statistics, frequency and percentage were used to express the results, and the findings, primarily in terms of the cognitive process dimension, are shown in Table 6.

Table 1. Number of questions in the subject areas "Matter and its Nature" and "Physical Phenomena" within the scope of 8th Grade FBDÖP and findings regarding RBT Lower and Higher Level Cognitive Domain Steps

Cognitive dimension	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**	**%**	**Number of lower level questions**	**Percentage of lower level questions**
Remember	1	0	0	0	0	1	2		
Understanding	5	2	2	1	3	13	26	30	60
Application	1	3	4	4	4	16	32		
Analysis	3	4	1	1	3	12	24		
Evaluation			1			1	2	20	40
Creating		3		3	1	7	14		
General Total	10	12	8	9	11	50	100	50	100

The findings in the table show that, as a result of the findings obtained as a result of the expert evaluation made according to RBT, 60% of the questions aimed at evaluating the

subject areas of "Matter and Nature" and "Physical Phenomena" in the LGS Science Tests between 2018 and 2022 were answered at the lower level field level and 40% of them were at the lower level field level. shows that it is concentrated in higher-level cognitive domain levels.

When we look at the lower level cognitive steps, 1 question (2%) asked in the 2018 exam is at the Remembering level, a total of 13 questions (26%) are at the Understanding level and 16 questions (32%) are at the Application level. Considering that these steps include basic stages in terms of achievements, students are expected to remember the basic terms related to the course, understand the basic relationships and be able to apply some basic steps in the desired direction. It can be stated that basic level competencies are prioritized in LGS exams. When the upper level levels are examined, 12 (24%) of the questions asked in the LGS exams administered between 2018 and 2022 and in the subject areas of this research are in the Analysis stage, 1 (2%) is in the Evaluation stage and 7 (14%) are in the Application stage. It can be thought that a total of 20 questions (40%) in the upper-level cognitive domain steps are included with the 'new generation' question types that have been implemented especially in recent years. Since only one question was identified in the Evaluation step and only one question in the Remembering dimension, it can be thought that a little more questions could be added to these steps.

Table 2. Question numbers in the subject areas "Matter and its Nature" and "Physical Phenomena" within the scope of 8th Grade FBDÖP and findings regarding RBT Lower and Higher Level Cognitive Field Steps

Cognitive process dimension	**2018**	**2019**	**2020**	**2021**	**2022**
Remember	S16				
Understanding	S7, S12, S17, S18, S19	S16, S19	S17, S19	S17	S13, S14, S17
Application	S8	S10, S11, S17	S11, S13, S14, S16	S12, S13, S19, S20	S10, S11, S18, S19
Analysis	S13, S15, S20	S8, S9, S12, S18	S18	S16	S15, S16, S20
Evaluation			S20		
Creating		S14, S15, S20		S14, S15, S18	S12

When Table 2 is examined, it can be seen that, specific to the years, in the 2018 LGS exam, a total of 10 questions were included from these subject areas [Matter and Nature" and "Physical Events", S8 was for the Application step and S16 was for the Remembering step, however, high-level cognitive areas were included. It has been determined that there is no question regarding the evaluation and creation steps. Looking at the questions of 2019, it is noteworthy that a total of 12 questions were asked, there were more questions at the higher-level cognitive levels, but there were no questions regarding the Remembering stage. Looking at the number of questions in 2020, it can be seen that there were 8 questions related to the purpose of the research, the majority of the questions were concentrated in the lower level steps,

and there were no questions regarding the Creation and Remembering steps. This year, keeping in mind that there is a coronavirus outbreak, it can be thought that a more intermediate level central exam will be held. Looking at 2021, it attracts attention with 3 questions placed especially in the Creation step. While 1 question [S16] was collected in the Analysis step, 1 question [S17] was collected in the Understanding and 4 questions [S12, S13, S19, S20] were collected in the Application stage, no questions were asked in the Evaluation and Remembering stages.

3.2. Findings Regarding the RBT Knowledge Dimension

The matrices collected by the researcher were examined and the LGS exam questions falling into the subject areas of "Matter and Its Nature" and "Physical Phenomena" were analyzed in terms of knowledge dimension. The knowledge levels that are expected to form the basis for solving the questions are marked. Descriptive statistics, frequency and percentage were used to report the results, and the findings are shown in Table 3 and Table 4.

