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PARENTS' USE OF THE SCIENTIFIC CONCEPTS IN DAILY LIFE AND STUDENTS' SCIENCE SUCCESS

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PARENTS' USE OF THE SCIENTIFIC CONCEPTS IN DAILY LIFE AND STUDENTS' SCIENCE SUCCESS

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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To my mother,

always desired the best for me.

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ABSTRACT

The aim of this study is to carry out an investigation to reveal the relationship between the frequency of use of scientific concepts by parents and students' science success. The use of science concepts by families in the home environment is important for the student's science success. This research was carried out with a total of 379 fourth grade students and their parents in one private and four state primary schools in Istanbul in the 2021-2022 academic year.

Survey type research method was used. The data were collected with the scientific concept test applied to the students and the scientific concept scale applied to the parents. The quantitative data obtained at the end of the process were analyzed with the SPSS 25 package program and evaluated with the descriptive analysis method. One-way ANOVA, t-test and linear regression were used for analysis of data. As a results of the research, it was determined that there was a significant relationship between the frequency of use of scientific concepts by parents and students' success in science. The use of scientific concepts by parents predicted students' scientific concept success in a statistically significant and positive way. On the other hand, there was a statistically meaningful yet slight difference among different education level of the parents and using scientific concepts of parents with daughters are higher than those of families with sons. The scores on using scientific concepts of the female participants were higher than the male participants. Parents' use of scientific concepts can explain 18.8% of the variance of students' success in scientific concepts.

Key Words: scientific concepts, science success, parents' involvement

ÖZET

Bu çalışmanın amacı velilerin bilimsel kavramları kullanma sıklıkları ile öğrencilerin fen başarıları arasındaki ilişkiyi ortaya koymaya yönelik bir araştırma yapmaktır. Ailelerin fen kavramlarını ev ortamında kullanmaları öğrencinin fen başarısı için önemlidir. Bu araştırma, 2021-2022 eğitim öğretim yılında İstanbul'da bir özel ve dört devlet ilköğretim okulunda toplam 379 dördüncü sınıf öğrencisi ve velisi ile gerçekleştirilmiştir.

Anket tipi araştırma yöntemi kullanılmıştır. Veriler öğrencilere uygulanan fen kavram testi ve velilere uygulanan fen kavram ölçeği ile toplanmıştır. İşlem sonunda elde edilen nicel veriler SPSS 25 paket programı ile analiz edilmiş ve betimsel analiz yöntemi ile değerlendirilmiştir. Sonuç analizi için tek yönlü ANOVA, t-testi ve doğrusal regresyon analizi kullanıldı. Araştırma sonucunda velilerin bilimsel kavramları kullanma sıklıkları ile öğrencilerin bilimdeki başarıları arasında anlamlı bir ilişki olduğu tespit edilmiştir. Bilimsel kavramların veliler tarafından kullanılması, öğrencilerin bilimsel kavram başarısını istatistiksel olarak anlamlı ve olumlu bir şekilde yordamıştır. Öte yandan, ebeveynlerin farklı eğitim düzeyleri arasında istatistiksel olarak anlamlı ancak çok az bir fark olduğu ve kız çocuğu olan ebeveynlerin bilimsel kavramları kullanmaları, oğlu olan ailelere göre daha yüksektir. Kadın katılımcıların bilimsel kavramları kullanma puanları erkek katılımcılardan daha yüksektir. Velilerin bilimsel kavramları kullanmaları, öğrencilerin bilimsel kavramlardaki başarılarının varyansının %18,8'ini açıklayabilir.

Anahtar Kelimeler: fen kavramları, fen başarısı, aile katılımı

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LIST OF ABBREVIATIONS

MONE: Ministry of National Education

PISA: Programme for International Student Assessment

TIMSS: Trends in International Mathematics and Science Study

1.INTRODUCTION

In this part, problem statement, the significance of the study and the research questions are explained detailed.

1.1. Problem Statement

Education is one of the words that individuals use frequently in their lives. It is a word that an individual encounter and thinks of its meaning in the processes that they go through from birth to death. Education is a process that aims to gain various knowledge, skills, attitudes, and values with certain purposes. With the help of education, scientific and technological improvements occur. Therefore, education is one of the biggest factors for countries in science and technology.

