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Analysis of High School Entrance Exam (LGS) Questions in Terms of PISA Scientific Literacy*

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ABSTRACT

The Ministry of National Education (MEB) abolished the Transition Examination from Primary Education to Secondary Education (TEOG) in 2017 and replaced it with the High School Entrance Examination (LGS). In this study, it is aimed to analyze the content of LGS questions applied to students in the last four years and to evaluate them in terms of PISA science literacy dimensions. In this context, the study in question is suitable for the qualitative research paradigm. Content analysis was used in data analysis. When the contents of the questions in the LGS, the questions related to content knowledge and scientific explanation of events are examined in 2017-2018 and 2019-2020, the questions related to the local (national) context are analyzed in 2019-2020 and 2020-2021, questions related to physical systems content area are encountered more in 2017-2018 and 2018-2019 years. However, it was seen that the questions examined by years were mostly at a medium level in terms of cognitive level. Finally, with the change in the exam in the Turkish Education System, it is aimed to increase the success of an exam that measures various skills at the international level, and what can be improved measures for this are explained in the suggestions section.

Keywords: PISA, High School Entrance Exam (LGS), Science Literacy, Document Analysis

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INTRODUCTION

With the technological developments in the world, it is important to raise individuals with various skills, to integrate the information they have learned into daily life, to be able to use it and to be literate against the events happening around them. In this respect, it will be possible for countries to raise individuals with 21st century skills who can keep up with the space age with the changes they will make in their education systems (Okumus & Yetkil, 2020). In Turkey, it has become more and more important for students to transfer the education they receive at school to daily life. In this respect, the Ministry of National Education (MEB) makes frequent changes in Turkish education system and tries to ensure that our students are individuals who can follow the developments as global citizens and have the skills required by their age. It is aimed that students become scientifically literate individuals by developing various exams conducted throughout the country, especially in the curriculum used in schools. In this context, it is seen that the LGS exam has been applied instead of the TEOG exam for the last 4 years in Turkey. LGS is a central examination conducted by the Ministry to place eighth grade students in higher education institutions (MEB, 2018b). These changes are very important as they also include skills that are addressed at the global level.

In 2021, it is more important for students to be people with various competencies rather than knowing knowledge. When we look at the education systems of developing countries, it can be said that the reports of the Program of International Student Assessment (PISA), which is held at the international level, are effective on the basis of the changes they have made within themselves and that they are trying to reach a certain standard globally (Iseri, 2019). PISA is an international exam organized by the Organization of Economic Cooperation and Development (OECD) every three years since 2000, which provides information about the course of the education systems of the participating countries by collecting students' reading skills, science and mathematics literacy with various additional data, and makes it possible to compare countries with each other in this sense. In this exam, open-ended, closed-ended and multiple-choice questions are asked to children aged 15 using a computer-based assessment system. This exam, which has been evaluating students in an innovative field since 2012, can also collect data on students' motivations, opinions about themselves, learning styles, school environments and families, apart from subject areas. Turkey participated in PISA exams for the first time in 2003 and continues to participate. PISA is an important international test in terms of showing the gaps in their education systems to countries and also allowing them to see their own place within the countries participating in the exam (Gurlen et al., 2019). The effect of this exam on the education policies of the participating countries should not be ignored. When we look at the content of the PISA exam, it is seen that one of the basic areas is accepted as the weighted area in each exam period. In this context, the weighted area in PISA 2006 and PISA 2015 studies was determined as science literacy.

Science Literacy

Science literacy can be expressed as the use of science-related subjects in daily life. A science literate individual understands the nature of science, the processes of science, the research processes of scientists, basic science concepts, principles, laws and theories, and uses scientific process skills. The individual with this skill has an idea about science and technology within a

certain logical framework (Karakoc Alatli, 2020). Science literacy is defined by the American Association for the Advancement of Science (AAAS) as knowing nature closely, understanding scientific concepts and principles, having scientific thinking skills, and using this knowledge for the benefit of society (Ustun et al., 2020). Today, one of the most important aims of education in schools is to enable students to transfer the information they learned at school to daily life and to bring scientific solutions and interpretations to the problems they encounter. In this context, raising scientifically literate individuals is important for individuals and the country. According to OECD (2016), science literacy should be evaluated in four dimensions: knowledge type, competencies, contexts and attitudes (Karakoc Alatli, 2020).

The first of the science literacy dimensions, “knowledge type” consists of “content knowledge”, “process knowledge” and “epistemic knowledge” as sub-dimensions. “Content knowledge” means knowledge of theories, explanatory ideas, information and facts (OECD, 2016). On the other hand, "process knowledge" includes the concepts and processing processes required for scientific inquiry, which form the basis of the collection, analysis and interpretation of scientific data. Process knowledge is needed both to conduct scientific research and to criticize the evidence used to support claims (OECD, 2019a). “Epistemic knowledge” refers to an understanding of the nature of knowledge, the nature and origin of science, and reflects students' capacity to think and engage in rational discourses, as scientists do (OECD, 2016). The difference between process knowledge and epistemic knowledge can be expressed as follows: While process knowledge is needed to explain what is meant by the control variable, epistemic knowledge is needed to explain why the use of control variables is important in the creation of scientific knowledge (OECD, 2019a).

Another science literacy dimension, the “competence dimension” consists of three sub-dimensions like "explaining events scientifically", "designing and evaluating a scientific inquiry method", "interpreting data and findings scientifically". Within the scope of "explaining events scientifically" competence, students are expected to have skills such as remembering and applying scientific knowledge, defining explanatory models and representations, making appropriate predictions and verifying these predictions, proposing explanatory hypotheses, understanding the implications of scientific knowledge for society (OECD, 2019a). Within the scope of "designing and evaluating a scientific inquiry method", some skills are expected from students such as distinguishing questions that can be researched scientifically, suggesting and evaluating methods for researching scientific questions, and expressing how data reliability is ensured (OECD, 2019a). In the competence of "interpreting data and findings scientifically", skills such as analyzing data, interpreting and drawing appropriate conclusions, creating findings, analyzing arguments based on scientific findings and opinions, evaluating scientific arguments and findings from different sources (for example, newspapers, internet, magazines, etc.) are expected from students (OECD, 2019a).

The “context dimension” is another PISA science literacy dimension. In this study, it was examined in three sub-dimensions as “personal”, “local/national” and “global”. Each sub-dimension is further detailed as "health and disease", "natural resources", "environment", "risks", "limitations of science and technology".

In this study, apart from the scope of science literacy, the questions in LGS were also examined in terms of cognitive level. Cognitive level was analyzed as “low”, “medium” and “high”. “Low” depth of knowledge here; contains items that require the student to carry out a one-step procedure, such as remembering a single fact, term, principle or concept, or finding a single point of knowledge from a graph or table. If it is "medium" knowledge depth; points to items that require the student to use and apply conceptual knowledge to describe or explain the phenomenon, choose appropriate procedures involving two or more steps, organize/view data, or interpret and use simple datasets and graphs. Finally, “high” depth of knowledge requires students to analyze complex information or data, synthesize or evaluate evidence, justify claims, reasons (considering various sources), or develop a plan to deal with a problem (OECD, 2016).