Table 3. Findings regarding the number of questions in the subject areas of "Matter and its Nature" and "Physical Phenomena" within the scope of 8th Grade FBDÖP and the distribution according to the RBT Knowledge Dimension

Knowledge dimension	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**	**Percentage (%)**
Factual knowledge	8	1	2	1	1	13	26
Conceptual knowledge	1	6	5	3	7	22	44
Procedural knowledge	1	5	1	4	3	14	28
Metacognitive knowledge				1		1	2
General Total	10	12	8	9	11	50	125

When Table 3 is examined, in terms of knowledge, 13 (26%) of the 50 LGS questions examined within the scope of the research require knowledge in the Factual Knowledge level, 22 questions (44%) require knowledge in the Conceptual Knowledge level, and 14 questions (28%) require knowledge in the Procedural Knowledge level. However, only 1 (2%) of the questions required metacognitive knowledge. The findings and distribution regarding subject areas and question numbers are shown in the table. When the tables were examined, the question that would require students to use their knowledge capacity at the metacognitive level was found among the questions asked in the exam in 2021. While the 2018 exam consists of questions based on factual information, in other years questions based on conceptual knowledge stand out.

Table 4. Findings regarding the question numbers in the subject areas of "Matter and its Nature" and "Physical Phenomena" within the scope of 8th Grade FBDÖP and the distribution according to the RBT Knowledge Dimension

Knowledge dimension	**2018**	**2019**	**2020**	**2021**	**2022**
Factual knowledge	Q7, Q8, Q12, Q13, Q15, Q17, Q19, Q20	Q16	Q17, Q19	Q17	Q17
Conceptual knowledge	Q18	Q8,Q9, Q11, Q12, Q17, Q19	Q11, Q13, Q14, Q16, Q18	Q12, Q13, Q16	Q10, Q11, Q13, Q14, Q15, Q14, Q20
Procedural knowledge	Q16	Q10, Q14, Q15, Q18, Q20	Q20	Q14, Q15, Q19, Q20	Q12, Q18, Q19
Metacognitive knowledge				Q18	

3.3. Findings Regarding the Application of LGS Questions to the RBT Matrix

Expert evaluation matrices collected by the researcher were examined, and LGS exam questions falling into the subject areas of "Matter and Nature" and "Physical Phenomena" were arranged in a table on the Revised Bloom's Taxonomy matrix. Questions are coded as year and question number. Descriptive statistics, frequency and percentage were used in reporting the results and the findings are shown in Table 10.

According to the table, it is most prominent in the Comprehension – Factual Knowledge [10 questions, 20%] and Application – Conceptual Knowledge [10 questions, 20%] cells. Afterwards, Analysis – Conceptual Knowledge [8 questions, 16%] and Creation – Procedural Knowledge [6 questions, 12%] also attract attention in terms of the number of questions. A priority area of evaluation here is that students must first have conceptual and factual knowledge, then be able to understand the questions and apply that knowledge to find the option that will be the correct answer to the question. Being able to analyze as high-level cognitive areas and designing a model or reading a model correctly by following the process steps are also competencies that students should have based on the data in this table.

In addition, in the exams examined, Application - Procedural Knowledge presents a less common situation with 5 questions [10%] and Comprehension - Conceptual Knowledge with 3 questions [6%]. Reaching a solution by fully and better understanding the situation given in the question by applying knowledge of the procedures or using conceptual knowledge is also targeted as important competencies.

Table 5. Findings Regarding the Application of LGS Questions to the RBT Matrix

Knowledge dimension	***Cognitive process dimension***					
	Remember	Understanding	Application	Analysis	Evaluation	Creating
Factual knowledge	2018Q16 (%2)	2018Q7, 2018Q12, 2018Q17, 2018Q18, 2018Q19, 2019Q16, 2020Q17, 2020Q19, 2021Q17, 2022Q17 (%20)	2018Q8 (%2)	2018Q13, 2018Q15, 2018Q20 (%6)		
Conceptual knowledge		2019Q19, 2022Q13, 2022Q14 (%6)	2019Q11, 2019Q17, 2020Q11, 2020Q13, 2020Q14, 2020Q16, 2021Q12, 2021Q13, 2022Q10, 2022Q11 (%20)	2019Q8, 2019Q9, 2019Q12, 2020Q18, 2021Q16, 2022Q15, 2022Q16, 2022Q20 (%16)		
Procedural knowledge			2019Q10, 2021Q19, 2021Q20, 2022Q18, 2022Q19 (%10)	2019Q18 (%2)	2020Q20 (%2)	2019Q14, 2019Q15, 2019Q20, 2021Q14, 2021Q15, 2022Q12 (%12)
Metacognitive knowledge						2021Q 18 (%2)