One of the fundamental institutions created to address society's educational requirements is the school. The school gives students the perspective necessary to meet the needs of the society and itself, the processes of thought generation and problem-solving, and values such as responsibility, justice and respect. It is expected from students to behave respectfully for their environment, to attend class regularly, to get along with friends and to obey the rules of the school (Erden, 2011). The school cannot force the desired beliefs and actions on the kids by itself. Family contribution on the students' education has an impact on gaining many desired behaviors (Gümüşeli, 2004). It is essential for the families to cooperate with instructions and school administrators.

Education carried out in cooperation with the family and the school will be beneficial to the student. The skills and knowledge that are desired to provide the students with a foundation are determined while creating the curriculum. The curriculum consists of different subject areas. Science is the one of the most urgent areas of the curriculum. Science can be defined as the systematic study of nature and events, and efforts to make prediction of yet-unobserved occurrences (Kaptan & Korkmaz, 2001). Science is an effort to examine and explain the concept in a field, to find generalizations and principles related to them, and to predict future events with the help of these principles (Kaptan, 1998). Science is also a process that affects every stage of life. Life is full of obscurity. With the help of science, individuals explore life's mystery. Individuals gain life skills by taking science education. These skills include asking questions, problem solving, analytical thinking and so on. Therefore, science increases students' curiosity about life and themselves.

While "Training all pupils as science-literate persons" was the course's stated goal in the curriculums published in 2013 (MONE, 2013a), the aim of the 2017 and 2018. Science programs was to "train all pupils as science-literate persons" (MONE, 2017; 2018). The main points that are common to science literacy definitions and dimensions are content knowledge and key science concepts. In this case, it is essential to teach the key concepts that form the basis of content knowledge for science and technology literacy. In the field of science, the question of which concepts an individual should know is important.

The most important factor in learning is to reveal students' previous knowledge. Teach concepts in a meaningful way starts with knowledge previously learned. According to Ausebel (1966) there is a need to use a pre-editor for pupils in learning new subjects. The definitions of scientific terminology and concepts are included in pre-editors. Those are employed to help pupils quickly learn newly acquired knowledge. Therefore, it reveals the importance of the family, which is the place where the students first start learning. The parents' use of the language towards their children is one of the most decisive factors in leaning new concepts. Since first pre knowledge is created in family environment, parents should pay attention to create scientific knowledge.

Unscientific knowledge that students learn daily life causes incomprehension of concept (Akgün &Aydın, 2009). Students have prior knowledge from their natural and social environment. This preliminary information keeps the student from getting scientific information and as a result, gaining new information may become difficult (Canpolat, Pınarbaşı & Bayrakçeçen,2004). This shows that the parents' importance in students learning experiences. Also, Turno's research (2004) results support the idea that parent's culture is related to students' science success. There is a strong relation between pupils' science literacy level and parents' cultural level. Parents' cultural level consists of the education level of parents. Parents who are high level education have a tendency to use scientific language and spend time with their children in quality experiences. By providing deep and connected learning experiences, it increases the intellectual quality of all students and enables them to think at a higher level.

When the relevant literature is searched, it is seen that there is much research about concept teaching but not much research done on how scientific concepts are learned with the help of parental involvement. However, it has been observed that most of the studies on parent involvement in our country are related to the pre-school period, and there are very few studies on primary education. It is known that the participation of families in education has a great effect on the students' achievements. In this context, teaching scientific concepts with family and school cooperation affects the student's scientific literacy and establishing connections between the concepts. In this study, the main issue is to study the effects of parents' using scientific concepts and students' science success.

1.2. Significance of The Study

Science is a way to understand the universe and make a sense of events. Individuals start to learn in family and continue in schools. They learn new information and develop themselves. Individuals benefit from their experiences while constructing their knowledge. These experiences are first acquired in the family environment. The parents' use of scientific language, quality activities spending with their children are decisive for learning journey of children. When they cause misunderstandings, children build new concepts into old ones in a wrong way. This causes concepts developed before formal schooling contradict with what they learn at school.