In this study, out of the scope of science literacy, the questions in LGS were also examined according to the content areas of science. The questions examined were classified by three content areas: "physical systems", "systems related to living things", "earth and space systems", according to the content area of the subjects in the Science course. In physical systems, content related to the structure of matter, its properties, chemical changes, motion and force, matter and energy interactions are included, while in systems related to living things, issues related to cells, organisms, universe and ecosystems are included. In the earth and space systems, there are contents related to the earth and space (OECD, 2019a).

Looking at the literature, it is seen that there are various studies on the PISA exam. With this exam, students' math and science literacy and reading skills are measured and reported together with various variables, giving researchers a rich material in terms of presenting many research topics. Therefore, studies on the subject have spread to a wide range. Some of the studies have focused on the interpretation of the PISA exam on behalf of Turkey. When we look at our situation in the PISA exam on behalf of Turkey, the results are not encouraging (Sezer, 2018).

It is seen that various countries set the PISA exam reports as criteria for the changes they made in their education policies (Iseri, 2019). In a study conducted by Gurlen et al. (2019), the opinions of experts on PISA and International Mathematics and Science Study (TIMSS) exams and how these exams affect education policies were examined. As a result of the research, experts stated that there is a parallelism between the content of international exams and our curriculum. However, they also stated that exam results are not the only criteria that can be used to interpret our education system. In addition, it has been revealed that experts have differences of opinion on the impact of the said exams on education policies. In another study, the factors affecting the changes in the curricula were examined. In the light of the results obtained, it has been understood that one of the factors affecting the curriculum is 21st century skills (Aksoy & Taskin, 2019). The basis of these changes is questioning, critical thinking and problem solving skills. With the development of these skills, the goal of raising individuals who are science literate will also be realized.

However, some of the studies included the opinions of teachers and students in order to improve the results. In the study of Bozdogan and Yildirim (2020), the opinions of science teachers on student success in international exams were examined. The teachers involved in the study in question stated that they had heard of PISA and TIMSS exams before and that Turkey's average success rate in these exams was unfortunately very low. The reason for this is the frequent

changes in the education programs in Turkey. In another similar study, through interviews with science teachers, what can be done to increase our success in the field of science in the PISA exam was investigated. According to the teachers involved in the study, people from parents to students and even teachers should be informed about such international exams. Another striking result is that teachers say that the question styles in the exams held in Turkey are different from the questions in the PISA exam (Cumaoglu et al., 2020). In another study that brings a different perspective to the subject, the opinions of the students who took the PISA 2015 exam were examined. In this context, students said that some of the open-ended and test question types they saw in the PISA exam were similar to the questions they encountered in the school exams, but they added that they had never encountered some question types (Simsek et al., 2018).

Some of the studies have compared the PISA results of different countries and tried to determine what causes the differences between the PISA results between countries. In the study conducted by Aytekin and Tertemiz (2018), the PISA exam results and education systems of Turkey and South Korea were compared, and as a result, although there is not much difference in the education systems of the two countries, it has been seen that the results of the PISA exam have been in favor of South Korea over the years. It was stated that the economic development program implemented by South Korea had a great impact on the emergence of such a result. On the other hand, when the PISA results of Turkey and Germany made until 2015 are examined, the factors affecting the success of these countries are examined. As a result, Germany's development in the skills in the PISA exam is much better than Turkey. It has been understood that socioeconomic levels and school types have a great impact on this (Weissbach, 2018). In another study comparing the results of PISA 2012 problem solving skills of different countries, it is seen that South Korea and Japan, which have a holistic education approach, are at the top of the list in questions measuring higher-order thinking skills. It was concluded that the fact that Turkey and Hungary remained at the lower levels was due to the differences in education practices in these countries (Ileriturk et al., 2017).

As a result, at this point where the PISA exam is important for many countries in the global sense, the literature studies in Turkey have also contributed by addressing the issue from different perspectives and shed light on the precautions that can be taken to the relevant authorities and the places that need to be improved in our training program.

Considering their relationship with this study, it is possible to come across various studies conducted within the scope of science course or science literacy in the literature. One of the studies that can be mentioned in this context belongs to Kızılay (2019). In the study, the science course questions in the Transition from Primary Education to Secondary Education (TEOG) exam held in 2015 were evaluated within the scope of PISA exam questions by consulting the opinions of experts. As a result, it has been stated that TEOG questions are based on knowledge and memorization, while PISA questions generally lead students to make comments. Therefore, it has been suggested that the questions in the national exams should be designed in a way that encourages students to comment and based on scientific process skills. In another similar study, it was aimed to compare 8th grade science teachers' written exam questions and TEOG science questions according to PISA 2015 cognitive steps (Sezer, 2018). According to the results of the research, it was determined that the TEOG questions were at a lower level than the PISA

questions. In this respect, it can be said that similar results were obtained with other studies in the literature.

In the research conducted by Cakir (2019), it was aimed to examine the science questions asked in the TEOG and LGS exams according to the two-dimensional structure of the Renewed Bloom Taxonomy (YBT) of the sample science questions shared within the scope of PISA. As a result, it has been determined that the questions in the TEOG exam are included in the understanding step of conceptual knowledge, but there are very few questions that require high-level cognitive skills. However, it was stated that LGS and PISA exam questions were similar in terms of measuring both low-level and high-level cognitive skills.

In this study, it is aimed to examine the questions in the content of the central exam (LGS) related to secondary education institutions that will take students with the exam applied for the first time in the 2017-2018 academic year, within the scope of the science literacy dimensions measured by the international PISA exam questions. Since the two exams in question are applied to close age groups (LGS≈14; PISA=15), it was deemed appropriate to compare them. In this context, it is important that the content of the two exams will be compared in the light of the questions asked in the LGS, which has been announced as the new exam system by the Ministry of National Education and has been applied for 4 years, as it will contribute to educators, researchers and program development studies. In the literature review, it was seen that comparisons were made in this way, but no study was found on the questions published by the Ministry of National Education and on the PISA science literacy dimensions.

In this study, PISA exam questions are the main theme of the study, both because of the importance of the dimensions of science literacy measured by the PISA exam, and because countries see this exam as a criterion while shaping their education policies. Success of students in such an important exam is only possible if they receive an appropriate education focused on the development of these skills and enriched in this sense. Of course, it is very important that the assessment and evaluation tools that we subject students serve the same purpose.