Looking at the RBT matrix, Analysis – Procedural Knowledge [1 question, 2%], Evaluation – Procedural Knowledge [1 question, 2%], Application – Factual Knowledge [1 question, 2%], Remembering – Factual Knowledge [1 question, 2%].] and Creation – Metacognitive Knowledge [1 question, 2%] cells, it was determined that only one question was asked. While there is a question from the metacognitive knowledge and creation cell, no questions were found in the Creation - Factual Knowledge, Creation - Conceptual Knowledge, Remembering - Conceptual Knowledge and Remembering - Procedural Knowledge cells. No questions were asked about the relationship of the metacognitive knowledge level with other levels of cognition.

4. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

4.1. Discussion

Under this heading, the findings of a descriptive study that will analyze the High School Transition System (LGS) Science Test "Matter and Nature" and "Physical Phenomena" subject area exam questions according to the Revised Bloom’s taxonomy are compared with the shared findings of previous research in the field, evaluations and discussions are included.

In line with the findings, 60% of the distribution of LGS questions regarding the RBT Cognitive Process Dimension in the subject areas of "Matter and Nature" and "Physical Phenomena" in the LGS Science Tests between 2018 and 2022 were collected in the lower-level domain steps and 40% in the higher-level cognitive domain levels. shows. It can be said that LGS exam questions focus more on low-level cognitive achievements.

Looking at the research in the literature, the findings confirm and support the findings of this research (Güneş, 2023; Gündoğdu, 2022; Aslan & Atik, 2018; Çolak Şeker, 2022; Yolcu, 2019; Aktan, 2020; Gökler, Aypay & Arı, 2012; Güven, 2014; Polat & Bilen, 2022; Yaman & Koray, 2002; Koman, 2022; Ekinci & Bal, 2019; Tel Aksakal, 2023; Baş & Beyhan, 2012; Karamustafaoğlu, Sevim, Karamustafaoğlu & Çepni, 2003; Pugh & Gates, 2021 ;Mahroof & Saeed, 2021; Wei & Qu, 2018;Lalogiroth &Tatipang 2020, Üzümcü & İpek, 2022; Özgün Günel, 2023; Çelik, 2022).

Özgün Günel (2023) reveals a similar finding in his study examining LGS and TEOG Science questions. Similarly and supportively, Güneş (2023) conducted a YCT analysis of LGS Science course questions between 2018 and 2021 and determined that the majority of the questions were at the Comprehension level in terms of cognitive process. Çelik (2022) also examined skill-based 'new generation' question types in his study and found that the questions placed more emphasis on lower-level cognitive competencies. Focusing on the questions of science teachers and LGS exams, Koman (2022) also states that teachers look for the most basic information, that is, factual information, and the questions they ask remain at the Remembering and Understanding level. Çolak Şeker (2022), Güven (2014), and Çolak Şeker & Demir (2022) found in their studies focusing on the content questions and end-of-unit evaluation questions of science textbooks that the majority of the questions were in the sub-cognitive stages of Remembering, Understanding, and Application. The point reached here suggests that students' developmental characteristics and readiness levels are also taken into account in the preparation of course materials. At the secondary school level, a situation appropriate to the students' knowledge and maturity level emerges.

In their study where Kocakaya & Gönen (2010) carried out the Original Bloom’s Taxonomy analysis of Physics questions in high school Physics exams and ÖSS exams, they found that more than half (52%) of the questions asked by teachers in Physics course written exams in different school types were at the lower level of cognition, while only 5% were at lower level cognition. They found that 27.5 percent were at the high level of cognition. The highest number of questions at the high-level cognition level are asked in Science High Schools, in accordance with the type of school. The distribution of ÖSS exam questions between 2000 and 2005 was found to be at the level of Application (45%) and Analysis (43%), in other words, at the intermediate level of cognition. Karamustafaoğlu, Sevim, Karamustafaoğlu & Çepni (2003) found in their study in schools such as Plain High School, Anatolian High School and Science High School in Amasya and Trabzon provinces that teachers mostly asked questions requiring proficiency at lower levels in Chemistry exams. In his review of primary school Mathematics Curriculum achievements, Aktan (2020) found that the achievements were

generally concentrated on lower-level steps, and that the achievements involving high-level cognitive steps such as analysis, creation and evaluation were few. Aslan and Atik (2018) also say that, according to the cognitive process dimension, the majority of Turkish course achievements are related to lower-level thinking skills (remembering, understanding, applying). Gökler, Aypay & Arı (2012) also reached a similar finding when we looked at the English course SBS exam questions and written attendance exam questions.