The overall goal of this research is to study the relationship between students' science success and the frequency of parents' daily use of scientific concepts. For this purpose, scientific concepts, concept teaching, science success and parent involvement will be discussed.

1.3. Main Problem and Sub-Problems

1.3.1. The main problem

The main problem is "What are the factors that affect parents' use of scientific concepts in daily life and what is their relationship with students' success in science?"

1.3.2. The sub-problems

Following sub questions are answered in this research:

1. What is the frequency of parents' use of scientific concepts?

2.What is the relationship between parents' use of scientific concepts in daily life and students' science success?

3.Does the frequency of parents' use of scientific concepts change according to education level of the families?

4.Does the frequency of parents’ use of scientific concepts change according to the student's gender?

5.Which parents’ gender uses scientific concepts more frequently?

6. Does the use of scientific concepts by parents predict students' scientific success?

1.4. Assumptions

1.4.1. Assumptions

It is accepted that parents who joined this research are sincere in their answers.

1.5. Definitions

Parents: In this research, the parents are responsible for raising a child who is an elementary school student in Ümraniye district of İstanbul province in the 2020-2021 academic year.

Students: In this research, the students are students at elementary school in Ümraniye district of İstanbul province in the 2021-2022 academic year.

Schools: In this research, the schools include some private and state elementary schools in Ümraniye district of İstanbul province in the 2021-2022 academic year.

Scientific concepts: Scientific concepts are composed of some scientific concepts in elementary school science and life science lesson curriculum in this research.

2. LITERATURE REVIEW

In this chapter, importance of science education, concept learning and teaching and language development is explained in detail.

2.1. The Importance of Science Education

Individuals start to ask questions when they grow up. Their curiosity about life increases day by day. Personal fulfillment becomes a necessity for them, so they seek their answers. Science meets these needs of understanding of the life. Science can be defined as an endeavor of making life more understandable. According to Kaptan (1998), science is an effort to examine and explain the concept in a field. Fitzgerald and Smith (2016) investigated the teachers' understanding of science in their study. Teachers defined science as the study of how and why things operate, the relationships between living things, comprehending our reality, creating conclusions based on evidence, and enquiring, questioning, and exploring the world around us.

Science comprises different areas like environment, space, animals, plants, chemical reactions and so on. It is no doubt that people harm the environment, some problems like climate change, greenhouse gases have occurred. With the increasing level of population, the destruction level of the environment rises. Therefore, science is a good guideline for how to behave and take action toward environmental issues. Also, science makes individuals more literate.

According to National Science Education Standards (1996), scientific literacy provides that a grasp of science offers personal satisfaction and enjoy. It is important to be a scientific literate in developing and changing life conditions, because scientific literacy gives people critical thinking skills. Scientific literacy refers to the comprehension and knowledge of scientific ideas and procedures necessary for making decisions for oneself and for participating in societal issues. Therefore, an individual criticizes and understand scientific concerns that underlie judgements and express themselves in scientifically and technologically.

Scientific literacy is significant for countries to create a powerful future in the meaning of social and economic. Developments in science and technology make countries more powerful. When looking at recent years, many countries have realized that each citizen should have a good education, should be trained as a science and technology literate to be able to create a strong future, and that science education is the key factor in this process (Eş & Sarıkaya,2010).

Science understanding enhances the potential of every pupil to have fulfilling and fruitful occupations in their future. "Entry-level workers who can understand, analyze, conceive creatively, make judgments, and solve issues are needed in the corporate sector. Additionally, issues with economic competitiveness highlight the need of a scientific and math education which will enable us to stay up with our rivals across the world.” (Science Education ,1996, p.12)

The countries took a scientific action with the following new developments. Russia launched the first satellite in 1957. After this event, America, England, and other developed countries took action for compete each other. With the aim of following this development, scientific and technological improvements occurred in the education system, because science is seen as a savior. As a result of supporting projects proposed by scientists, many new science curricula have been developed in a short time (Blosser,1981). With the changing and developing world conditions, learning science and technology play a vital role for countries. This vital role has four main purposes.

These are:

- Science is a personal requirement, so individuals have to learn how to cope with new technological improvements.
- Science helps individuals for solving social issues.
- Individuals are prepared for academic life through science education.
- Science prepares individuals science and technology-oriented business areas (Yager & Penick, 1988).