Purpose of the research

The Ministry of National Education (MEB) abolished the Transition examination from Primary Education to Secondary Education (TEOG) in 2017 and replaced it with the High School Entrance Examination (LGS). The reason for this change made by the MEB in the examination system is the low levels of science literacy, mathematical literacy and reading skills in the international PISA examinations for Turkey. From this point of view, in the new exam system, questions parallel to the questions asked in the PISA exam are tried to be asked to the students and thus, it is aimed to increase the success level in the PISA exams. For the first time in the 2017-2018 academic year, MEB applied LGS with the change it made in the exam system, and this practice continues. The parallelism of the two exams (LGS and PISA) in question, and what can be done to increase the success of students in this sense, are encountered in a few studies in the literature based on teacher opinions. However, no study has been found in which the relationship between the content of the questions in the published LGS and the dimensions of science literacy that the PISA exam tries to measure are investigated in detail. Therefore, in this study, it is aimed to analyze the content of LGS questions applied to students in the last four

years and to evaluate them in terms of PISA science literacy dimensions. For this purpose, "which PISA science literacy dimensions include the contents of the questions that appeared in the LGS, published by the Ministry of National Education in the last four years, in the 2017-2018, 2018-2019, 2019-2020, 2020-2021 academic years?" is sought in the context of the following questions.

1. Which types of knowledge can be included in the content of the questions that appeared in the LGS, published by the Ministry of National Education in the last four years, from the PISA science literacy dimensions?

2. Which competencies in PISA science literacy dimensions include the contents of the questions that appeared in the LGS published by the Ministry of National Education in the last four years?

3. Which contexts of the PISA science literacy dimensions include the contents of the questions that appeared in the LGS published by the Ministry of National Education in the last four years?

4. At which cognitive level is the content of the questions that appeared in the LGS published by the Ministry of National Education in the last four years, within the framework of PISA science literacy?

5. Which content areas in the PISA exam cover the contents of the questions that appeared in the LGS published by the Ministry of National Education in the last four years?

METHOD

Research Design

Qualitative research emerges as a research conducted to reveal perceptions and events in a natural environment in a realistic and holistic way (Yildirim & Simsek, 2016). Qualitative data collection methods such as observation, interview and document analysis are used in qualitative research. The data of this study were collected through document analysis, one of the data collection tools frequently used in qualitative research. Document analysis is a systematic procedure for reviewing or evaluating documents in both print and electronic media. Like other analytical methods in qualitative research, document analysis requires examining data to develop empirical knowledge and make sense of it (Corbin & Strauss, 2008). With this method, it is possible to make detailed interpretations by examining the data on the subject.

Documents Examined in the Research

The documents examined in the study are the 80 Science course questions asked in the High School Entrance Exam (LGS) applied in the academic years of 2017-2018, 2018-2019, 2019-2020 and 2020-2021 on the official website of the Ministry of National Education. (MEB, 2018c, 2019b, 2020, 2021).

Data Collection Tool Development Process

In this study, a document review form prepared by the researchers was used as a data collection tool. With the form, it is aimed to evaluate the published Science course questions according to the PISA science literacy evaluation dimensions. In this respect, the questions were evaluated in detail in terms of 3 dimensions, which are "type of knowledge", "competence", "context", which are among the PISA science literacy dimensions, and also under five dimensions in total, namely "cognitive level" and "content area".

One of the PISA science literacy dimensions is the knowledge type dimension and it was examined in terms of "content knowledge", "process knowledge" and "epistemic knowledge" sub-dimensions. Another science literacy dimension is the competence dimension and it was analyzed in three sub-dimensions: "explaining events scientifically", "designing and evaluating a scientific inquiry method", "interpreting the data and findings scientifically". The "context dimension", which is another of the dimensions of science literacy, was examined under 3 sub-dimensions as “personal”, “local/national” and “global”. Each sub-dimension is further detailed as "health and disease", "natural resources", "environment", "risks", "limitations of science and technology".

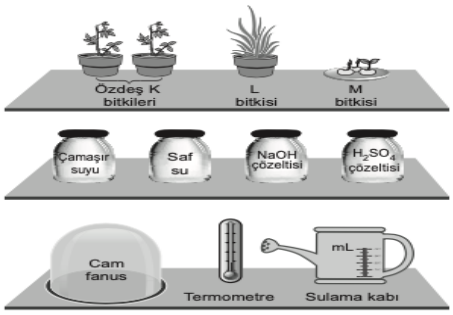
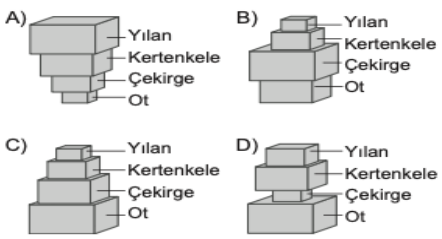
In the data collection tool, another dimension other than the science literacy dimensions is the "cognitive level" theme. This main theme was analyzed by dividing it into three sub-dimensions as low, medium and high. The last dimension is the "content area" and the questions to be evaluated here are classified according to three content areas: "physical systems", "systems related to living things", "earth and space systems". The document review form developed in this study is included in Appendix-1.

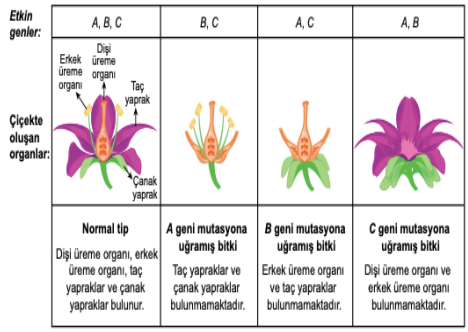
Analysis of Data

The document analysis process proposed by Corbin and Strauss (2008) was used in data analysis. In the analysis process of the data, the steps of review (surface examination), reading (detailed examination) and interpretation were followed.

The analysis of the data was carried out with the document review form prepared by the researchers. The questions that appeared in LGS in the last four years were examined by considering the PISA science literacy assessment dimensions (knowledge type, competence, context), cognitive level and content area criteria. Due to the scope of the study, detailed analyzes of the science course questions in the last four years were made and the analysis of a question that came out in each exam period was shared as an example in order to show which category they were placed in (Table 1).

Table 1. Sample analysis of a question that came out in each exam period

Question Number	Question Content	Year	Correct Answer	Knowledge type	Competence	Context	Cognitive Level	Content Area
Q17	**17.** Bir deney yapılarak asit yağmurunun bitkiler üzerindeki etkisi gözlenmek isteniyor.  Bu deneyde şekildeki bitki ve malzemelerden uygun olanlar seçilerek iki düzenek hazırlanıyor. Seçilen sıvılar bitkilere sulama kabıyla yağmur gibi üstten verilerek gözlem sonuçları karşılaştırılıyor. **Buna göre, düzeneklerde aşağıdakilerin hangisinde verilen bitki ve malzemeler kullanılmıştır?** A) L bitkisi ve özdeş K bitkileri, çamaşır suyu, eş değer miktarda H_2SO_4 ve NaOH'ten oluşan karışım, cam fanus B) K bitkisi, M bitkisi, NaOH çözeltisi, saf su C) Özdeş K bitkileri, H_2SO_4 çözeltisi, saf su D) L bitkisi, M bitkisi, eş değer miktarda H_2SO_4 ve NaOH'ten oluşan karışım, termometre, cam fanus	2017 - 2018	C	Process knowledge	Designing and evaluating a scientific inquiry method	Global / Risks	Medium	Physical systems
Q1	**1.** Karasal bir ekosistemdeki besin zinciri şekildeki gibidir. Ot → Çekirge → Kertenkele → Yılan Bu besin zincirindeki canlıların yaşadıkları ortamdaki birey sayıları farklı boyutlardaki tahta bloklar ile eşleştirilecektir. Bu blokların boyutları birey sayısını temsil etmektedir. Büyük olan bloklar birey sayısının çok, küçük olanlar ise birey sayısının az olduğunu göstermektedir.  **Buna göre, bu besin zincirindeki canlıların birey sayılarını temsil eden tahta blokların dizilimi aşağıdakilerin hangisindeki gibi olmalıdır?**  	2018 - 2019	C	Content knowledge	Explaining events scientifically	Global / Environment	Low	Systems related to living things