Wei & Qu (2018) conclude that the questions in science classes in secondary schools in Mainland China, Taiwan, Hong Kong & Macao are again aimed at lower-level cognitive skills. Again, Lee, Kim & Yoon (2015) also state that the curriculum of science courses given in schools from the third to the sixth grade in Korea and Singapore focuses on lower-level competencies. As a similar finding, Pugh & Gates (2021) and Cullinane & Liston (2016) also report that questions focused on lower-level cognitive competencies are asked in university Physics courses. Cullinane & Liston (2016) stated that the majority of questions in end-of-high school Biology exams are at a level that does not require a high level of competence.

Lalogiroth & Tatipang (2020) also analyze Indonesian High School students 2015 – 2016 English National Exam questions in terms of RBT cognitive domains. In addition to the questions, as a result of the interviews with the teachers, it was concluded that the questions were mostly concentrated in the lower level cognitive levels, concentrated in the areas of Remembering and Understanding, and there were no questions at the Evaluation and Creation levels. Regarding the mathematics and science curricula of Estonia, Slovenia, Poland and the Czech Republic, Kácovský & others (2022) also found that very few achievements regarding higher-level cognitive competencies were included. Edwards (2010), who conducted an analysis of 12th Grade Science course questions, also provides a similar and supportive result from South Africa.

However, there are also studies that differ from the findings of this study and reach contradictory findings. Ekinci & Bal (2019), who examined the Mathematics questions of 2018, and Üzümcü & İpek (2022), who examined the 2021 LGS questions and Mathematics achievements, concluded that the mathematics questions were mostly aimed at the high-level cognitive domain. Yılmaz & Doğan (2022) also observed that there are no questions in the Remembering, Understanding and Creating dimensions in terms of the cognitive process dimension, and that the questions are frequently piled up in the Application, Analysis and Evaluation steps in the cognitive process dimension of the Revised Bloom's taxonomy. From this perspective, it can be said that Mathematics questions present a high-level domain-oriented view.

Again, as an indication of a different finding, a data that was put forward in a different culture and differs from the findings of this study, Tikkanenand & Aksela (2012) reported that in the examination of Chemistry questions in proficiency exams in Finland, the rate of questions requiring the use of Lower Level cognitive abilities was 23% (60 questions). The rate of questions requiring the use of high-level cognitive abilities was calculated as 77% (197 questions). Additionally, unlike this study, Tikkanen & Aksela (2012) did not find any questions in their analysis that required only factual knowledge and metacognitive competence at the level of recall. It is understood that proficiency exams include questions in more than one category and proficiency level. Regarding the differing findings, it can be thought that the content of the courses, as well as the unique characteristics of the class level and schools, their differences and question-solving approaches, and the educational policies of the countries may have affected the results in this regard. Considering that proficiency exams are also selection and ranking exams, and that the questions may differ from normal and may aim to determine

higher-level skills and knowledge potential, it can be seen as an understandable situation to include more questions related to high-level cognitive competence.

In this study, regarding the distribution of questions according to cognitive steps, when looking at the lower level cognitive steps, the most questions were determined in the Application level [16 questions (32%)] and in the Comprehension level [13 questions (26%)]. Many available studies reveal similar results (Zorluoğlu, Kızılaslan & Sözbilir, 2016; Avcı, Aslangiray & Özyalçın, 2021; Cangüven & Avcı, 2022, Bekdemir & Selim, 2008; Yolcu, 2019; Pugh & Gates, 2021; Güneş, 2023). According to Güneş (2023) and Tel Aksakal (2023), while the most questions were found at the Comprehension level, Pugh & Gates (2021) found that more questions were asked at the application level in university Physics written examinations. However, there are also studies (Tikkanen & Aksela, 2012) that reveal that more importance is given to analysis and high-level competencies.

In this study, it was observed that the lowest number of questions was in the Remember[1 question (2%)] and Evaluation[1 question (2%)] steps. In a study conducted in Finland (Tikkanen & Aksela, 2012), it was observed that there were no questions that students could answer only at the Remembering level.