The National Scientific Education Standards declare that providing students with the tools to comprehend and address social and personal concerns is a key goal of science education. (Paulson, 1996).

Table 1

Science in Personal and Social Perspectives (Science Education book, p.108)

LEVELS K-4	LEVELS 5-8	LEVELS 9-12
Personal health	Personal health	Personal and community health
Characteristics and changes in populations	Population, resource and environments	Population growth
Types of resources	Natural hazards	Natural resources
Change in environment	Risk and benefits	Environmental quality
Science and technology in local challenges	Science and technology in society	Natural and human induced hazard
		Science and technology in local, natural and global challenges

Giving pupils a tool to comprehend and address personal and social issues is one of scientific education's key goals. Students can improve their decision-making abilities by integrating science with personal and social viewpoint standards. Students have a foundation upon which to build the selections they will need to make as citizens thanks to the insights into the principles in Table1. When the age of level groups increases, the concepts become wider and more environmental. Whereas the concepts in levels group K-4 and levels group 5-8 are related to personal and natural, community and global perspectives are added the concepts in levels group 9-12.

2.2. Aims of The Science Education

The era we live in is one of technology and information. When we look at the world, many changes and developments are seen. At the forefront of these changes and developments, with the emergence of information societies, comes technology without a doubt. Technology is the application of knowledge obtained by testing its accuracy. Science education is also a science that gives students positive attitudes about technology. Therefore, the main aims of science education are;

- To train people who can profit from the most recent technology advancements in every profession and stay up with the continually changing and evolving world.
- To teach that science is necessary in all technological inventions and developments.
- To raise new generations with an investigative spirit (Hançer, Şensoy and Yıldırım, 2003).

Science education needs a strong curriculum to be able to obtain the mentioned aims. Countries also take the needs of country as a basis while preparing this curriculum. Our country also aims the following purposes within the scope of its own needs:

- Improving realist and consistent worldview.
- Explaining science concepts.
- Improving scientific skills.
- Adopting new scientific and technological improvements.
- Becoming a beneficial citizen (Gücüm & Kaptan,1992).

In the elementary school science curriculum prepared by the MONE (2017), some features are defined for the individuals who are targeted to be trained. These features are self-confident that is open to cooperation, able to express itself, entrepreneurial and sustainable development life-long learners with the consciousness of science. Also, they have positive attitude, skills, knowledge, moral and national values; engineering of science, understanding of its relationship with technology, the environment, and public, and psychomotor skills.

The following are the general goals as indicated in MONE's (2017) curriculum:

1. To offer fundamental knowledge about engineering and its "application," chemistry, physics, biology, astronomy, geology and environment sciences, and other related fields.
2. To explore nature, to comprehend the interaction between people and their surroundings, using scientific research methods, and problem-solving techniques in various domains.
3. To become aware of how people, society, and environment are interconnected; to improve public understanding of sustainable growth in terms of the use of resources and the economy.

4. To guarantee the use of scientific methods, practical knowledge, and responsibility for resolving issues in daily life.
5. To develop entrepreneurship and career awareness in the scientific field.
6. To aid in the comprehension of how scientific information was created and how it is applied to future research.
7. To understand the importance of safety and to increase the awareness of safe working, in scientific studies.
8. To develop enthusiasm in and wonder about natural world occurrences.
9. To enhance one's capacity for using scientific reasoning and decision-making in socio-scientific problems.
10. To make sure that scientific ethical principles and international, national, and cultural values are adopted (MONE, 2017).

2.3. Concept Learning

Concept is the name given to groups of entities, thoughts, and events with similar characteristics (Temizyürek, 2003). Each illustration of a concept has characteristics that are shared by all other illustrations of the idea. Concepts, as stressed by Lieberman (2012), provide people the ability to analyze and comprehend the social and physical context in which they exist. If two or more objects or events can be grouped and these objects and events have special distinguishing characteristics they can be named as a concept (Shipstone et al.,1988). Rosh (1999) stated that the concepts are a tool for identifying objects and explaining new situations. Von Glasersfeld (1995), on the other hand, characterized concepts as an individual constructs to which mental images responsively through available perceptual cognitive material. According to Karamustafaoğlu, Karamustafaoğlu and Yaman (2005), concepts reduce the confusion of the world. Similar objects can be classified, and confusion is removed. For example, using the word cat rather than a four-legged, domesticated, whiskered animal is a more universal expression. On the other hand, when the concepts are learned, it is easier to make connections to other concepts.