Q6	**6.** Bitkilerde çiçek organlarının (çanak yaprak, taç yaprak, erkek üreme organı, dişi üreme organı) oluşumunda *A*, *B* ve *C* genleri etkilidir. Tabloda *A*, *B* ve *C* genlerinin etkin (işlevsel) olduklarında oluşan çiçek organları verilmiştir.  **Tablodaki verilere göre aşağıdakilerden hangisi doğrudur?** A) *A* geninin işlevsiz olduğu çiçekte, çiçek organlarının tümünün normal gelişim göstermesi beklenir. B) *B* geninin işlevsiz olduğu çiçekte, üremeden sorumlu hiçbir organın gelişmediği görülür. C) *C* geninin işlevsiz olduğu çiçeğin, eşeyli üremeyi gerçekleştirmesi beklenir. D) Çiçekte bir organın oluşumu üzerinde birden fazla gen etkili olabilir.	2019 - 2020	D	Content knowledge	Interpreting the data and findings scientifically	Global / Environment	High	Systems related to living things
Q9	**9.** Yerkürenin doğal dengesini korumak amacıyla 2002 yılında yapılan bir dünya zirvesinde kabul edilen ilkelerden biri "Tehlikeyi Önleme İlkesi"dir. Bu ilkeyle, doğal dengeyi korumak için söz konusu sorun ortaya çıkmadan önlem alınması amaçlanmıştır. **Buna göre aşağıda verilenlerden hangisi "Tehlikeyi Önleme İlkesi" kapsamında yapılan bir uygulama değildir?** A) Akarsulara evsel atıkların karışmasının önlenmesi B) Atmosfere karbondioksit veren enerji kaynaklarının kullanımının artırılması C) Plastik ve cam gibi malzemelerin geri dönüşümünün sağlanması D) Orman varlığının korunması için kâğıt kullanımının azaltılması	2019 - 2020	B	Content knowledge	Interpreting the data and findings scientifically	Global / Natural resources	Low	Systems related to living things

When the analysis of one of the exam questions (Q17) that came out in the 2017-2018 academic year as an example is examined; In order to understand the effect of acid rain on plants, the student is expected to design an experimental setup by using various materials. Here, it is in the category of "process knowledge" as a type of knowledge, as it measures the knowledge of procedures that are essential for scientific research. The competence dimension of the question is "designing and evaluating a scientific inquiry method" because here the student is expected to propose a method to scientifically investigate a particular question. The context of the problem is in the category of "global/risks" since acid rain is a global issue and can be considered as a result of climate change. The cognitive level of the question in question is medium because the student is expected to choose appropriate procedures that involve two or more steps using their conceptual knowledge. The content area of the problem can be examined under the title of physical systems because it can be considered as a continuation of the topic of acids and bases.

Looking at the analysis of one of the exam questions (Q1) that came out in the 2018-2019 academic year, as an example, in the question related to the food chain, the student is expected to know that there are producers at the bottom step and that a pyramid-like image will emerge as the number of living things decreases as you go up. From this point of view, the type of knowledge is "content knowledge" since the question directly asks the information about the subject. In the competence dimension, it can be said that it is in the category of "explaining events scientifically" since it is expected from the student to remember and apply the scientific information about the situation. Looking at the context of the problem, the food chain/pyramid can be examined under the title of "global/environment" since it can be considered within the scope of biodiversity. The cognitive level of the question is low because it is expected from the student that the producers should be in the lowest group and to find a triangle-like shape that shows the relationship between living things, and this points to a single truth or principle. Finally, since the content area of the problem is ecosystems and the food chain, it can be clearly expressed as "systems related to living things".

When the analysis of one of the questions (Q6) of the 2019-2020 academic year is examined as an example, the student is expected to understand how the genes that are effective in the formation of the flower in the plant affect in various situations. In this respect, the knowledge type of the problem is “content knowledge”. In the question, the student was asked on a table what effect the various mutations in the genes had on the formation of the flower. In this respect, since the student is expected to analyze the data, interpret it and draw appropriate conclusions, the competence of the question can be said to be "interpreting the data and findings scientifically". Since the subject of biodiversity is addressed in the question, its context is in the category of "global/environmental". In addition, the cognitive level of the question is "high", as the student is expected to analyze and evaluate the data and justify the claims considering various sources. Finally, since the content of the problem is the changes that occur on DNA and genes, the content area is "systems related to living things".

When we look at the analysis of one of the questions (Q9) of the 2020-2021 academic year as an example, in the question (Q9) the student was asked what practices could be included in the principle after the purpose of the "prevention of danger principle" was given, and in this respect, it is expected that an explanatory idea will be given in the question. The knowledge type of the question is “content knowledge”. The competence of the question is in the category of "interpreting the data and findings scientifically", both because the student is expected to analyze and interpret the information given and to draw an appropriate conclusion, and because the student evaluates scientific arguments. In addition, considering the context of the problem, it can be said that the problem is in the context of "global/natural resources" since it questions the sustainable use of resources. The cognitive level of the question is "low", as the student is expected to perform a one-step procedure, that is, to understand the purpose of the danger avoidance principle and evaluate the options. Finally, since the question draws attention to the issue of sustainability, the content area can be discussed under the title of "systems related to living things".

The sample analyzes shared for each year were made separately for a total of 80 questions in the study. Each question in the LGS published by the Ministry of National Education in the last four years was examined in terms of knowledge type, competence, context, cognitive level and

content area, which are among the PISA science literacy dimensions, and the information obtained was transferred to the document analysis review form.

The reliability criterion for qualitative research focuses on identifying and documenting recurring correct and consistent (homogeneous) or inconsistent (heterogeneous) features, such as patterns, themes, worldviews, and other phenomena studied in similar or different human contexts (Labuschagne, 2003). In this study, the criteria put forward by Guba and Lincoln (1982) (credibility, transferability, consistency and confirmability) were taken into account in order to ensure the credibility of the analyzes. In order to ensure credibility in this research, the questions were examined in detail by the researchers and analyzed at different times. In addition, the questions with consensus and disagreement among the researchers were determined and the reliability of the analysis was calculated as .81 (Miles & Huberman, 1994). In order to ensure transferability, the research process has been tried to be explained in detail. To ensure confirmability, the researchers compared the obtained results and questions by reviewing them at different times.