When the knowledge dimension is evaluated, in this research, 26% of the total 50 LGS questions examined require knowledge at the Factual Knowledge level, 44% at the Conceptual Knowledge level and 28% at the Procedural Knowledge level. However, among the questions, the number of questions requiring metacognitive knowledge was determined at a very low rate (only 1 question, in 2021). Supporting these findings, similar studies in the literature also show that the gains are more conceptual knowledge-based (Bekdemir & Selim, 2008; Avcı, Aslangiray & Özyalçın, 2021; Gündoğdu, 2022; Zorluoğlu, Kızılaslan & Sözbilir, 2016; Yolcu, 2019; Baş & Özyalçın, 2021). Beyhan, 2012; Ekinci & Bal, 2019; Güneş, 2023, Tel Aksakal, 2023; Özgün Günel, 2023).

Kim (2019) also reports in his research that the gains in the environmental education curriculum in both Australia and Korea are based on Conceptual knowledge. While the majority of the questions in Tikkanenand & Aksela (2012), Özgün Günel (2023) and Yılmaz & Doğan (2022) required procedural knowledge, the number of questions requiring conceptual and procedural knowledge in Güneş (2023) was found to be close to each other. Tel Aksakal (2023), who examined the Religious Culture and Ethics Course LGS questions, also identified conceptual knowledge at the forefront. In the studies by Üzümcü & İpek (2022) and Yılmaz & Doğan (2022) where they examined the 2021 LGS mathematics questions and achievements in terms of RBT, the results in terms of the knowledge dimension of the taxonomy were more oriented towards the procedural and metacognitive knowledge dimension of the questions, while the 8th grade mathematics achievements measured by these questions were not. It indicates that it requires more factual, conceptual and procedural knowledge. As a different finding, Tikkanen & Aksela (2012) conclude that no questions requiring metacognitive knowledge are included in the proficiency exam in Finland.

The findings of the research indicate that LGS questions are at a sufficient level in terms of question preparation and question content for program achievements, however, they appear to be at a lower level and superficial, especially in terms of knowledge levels and the use of cognitive potential. As a national selection and placement exam, including more questions in LGS that require the use of high-level cognitive areas can help understand the student's capacity as well as school success. The fact that the Science course is a course that is 'directly linked to life' and that many things taught and learned in the classroom can be observed

and experienced can be said to be a feature that can be evaluated in terms of high-level knowledge and cognitive potential on this subject.

If we make a general evaluation, when we look at the findings of the studies conducted at the national level and in different countries and educational contexts, excluding the Finnish Chemistry proficiency exam, asking questions based on lower-level cognitive domains, regardless of the course or curriculum, results in a more intermediate level of learning and teaching before the transition to higher education. Limiting the scope of the program and emphasizing and appropriateness to the developmental characteristics of the students come to mind. The questions posed in the exams emphasize a more solid level of basic knowledge and skills and leave metacognitive knowledge and higher-level cognitive competencies such as evaluation and creation to later periods.

Considering the field findings (Miedijensky, Sasson & Yehuda, 2021, Polat & Bilen, 2022), questions and educational activities aimed at developing high-level skills will both increase students' academic success in national exams and have a positive impact on the organizational effectiveness level and culture of schools. Instead of just memorizing certain names, formulas, places and basic terminology, students' ability to use this information, synthesize it with new information and create a new situation/context/product can affect the quality of their lives more positively and make it easier for them to adapt to developments. In this case, the function of schools to prepare students for life as more productive and successful individuals in terms of both working life and social relations will be ensured.

Particularly, considering that the results of the applications implemented at the international level at PISA, TIMMS, PIRLS and TALIS class levels and aiming to measure certain competencies are guiding national education policies and practices, the application and analysis skills of the Revised Bloom's Taxonomy are given a separate heading and analysis in the preparation of the questions of the national exams and the determination of the scope. Allocating time can be considered as an option that will increase the level of harmony between the content and achievements of the curriculum and the exam questions and the rate of compatibility with contemporary education programs. In preparing evaluation questions or exam questions for education and training activities, while taking into account students' knowledge levels, development levels and proficiency levels, the basic requirements of the next level of education (high school or higher education) should not be forgotten and the context should be expanded with a more holistic strategy.

4.2. **Results**

The findings of the research will be summarized in accordance with the order in the research sub-problems, the findings will be evaluated together with the results of research in the field, and suggestions will be developed based on the findings.

Looking at the distributions of the Revised Bloom's Taxonomy regarding the cognitive process, 60% of the questions regarding the evaluation of the "Matter and Nature" and "Physical Events" subject areas in the LGS Science Tests between 2018 and 2022 were at the lower-level domain level and 40% were at the higher-level cognitive domain level. shows that it is collected. It can be said that LGS exam questions focus more on low-level cognitive achievements.