Concepts are classified as concrete and abstract. While concrete concepts are received by five senses of the individuals' abstract concepts isn't received by five senses (Cantekin, Çağdaş & Albayrak, 2000). Individuals start to learn concepts concrete to abstract and simple to complex.

Concepts play a crucial role in an individual's social and education life. They understand new concepts with making a connection to previous ones, so the more individuals grasp new concepts, the more familiar they are with existing notions. The process of acquiring new concepts will be more effective for kids if they can generalize them (Powell, 2011). Concepts make managing and planning more straightforward (Aral, 2011).

Individuals start to learn concepts in the family and continue in the school. Concepts are formed through experiences that people have when examining their social and physical environments (Allen &Coole, 2012). Their experiences play a vital role in formation of concepts. When individuals meet new concepts, they perceive differences, similarities, order, group and categorize them. Differentiation is a start point of learning concepts (Aral, 2011). The acquisition of a category or a schema which relates to a subset of occurrences or things, such that those objects or events are perceived as comparable, according to the definition of Lewis (2010) regarding the idea creation process. A schema can be defined as a mental representation.

Piaget also says that schemas have an important place in constructing new knowledge in constructivist theory. The mainstay of the constructivist theory is the idea that the individual develops the schemas in his mind by combining new knowledge with existing knowledge and experiences. These schemas form the cognitive structure, and a cognitive balance occurs at the end of a learning situation that creates a sense of satisfaction. Piaget explains learning with the concepts of assimilation, adaptation, accommodation, and balance. The individual adapts the newly learned information to the schemas in his mind (assimilation), if he cannot adapt it, he renews (arranges) the schemas in his mind. With new learning, that is, with the processes of assimilation and regulation, the balance is restored. In this process, there are some contractions and expansions in the meanings of the concepts. When the individual encounters a new situation, his cognitive balance is disturbed. Through the assimilation process, some information is incorporated into our preexisting schemas, while the process of accommodation results in the creation of new schemas or complete modifications of preexisting concepts. Accommodation leads to create new schema. To put it more clearly, when a new situation makes the individual realize that his current knowledge is not sufficient and he needs to learn something new, it is called cognitive deterioration. So that cognitive development works continuously and remains active. If the desire to learn does not arise, the balance is not disturbed (Altun,2006).

Like Piaget, Bruner believes that education should involve students' active engagement since he views learning as an active process. He claims that teaching via creation is the only way to ensure that students are actively engaged in their education. The discovery or invention method is a motivating teaching strategy focused on pupil participation in instruction which collects and analyzes data related to a certain problem and provides access to abstractions. In addition, Bruner argues that when teaching concepts, it is important to provide the concept's name, description, qualities, and examples that are linked to it (Özmen, 2004).

The most significant component influencing learning, according to the theory of meaningful learning of Ausubel, is the individual's present knowledge. This should be disclosed, and instruction should be designed accordingly. He contends that verbal communication is the primary mode of learning. The most crucial factor is that learning has purpose. If done right, verbal learning may be beneficial. Additionally, linguistic tactics are used to convey a lot of information to the person in a little period of time (Özmen,2004)

Ausubel outlined the four psychological foundations of verbal learning as follows:

- When new ideas, information, and principles are connected to ones that have already been learnt, they take on more meaning. A person cannot understand the subject if they cannot make this connection.
- Each piece of information stands alone as a complete. There are concepts and relationships between concepts in this totality. The person will have trouble understanding the subject if they are unable to comprehend this arrangement and the connections between the new concepts.
- It is challenging for a person to understand and assimilate a new subject if it is inconsistent with or goes against what they already know.
- Deduction is the thought method that is most useful for learning a cognitive subject. A person has not understood a rule if they can't properly apply it in unique circumstances (Özmen, 2004).