FINDINGS

The contents of the questions that appeared in the LGS published by the Ministry of National Education in the last four years were examined in terms of PISA science literacy dimensions (knowledge types, competence, contexts, cognitive levels and content areas) and the findings were presented.

Findings on Types of Knowledge

The questions that appeared in the LGS published by the Ministry of National Education over the years were examined in terms of content knowledge, process knowledge and epistemic knowledge, which are one of the PISA science literacy dimensions (Table 2).

Table 2. Examination of the content of the questions in LGS in terms of knowledge type dimension

	Types of Knowledge					
	Content knowledg		**Process knowledge**		**Epistemic knowledge**	
Years	**f**	**%**	**f**	**%**	**f**	**%**
2017-2018	15	75	4	20	1	5
2018-2019	12	60	7	35	1	5
2019-2020	15	75	5	25	0	0
2020-2021	14	70	6	30	0	0

As a result of the analyzes, while there were more questions about content knowledge in 2017-2018 and 2019-2020, this rate decreased in other years. However, it can be said that more than 60% of the exam questions every year consists of questions covering content knowledge. While there were more questions in the process knowledge in 2018-2019, this number remained at the lowest level in 2017-2018. As a result, it is seen that the questions asked vary between 20-35%

on a yearly basis in the category of process knowledge. When the questions in 2017-2018 and 2018-2019 were examined, it was determined that the number of questions containing epistemic knowledge was only 1. However, in other years, no questions regarding this type of knowledge were included. For the questions examined in our study, the distribution of epistemic knowledge type questions on years does not exceed 5%.

Findings on Competence

The contents of the questions in the LGS published by the Ministry of National Education over the years were analyzed in terms of scientific explanation of events, designing and evaluating a scientific inquiry methods, and scientific interpretation of data and findings in the competence category of PISA science literacy dimensions, and the results are shown in the table (Table 3).

Table 3. Examination of the content of the questions in LGS according to the competence dimension

	Competence					
	Explaining events scientifically		**Designing and evaluating a scientific inquiry method**		**Interpreting the data and findings scientifically**	
Years	**f**	**%**	**f**	**%**	**f**	**%**
2017-2018	12	60	4	20	4	20
2018-2019	6	30	6	30	8	40
2019-2020	8	40	5	25	7	35
2020-2021	6	30	6	30	8	40

In the sub-dimension of scientifically explaining events, while there were more questions (60%) in 2017-2018, the number of questions decreased in the following years and the percentage distribution of the questions asked varies between 30-40%. In the category of designing and evaluating a scientific inquiry method, the distribution of questions over the years is between 20-30%. Finally, in the sub-dimension of scientifically interpreting the data and findings, it is seen that the distribution varies between 20-40%. It can be stated that the distribution of questions on competence in 2018-2019 and 2020-2021 is the same.

Findings Related to Contexts

The contents of the questions in the LGS published by the Ministry of National Education over the years were examined according to the PISA science literacy dimensions, in terms of personal, local (national) and global contexts (Table 4). Personal, Local/National and Global

context consists of health and disease, natural resources, environment, risks and limitations of science and technology.

Table 4. Examination of the content of the questions in LGS by years according to the context dimension

	Context					
	Personal		**Local/National**		**Global**	
Years	f	%	f	%	f	%
2017-2018	7	35	6	30	7	35
2018-2019	4	21	6	32	9	47
2019-2020	0	0	15	75	5	25
2020-2021	1	5	12	60	7	35

When we look at the distribution of the 80 questions examined in terms of context by years, the questions in 2017-2018 show an equal distribution in the personal and global context, with a ratio of 35%. Looking at the questions in 2018-2019, it is seen that 50% of them have content in the global context. The questions in 2019-2020 do not contain any personal content. However, it can be stated that 75% of the questions were asked in the local/national context for the same year. LGS questions in 2020-2021 are also similar to the previous year in terms of distribution. It can be said that in the exam held in 2020-2021, no questions were asked in a personal context, except for a single question, and there was 60% of the question content in the local/national context.

Findings Related to Cognitive Levels

The contents of the questions that appeared in the LGS published by the Ministry of National Education by years were analyzed according to the PISA science literacy dimensions in terms of low, medium and high cognitive levels (Table 5).

Table 5. Examination of the content of the questions in LGS by years in terms of cognitive levels

	Cognitive Level					
	Low		**Medium**		**High**	
Years	**f**	**%**	**f**	**%**	**f**	**%**
2017-2018	6	30	12	60	2	10
2018-2019	4	20	11	55	5	25
2019-2020	5	25	8	40	7	35
2020-2021	5	25	9	45	6	30

When Table 5 is examined, it is seen that the number of medium-level questions is higher with a distribution ratio of at least 40% compared to years.

Findings Related to Content Areas

The contents of the questions published in LGS published by the Ministry of National Education over the years were examined according to the content areas of physical systems, systems related to living things, and earth and space systems, which are one of the PISA science literacy dimensions (Table 6).

Table 6. Examination of the questions in LGS according to the years in terms of content areas

	Content Area					
	Physical systems		**Systems related to living things**		**Earth and space systems**	
Years	**f**	**%**	**f**	**%**	**f**	**%**
2017-2018	13	65	5	25	2	10
2018-2019	12	60	7	35	1	5
2019-2020	9	45	8	40	3	15
2020-2021	9	45	9	45	2	10

According to the findings obtained over four years, it is seen that more questions are given to the physical systems content area. In the questions in 2020-2021, more emphasis was placed on the content area of systems related to living things. It can be said that the year with the highest number of questions in the field of earth and space systems was 2019-2020, however, the distribution on the basis of years did not exceed 15%.

CONCLUSION AND RECOMMENDATIONS

The contents of the questions in the LGS published by the Ministry of National Education in the last four years were examined in terms of knowledge types, competencies, contexts, cognitive levels and content areas from the PISA science literacy dimensions, and the results are presented below.

When the questions that appeared in the LGS published by the Ministry of National Education by years are analyzed according to the types of knowledge, one of the PISA science literacy dimensions, it is determined that the content knowledge in 2017-2018 and 2019-2020, the process knowledge in 2018-2019, and one question in 2017-2018 and 2018-2019 about epistemic knowledge were encountered more frequently. When we look at the results of the mentioned 80 questions regarding the types of knowledge, it can be said that almost more than half of the exam questions every year consist of questions covering content knowledge.