The highest number of questions on lower-level cognitive steps were determined in the Comprehension level [13 questions (26%)] and the Application level [16 questions (32%)]. Considering that these steps include the basic parts and stages of the courses, it is aimed to measure whether the students remember the basic terms, names, dates or formulas related to the course, understand the basic relationships and can apply some basic steps in the desired

direction. It can be stated that the LGS exams of the last five years primarily focused on basic level competencies.

Looking at the results in terms of upper level levels, 12 (24%) of the questions asked in the LGS exams administered between 2018 and 2022 and in the subject areas of this research are in the Analysis stage, 1 (2%) in the Evaluation stage and 7 (14%) in the Application stage. is in the step. It can be thought that a total of 20 questions (40%) in the upper-level cognitive domain steps are included with the 'new generation' question types that have been implemented especially in recent years. Since only one question was identified in the Evaluation step and only one question in the Remembering dimension, it can be thought that a little more questions could be added to these steps. New generation questions require reading comprehension, data processing, remembering, ability to use achievements within a system and broader thinking, and it will be beneficial for students to improve themselves in this regard.

When the findings regarding the Knowledge dimension are evaluated, in terms of knowledge, 13 (26%) of the total 50 LGS questions examined require knowledge at the Factual Knowledge level, 22 questions (44%) require knowledge at the Conceptual Knowledge level, and 14 questions (28%) require knowledge at the Procedural Knowledge level. However, the number of questions requiring metacognitive knowledge was found to be very low, with only 1 (2%) among the questions asked in the 2021 exam. While the 2018 exam consists of questions based on factual information, in other years questions based on conceptual knowledge stand out.

When the findings regarding the application of LGS questions to the RBT Matrix are examined, they stand out most in the Comprehension – Factual Knowledge [10 questions, 20%] and Application – Conceptual Knowledge [10 questions, 20%] cells. Afterwards, Analysis – Conceptual Knowledge [8 questions, 16%] and Creation – Procedural Knowledge [6 questions, 12%] also attract attention in terms of the number of questions. It is a priority for exam practitioners that students should first have conceptual and factual knowledge about the foundations of the courses, their names, locations, relationships with other subjects and basic systematics, and then be able to understand the questions and apply that knowledge to find the option that will be the correct answer to the question. Being able to analyze as high-level cognitive areas and designing a model or reading a model correctly by following the process steps are also competencies that students should have based on the data in this table.

In addition, in the examinations examined, Application - Procedural Knowledge and Understanding - Conceptual Knowledge were included in a small number of questions, while Analysis - Procedural Knowledge, Evaluation - Procedural, Application - Factual Knowledge, Remembering - Factual Knowledge and Creation - Metacognitive Knowledge were tested with only one question. While there is a question from the metacognitive knowledge and creation cell, no questions were found in the Creation - Factual Knowledge, Creation - Conceptual Knowledge, Remembering - Conceptual Knowledge and Remembering - Procedural Knowledge cells. It was concluded that no questions were asked about the relationship of the metacognitive knowledge level with other levels of cognition. From the perspective of the matrix, reaching a solution by fully and better understanding the situation given in the question by applying knowledge of the operations or using conceptual knowledge should be targeted as important competencies and should be tested in exams with more questions.

Generally speaking, it has been concluded that the skills required from students in the examined LGS questions are predominantly at the conceptual knowledge, factual knowledge and comprehension level.

4.3. Suggestions

The following recommendations have been developed within the scope of the research findings:

• In order to increase the effectiveness of centrally administered national selection and ranking exams, it may be suggested to include high-level cognitive achievements such as creation, explanation and analysis, as well as procedural knowledge and metacognitive knowledge levels, into course activities. In order to be supportive and guiding in this regard, the number of skill-based question examples published by the Ministry of National Education and shared at regular intervals can be increased.

• Developing an application related to question and activity planning specific to RBT in education faculties can increase the level of knowledge and awareness of both prospective teachers and teachers regarding the advantages and contribution of the taxonomy in the classification and evaluation of educational objectives and can open the door to a more efficient education system.

• In central exams, it is expected that the inclusion of questions that require the use of metacognitive knowledge will be quite limited, due to the nature of multiple choice questions. However, especially in written exams, teachers should encourage open-ended questions, group studies, portfolio and presentation studies to support students in applying what they have learned and giving new and original answers of their own design.

• This research is limited to the LGS exam. In the following years, AÖF exams, YKS etc. Qualitative, mixed or quantitative studies can be conducted on the scope of the exams and the compliance levels of achievements.

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