Relying on these psychological principles, Ausubel created a teaching strategy he named "expository teaching." Three steps are taken to implement this model:

1. 1.To make the individual ready to understand the new issue by using pre-editors. Ausubel draws attention to the need to use a pre-editor in comprehending new issues for pupils. Pre-editors are used to help students learn the newly learned knowledge more quickly and include the definitions of scientific terminology and vocabulary as well as some reminders. Those are given to the individuals prior to the subject is covered so that they are ready to learn the subject (Collette & Chiappetta, 1989).
2. To provide the new topic's specifics step-by-step,
3. To provide the student to develop mental processes such as combining, integrating and reconciling by using many instances to illustrate the new subject's primary idea (Özmen, 2004).

To say that individuals can understand the concepts, they meet some requirements. First, they should differentiate between close-in (extremely similar) nonexamples of the idea and those that lack one or more of its distinguishing characteristics. After then, they should locate instances of the notion in a variety of contexts. Final requirement is that individuals should give examples and nonexamples that weren't covered in class (Özmen,2004).

2.3.1 Concept teaching in science education

Science consists of so many abstract concepts, so students see science as difficult (Günbatar & Sarı, 2005). Scientific concepts are taught starting from elementary school. New knowledge is built into older knowledge which is learned in elementary school years. With the change in science curriculum there are science lessons at third and fourth grade. This situation provides the teachers an opportunity to teach concepts in small ages, since science consists of abstract and concrete concepts. Thanks to early course of science, the students will be engaged scientific activities which helps students to understand abstract concepts easier.

Ecevit and Şimşek (2017) conducted a study on classroom teachers and science teachers teaching science concepts, and in this study, some teaching methods which include drama, analogy, questioning, associating with daily life, word association, computer-assisted teaching and teaching through discovery used by instructors were determined. According to the results of the research, teachers teach concepts with the help of analogies and dramas; It is one of the results obtained that these methods facilitate concept teaching. Küçükaydın (2020) also revealed that concept maps are used effectively in teaching science concepts. These teaching tools are included in the inductive method used in concept teaching, and in this approach, the pupil is requested to determine the descriptive and distinctive qualities by examining the examples that are included and not included in the method. This method is similar to Piaget's constructivist learning theory in terms of structure and operation. Another method used in concept teaching is the traditional teaching method. Traditional teaching method in science education is inadequate for concept teaching. Traditional teaching method consists of asking questions, using science books, and direct teaching. This method leads students to memorize concepts. Memorization can create contradictions between the existing old knowledge of the individual and the new knowledge he has acquired, and this leads to the formation of misconceptions (Sönmez & Geban, 2001).

In the education of science, it is urgent to be sure that students understand the concepts, because science curriculum is a spiral curriculum which means new subjects are presented repeatedly, but it does not mean the same subjects are repeated in each year. If students are not able to understand the concept' meaning, its examples and nonexamples, it is difficult to teach new concepts, and related principles.

Constructivism is a cognition-based learning approach that occurs because of the mental configuration of the individual (Erdem & Demirel, 2002). In constructivist learning, the main thing is not direct transfer of the information or concept to the student, but how the student makes a meaning from it. Information is shaped according to students' experiences. With the implementing constructivist approach on science lessons, students do not directly reach the knowledge, they ask questions, search, hypothesize, make experiments, and make inferences about them. Thanks to this, students explore new information and construct information on their minds. Mind maps, concept maps, concept cartoons, analogies, 5E model of instruction provide an active mental processing.

With the technological improvements in education, the different teaching strategies are developed. Students spend their time with technological tools which are smartphones, iPads, computers. In order to reach all students, different strategies which are focused on technological application are applied. There are beneficial teaching applications. Concept maps, cartoons can be created on websites. Science simulations are available on web sites, this helps students to understand concepts. However, in order to use these applications in classrooms, the teachers improve their technological skills. Olson (2008) stated that the formation of concepts gets difficult for students only using science formula without any hands-on activities. These activities are held in both class and online environments. One of the goals of science education is to supply meaningful training instead of memorizing. Therefore, different activities should be used for students to experience and make connection with the concepts.