According to the latest PISA 2018 Turkey Preliminary Evaluation Report, the content knowledge of the questions asked in PISA 2018 varies between 54-66% (MEB, 2019a). When we look at the analyzes made, it can be said that the distribution of the questions asked in four years in the dimension of process knowledge is at a moderate level. According to the PISA 2018 Preliminary Evaluation Report published on behalf of Turkey, the weight of process knowledge on the questions is between 19-31% (MEB, 2019a). In this respect, it can be stated that a great deal of harmony has been achieved in the category of knowledge types in PISA with the changes made in the examination system. However, in the same report, it was stated that the epistemic knowledge distribution of PISA 2018 questions was between 10-22% (MEB, 2019a). For the questions examined in our study, questions of this type of knowledge are almost non-existent. When the general distribution of the questions in the context of knowledge types is examined, a similar situation can be seen in the renewed science curriculum. In this context, in the study conducted by Cansiz and Cansiz (2019), the extent to which the science course curriculum implemented in Turkey reflects the dimensions of science literacy was investigated using the PISA 2015 Science Literacy Evaluation Framework. According to the results of the research, course outcomes do not show a balanced distribution in terms of knowledge type at all levels from the 3rd to the 8th grade. It has been determined that the course outcomes in question are quite inadequate in terms of epistemic knowledge. In this type of knowledge, no acquisitions that will directly enable the development of students were found at the 4th, 5th, 6th and 8th grade levels. Epistemic knowledge is very important because it encompasses an understanding of the nature and origin of science and includes content in which students experience thinking skills as scientists do. Since one of the most important goals in the science curriculum is to raise individuals who are scientifically literate and to enable students to understand scientific research methods, it can be said that more questions should be included both in terms of achievements and in the exams, and as a result, the success achieved in the PISA exams will also increase.

When the contents of the questions in the LGS published by the Ministry of National Education according to the years are examined in terms of the competences sub-dimension, one of the PISA science literacy dimensions, there were more questions in the sub-dimension of explaining events scientifically in 2017-2018, while there were more questions in designing and evaluating a scientific inquiry method and interpreting the data and findings scientifically in 2018-2019 and 2020-2021. According to the results obtained, it is seen that the questions asked at the "explaining events scientifically" competence level are at a medium level in terms of distribution. Looking at the PISA 2018 Turkey Preliminary Evaluation Report, the expected distribution of questions for this level of competence is between 40-50% (MEB, 2019a). At the level of "designing and evaluating a scientific inquiry method", which is another level of competence, it can be said that the distribution of the questions over the years is balanced. According to the PISA 2018 report, the expected rate at this level is exactly 20-30% (MEB, 2019a). It can be said that the distribution of the questions is moderate in the category of "interpreting the data and findings scientifically", which is the last level of competence. Again, if we take the PISA 2018 Preliminary Evaluation report as a reference on behalf of Turkey, we can state that the expected distribution of questions is 30-40% (MEB, 2019a). Kızılay (2019), in her study examining the science questions in the PISA and 2015 TEOG exams in the context of teaching principles, similarly expressed the competence levels expected to be found in the

questions in the PISA 2015 exam. In this state, it can be said that the content of LGS exams organized by the Ministry of National Education in the last four years is at the required level according to PISA science literacy competence.

To analyze the contextual findings of the questions examined, while there were an equal number of questions regarding the personal and global context in 2017-2018, the number of questions regarding the local (national) context in 2019-2020 and 2020-2021 is quite high. Looking at the findings of the same years, it was seen that almost no questions were asked in a personal context. In 2018-2019, questions regarding the global context were more than other years. Considering the general logic of the PISA questions, it is tried to determine how much the students are interested in their family, social environment and global events in addition to their experiences at school. Students are expected to comment on their own life and social environment, the society in which they live and the situations in the world, with questions covering various fields such as health, natural resources, environment, risks arising from disasters, and the limits of science and technology. While evaluating the questions in this section, it is necessary to consider the cultural differences of the countries and the living conditions of the students, so generalizing the results of the study according to all countries may lead to incomplete and erroneous interpretations (Gokdemir, 2020). However, it has been suspected from time to time that it is very difficult to put the questions in the study into the categories mentioned in the context, and that some of the question contents are not suitable for almost any of the categories in question. This situation is not surprising because in the studies that tried to determine how much the science curriculum overlaps with the science literacy dimensions in the literature, it was emphasized that the science lesson outcomes did not contain sufficient context-based outcomes (Cansiz & Cansiz, 2019). It is inevitable that the questions asked in LGS will be weak in terms of context since the achievements in the curriculum are guiding both in the preparation of national-scale exams and in the assessment and evaluation processes used by the teachers in the course.

When the contents of the questions in the LGS published by the Ministry of National Education by years are analyzed according to cognitive levels, one of the PISA science literacy dimensions, it is seen that the number of medium level questions is higher than the years. However, while low-level cognitive questions were given more space in 2017-2018, high-level cognitive questions were included more in the following years. If we look at how the questions asked in LGS are distributed in the cognitive level dimension over four years, it is seen that there are more questions asked at medium level in almost all years. However, it can be said that low and high cognitive level questions are also included in certain proportions. In order for the assessment to be balanced, it is very important that all three cognitive levels are included (OECD, 2016). In this respect, it can be stated that the questions that emerged as a result of the study have the necessary framework. As a matter of fact, Kızılay (2019) stated in her study that 61% of the questions included in the PISA 2015 science evaluation had a medium cognitive content. The remaining distributions of the questions also include other cognitive levels. This situation supports the results of our study on this dimension.

When the contents of the questions published in LGS published by the Ministry of National Education by years are analyzed according to the content areas of PISA science literacy dimensions, physical systems content area is given more place in the questions in 2017-2018

and 2018-2019, while in the questions in 2020-2021, systems related to living things are included in the content area. It was seen that the year with the highest number of questions related to the earth and space systems content area was 2019-2020. In summary, it can be said that the physical systems content area is given more space in all years in the questions in LGS. However, it is another remarkable result that there are very few questions about the earth and space systems. It can be said that this result is similar when we look at the distribution of the achievements in the 8th grade units in the updated Science Curriculum. In total, it is seen that the achievements in seven units are mostly in the field of physical systems content, while the unit with the least achievements is in the field of earth and space systems (MEB, 2018a). At this point, when we look at the PISA 2018 Turkey Preliminary Evaluation Report, the distribution of the questions according to the content areas is stated as 36% for physical systems, 36% for systems related to living things, and 28% for earth and space systems content area (MEB, 2019a). As it can be understood from here, it can be said that the content of the questions is not balanced and distributed as it should be. The problem here is that the distribution of the gains in the curriculum is unbalanced and, as a result, the exam prepared according to this program is negatively affected. Looking at the literature, it can be said that there are studies that reach similar results. In the study conducted by Kasıkci et al. (2015), it was aimed to determine the level of meeting the achievements in the curriculum of the 2nd semester TEOG exam science and technology exam questions applied to the 8th grades in the 2013-2014 academic year. As a result of the study, it was found that the science lesson questions in TEOG did not show a homogeneous distribution according to the achievements in the curriculum. In addition, according to a study cited by Kızılay (2019), it was aimed to examine the science course curriculum within the scope of TEOG and TIMSS exams. As a result, it was revealed that the content validity of TIMSS 2015 and the 8th grade science curriculum in terms of achievements was low. Considering all these, it can be thought that the distribution of the questions in LGS according to the content areas is not at the expected level as reported in the PISA reports, due to the unbalanced distribution of the contents in the curriculum. It should also be stated that the revisions made in the science curriculum are still insufficient in this sense.

PISA exams guide the participating countries to make changes in many issues. In this sense, it is seen that countries can achieve better results with the improvements they have made both in their education systems and in various components of this system (Berberoglu et al., 2019). Since the concept of science literacy is measured in exams like PISA and TIMSS, this concept was included in the revised curriculum and it was aimed that students could adapt what they learned to daily life issues. At this point, the concepts of "informal learning" and "interdisciplinary" were included in the renewed curriculum (Aksoy & Taskin, 2019). As a result, we see that the science literacy results in Turkey's past PISA exams are getting better (PISA, 2018). We can say that this improvement has also emerged as a result of different variables such as the increasing number of female students in schools and the decrease in the difference in success between private and public schools, apart from some adjustments made in the curriculum (Albayrak, 2009).

Education is a holistic process with exams and evaluations for both transferring knowledge and seeing how it takes place in the mind of the student. Therefore, in order for students to be individuals who question and use information, in order to keep up with the globalizing world,

the education they receive in their schools and the written exams they are subjected to or the national exams should be compatible with those held at the international level. Thus, when the achievements in the curricula that form the components of our education system and the assessment and evaluation processes are compatible with each other, the results we get in important exams like PISA will be more positive (Unal, 2019).

It is very important that we have an education system that can meet the needs of the children of the Z generation, as they have different interests and ways of thinking compared to their peers in the past. In this context, the Ministry of National Education has stated that it aims to raise individuals with high-level thinking skills, who can question information, associate what they have learned with daily life, in the curriculum it has published recently. It can be said that the science course has an extremely rich content in terms of covering high-level thinking skills, which we can also call logical reasoning skills, and transferring them to the student, in terms of establishing a relationship with daily life (Sezer, 2018). In this respect, our examination system also gets its share from the changes made in order to meet the needs of the age. With frequent updates, it is aimed that students can keep up with the developments in our age, where access to information and its availability are so important. In this sense, the achievements in the curriculum developed were prepared by adopting the constructivist approach, and thus, it was aimed that the student himself could reach the information by going through the questioning and research processes. In addition, it is extremely important to get correct results that the content of the exams, which can be considered as an output of the teaching in schools, is in the same parallelism.

Although the success of the students in Turkey has increased over the years, the results of the students in terms of high-level thinking skills are still behind the average of many countries and are below the general average in terms of ranking. For high-level thinking skills, a common understanding should be adopted and arrangements should be made according to the content of curricula and books, the activities used by teachers in the classroom, and teacher training programs in universities. Both the teacher and the students will benefit from the content prepared correctly. In this context, it is very important to prepare teacher training programs in universities well and to enable teacher candidates to develop different measurement tools. When teachers use up-to-date measurement and evaluation techniques that will improve students' thinking skills in their lessons, the success in international exams such as PISA, TIMSS, etc. will increase. Teachers who have graduated can be provided with various in-service trainings so that they do not feel inadequate in the preparation of questions and activities based on scientific thinking, which is called the new generation. Finally, in order to improve science literacy, the effect of laboratory applications based on students' scientific process skills and transferring information to daily life should not be ignored. Therefore, it is recommended to create the necessary financial opportunities for schools.

This study is limited to the questions in the LGS published by the Ministry of National Education in the last four years, the type of knowledge, competence, contexts, data analysis form developed by the researchers and document analysis from the PISA science literacy dimensions.

REFERENCES

Aksoy, G. & Taskin, G. (2019). Öğretim programlarının değişmesini etkileyen faktörlerin, sosyal bilgiler ve fen bilimleri dersi müfredatlarını etkileme boyutu [The influence of the factors that affecting the change of curriculum on social studies and science curriculum]. *Milli Eğitim Dergisi*, *48*(224), 75-99.

Albayrak, A. (2009). *PISA 2006 sınavı sonuçlarına göre Türkiye'deki öğrencilerin fen başarılarını etkileyen bazı faktörler [According to the PISA 2006 results, some factors that affect the success of science of Turkish students]*. Unpublished Master's Thesis. Hacettepe University.

Aytekin, G. K., & Tertemiz, N. (2018). PISA sonuçlarının (2003-2015) eğitim sistemi ve ekonomik göstergeler kapsamında incelenmesi: Türkiye ve Güney Kore Örneği [Examining PISA results (2003-2015) within the scope of education system and economic indicators: The case of Turkey and South Korea]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *19*(1), 103-128.

Berberoglu, G., Caliskan, M., & Karsli, N. (2019). Türkiye'de PISA fen okuryazarlık puanlarını yordayan değişkenler [Variables Predicting PISA Scientific Literacy Scores in Turkey]. *International Journal of Science and Education*, *2*(2), 38-49.

Bozdagan, K., & Yildirim, M. (2020). Ortaokul öğrencilerinin uluslararası sınavlardaki durumlarına yönelik öğretmen görüşlerinin incelenmesi: Türkiye örneği [Investigation of teachers' opinions on status of secondary school students in international assessment: The case of Turkey]. *International Journal of Humanities and Education (IJHE)*, *6*(14), 491-515.

Cansiz, N., & Cansiz, M. (2019). Evaluating Turkish science curriculum with PISA scientific literacy framework. *Turkish Journal of Education*, *8*(3), 217-236.

Corbin, J. & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: Sage.

Cumaoglu, Z. T., & Ozdemir Simsek, P. (2020). Uluslararası sınavlarda fen bilimleri derslerinden alınan sonuçların iyileştirilmesine yönelik fen bilimleri öğretmen görüşleri [Science teacher opinions towards the improvement of science courses scores for international examinations]. *Hacettepe University Journal of Education*, *35*(4), 949-970.

Cakir, Z. (2019). *TEOG, LGS ve PISA Fen Bilimleri Sorularının Analizi ve Karşılaştırılması* [TEOG, LGS and PISA science questions analysis and comparison]. Unpublished Master's Thesis. Uşak University.

Gokdemir, H. (2020). *Fen Bilimleri Öğretmen Adaylarının PISA Fen Okuryazarlığı Yeterliklerinin Araştırılması [Investigation of pre-service science teachers' Pisa scientific literacy competencies].* Unpublished Master's Thesis. Hacettepe University.

Guba, E. G., & Lincoln, Y. S. (1982). Epistemological and methodological bases of naturalistic inquiry. *Educational Communication and Technology Journal*, *30*(4), 233-252.

Gurria, A. (2016). PISA 2015 results in focus. *PISA in Focus*, 67, 1-15.

Gurlen, E., Demirkaya, A. S., & Dogan, N. (2019). Uzmanların PISA ve TIMSS sınavlarının eğitim politika ve programlarına etkisine ilişkin görüşleri [Experts opinions on the impacts of PISA and TIMMS exams on educational policies and curriculums]. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, 52, 287-319.

Ileriturk, D., Celik Ercoskun, N., & Kıncal, R.Y. (2017). Farklı ülkelerin PISA 2012 problem çözme becerileri sonuçlarının karşılaştırılması [A comparison of PISA 2012 problem solving skills results of different countries]. *The Journal of Academic Social Science*, *5*(43), 406-422.

Iseri, A. (2019). Uluslararası PISA yeterlikleri ve Türkiye öğretim programları kazanımları [International PISA competencies and the curriculum outcomes in Turkey]. *Mersin University Journal of the Faculty of Education*, *15*(2), 392-418.

Karakoc Alatli, B. (2020). Öğrencilerin fen okuryazarlığı performanslarının aşamalı doğrusal modelleme ile incelenmesi: PISA 2015 Türkiye ve Singapur karşılaştırması [Investigation of factors associated with science literacy performance of students by hierarchical linear modeling: PISA 2015 comparison of Turkey and Singapore]. *Educatıon and Science*, *45*(202), 17-49.

Kasıkci, Y., Bolat, A., Degirmenci, S., & Karamustafaoglu, S. (2015). İkinci dönem TEOG sınavı fen ve teknoloji sorularının bazı kriterlere göre değerlendirilmesi [The evaluation of science and technology questions in the second semester TEOG examination according to some criterias]. *Journal of Research in Education and Teaching, 4*(1), 225-232.

Kızılay, E. (2019). *2015 Yılı TEOG ve PISA Sınavları Fen Bilimleri Sorularının Öğretim İlkeleri Bağlamında Değerlendirilmesi [Comparation of science questions of national (TEOG) and international (PISA) exams held in 2015 in context of teaching principles]*. Unpublished Master's Thesis. Marmara University.

Labuschagne, A. (2003, March). Qualitative research - Airy fairy or fundamental? *The Qualitative Report, 8*(1), 100-103. Retrieved [2.11.2021], from http://www.nova.edu/ssss/QR/QR8-1/.html

MEB (2018a). Fen bilimleri dersi öğretim programı (ilkokul ve ortaokul 3, 4, 5, 6, 7 ve 8. sınıflar). Ankara: Milli Egitim Bakanlıgı Yayınları.

Miles, M. B., & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Newbury Park, CA: Sage.

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2018b). LiselereGeçişSistemi.Retrieved[12.03.2021],from http://www.meb.gov.tr/meb_iys_dosyalar/2018_12/17094056_2018_lgs_rapor.pdf.

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2018c). Sınavla Öğrenci Alacak Ortaöğretim Kurumlarına İlişkin Merkezi Sınav Sayısal Bölüm A Kitapçık Türü. Retrieved[15.03.2021],fromhttps://odsgm.meb.gov.tr/www/02-haziran-2018-tarihinde-yapilan-sinavla-ogrenci-alacak-ortaogretim-kurumlarina-iliskin-merkez-sinava-ait-soru-ve-cevap-anahtarlari/icerik/317.

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2019a). İzleme Araştırmaları.Retrieved[20.03.2021],fromhttp://www.meb.gov.tr/meb_iys_dosyalar/2019_12/03105347_PISA_2018_Turkiye_On_Raporu.pdf.

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2019b). Sınavla Öğrenci Alacak Ortaöğretim Kurumlarına İlişkin Merkezi Sınav Sayısal Bölüm A Kitapçık Türü. Retrieved[15.03.2021], from https://www.meb.gov.tr › 2019_06 › 02130019_20... .

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2020). Sınavla Öğrenci Alacak Ortaöğretim Kurumlarına İlişkin Merkezi Sınav Sayısal Bölüm A Kitapçık Türü. Retrieved[15.03.2021], from https://cdn.eba.gov.tr › 2020/06 › 2020_sayisal_bolum_a.

Milli Egitim Bakanlıgı Olcme, Degerlendirme ve Sınav Hizmetleri Genel Mudurlugu. (2021). Sınavla Öğrenci Alacak Ortaöğretim Kurumlarına İlişkin Merkezi Sınav Sayısal Bölüm A Kitapçık Türü. Retrieved[15.03.2021],fromhttps://www.meb.gov.tr/06062021-tarihinde-uygulanan-sinavla-ogrenci-alacak-ortaogretim-kurumlarina-iliskin-merkezi-sinavin-soru-kitapciklari-sayisal-ve-sozel-ve-cevap-anahtarlari/haber/23363/tr.

OECD, (2016). PISA 2015 Results (Volume I): Excellence and equity in education, PISA, OECD Publishing, Paris, http://dx.doi. org/10.1787/9789264266490-en.

OECD (2019a). *PISA 2018 Assessment and Analytical Framework*. Paris: OECD Publishing. doi:https://doi.org/10.1787/b25efab8-en

Okumus, S., & Yetkil, K. (2020). Ortaokul öğrencilerinin sorgulama becerilerinin değerlendirilmesi [Evaluation of inquiry skills of secondary school students]. *Bayburt Eğitim Fakültesi Dergisi*, *15*(30), 508-527.

Sezer, A. (2018). *Fen Bilimleri Dersi Sınav Soruları ve Merkezi Sınav Sorularının Yenilenmiş Bloom Taksonomisi, TIMSS ve PISA Açısından Analizi (Kırıkkale İli Örneği) [Analysis of science examination questions and central exam questions according to the revised BLOOM taxonomy, TIMMS and PISA (Kırıkkale provience example)]*. Unpublished Master's Thesis. Kırıkkale University.

Unal, M. (2019). *PISA sınavlarının özelliklerinin fen bilimleri öğretmenlerinin hazırlamış oldukları sınav soruları ile karşılaştırılması: PISA kültürünü yaygınlaştırma model önerisi*

[Investigate the character of PISA science questions with teacher questions for exams: A model proposal for expansion of PISA culture]. Unpublished Master's Thesis. Uludag University.

Ustun, U., Ozdemir, E., Cansiz, M., & Cansiz, N. (2020). Türkiye'deki öğrencilerin fen okuryazarlığını etkileyen faktörler nelerdir? PISA 2015 verisine dayalı bir hiyerarşik doğrusal modelleme çalışması [What are the factors affecting Turkish Students' science literacy? A hierarchical linear modelling study using PISA 2015 data]. *H. U. Journal of Education*, *35*(3), 720-732.

Weissbach, H. (2018). *Almanya ve Türkiye'nin PISA 2000-2015 sonuçlarındaki değişimin incelenmesi ve PISA sonrası Almanya'daki eğitim reformları [An investigation into the change in PISA 2000-2015 results of Germany and Turkey and the education reforms in Germany since PISA]*. Unpublished Master's Thesis. Hacettepe University.

Yildirim, A., & Simsek, H. (2016). *Sosyal bilimlerde nitel araştırma yöntemleri* (Extended 10th Edition). Ankara: Seçkin Yayıncılık.

Appendix-1. Document Review Form

Question	Knowledge Type			Competence			Context																Cognitive Level			Content Area		
							Personal					Local / National					Global												
	Content knowledge	Process knowledge	Epistemic knowledge	Explaining events scientifically	Designing and evaluating a scientific inquiry method	Interpreting the data and findings scientifically	Health and disease	Natural resources	Environment	Risks	Limitations of science and technology	Health and disease	Natural resources	Environment	Risks	Limitations of science and technology	Health and disease	Natural resources	Environment	Risks	Limitations of science and technology	Low	Medium	High	Physical Systems	Systems related to living things	Earth and space systems
1																												
2																												
3																												
4																												
5																												
.																												
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19																												
20																												