2.3.2. Factors affecting concept teaching and learning

Before teaching the concept, it can be revealed that factors affect students' learning of concepts. According to Ülgen (2001), inadequate or incorrect previous knowledge, misconception, and inadequate learning environment are the main issues that influence students' concept learning and developing the ability of learning concepts.

2.3.2.1. Previous knowledge

Learning concepts means creating new information in mind with categorizing stimulus (Ülgen,2001). The process of creating new information changes from student to student. Gaining new information in mind is related to how to learn concepts. Ausubel's Meaningful Learning Theory states that the most urgent issue in learning is to reveal students' previous knowledge. It also emphasizes that students' previous knowledge should be investigated before teaching and learning concepts (Şimşek, 2007).

Students make connections between new concepts to old concepts to structure information that they learned. This situation is related to students' previous knowledge. Previous knowledge has an influence on both learning and teaching new concepts. If previous knowledge is wrong, it causes misconception. Correcting misconception is more difficult than teaching new concepts.

It is seen that the most important factor affecting previous knowledge is daily life experiences. It is stated that daily life experiences and experiences caused previous knowledge are starting points of teaching activities (Bodner, 1990).

2.3.2.2. Misconceptions

Misconceptions are notions held by students that are at odds with the findings of science (Larkin, 2012). It is stated in another research that misconception can be defined as differences between students' knowledge based on experiences and scientific knowledge. (Büyükkasap, Dügün, Ertuğrul and Samancı, 1998).

Misunderstanding is an important issue in science education. As the students have misunderstanding about scientific concepts, they build new concepts into old ones in a wrong way. They unknowingly create misconceptions by making explanations, solving problems. Additionally, these incorrect notions formed prior to receiving formal education conflict with what kids are taught in classrooms (Allen & Coole, 2012). Media, teachers, parents, textbooks, science curricula, and other teaching materials strengthen and support to remove misconceptions (Gooding & Metz, 2011).

In order to teach new concepts more meaningfully, the main causes of misconceptions should be handled correctly. These reasons are listed below:

·Incomplete or misunderstanding of previously acquired concepts.

·The concepts used in daily language serve various purposes in scientific discourse, Failure to design learning environments that are appropriate for the instruction of concepts and subjects.

When the concepts are not related to each other and daily life, this can cause misunderstanding (Erdem, Yılmaz & Morgil,2001). Coştu, Ayas and Ünal(2007) are stated that lack of information, experiments and previous experiences cause misconception.

It was revealed that teachers specified misconception by asking questions, students' answers to exam questions, students' wrong answers. This research shows that asking questions in science has an important role to determine misconceptions. In addition, teachers' techniques which are used for removing misconceptions are making experiments, brainstorming, giving examples of daily life (Güneş, Dilek, Demir, Hoplan & Çelikoğlu,2010).

According to Tobias (1990), when teachers' pay attention to teach scientific facts and unnecessary information, a great majority of students are not willing to learn science. If they focus on making experiments that makes students more active learner, students start to like science lesson. Their participation on science lesson increases, so they foster a deeper understanding science topic. As continuing giving unnecessary details, students' misunderstanding is not corrected. In order not to meet this situation, concepts are grasped with different learning activities. According to Schill and Howell (2011), in order to improve students' comprehension of science, specific care should be linked to conceptual learning.

Elementary school years have a vital role on students' misconception. Students' knowledge is structured in these years and new knowledge built into old ones. When the research is investigated, it is found that misconceptions mostly are created in elementary school and it is hard to remove misconceptions which are fostered in these years (Harman & Çökelez, 2015) According to Kara and Aktürkoğlu's (2019) research results, third grade science lesson books cause misconceptions due to the lack of information. Also, Uyanık (2019) states that there are misconceptions of fourth grade students. Misconceptions can negatively affect students' success (McDermott, 1991).

When research related to misconception is investigated, the importance of previous knowledge and experiences is revealed. Students' previous knowledge and experiences are shaped with their families. Therefore, the students start to learn misconceptions in their family environment.

2.3.2.3. Learning environments

Conditions of learning environment have a vital role in concept learning. Children’s learning environment include home, social and school/classroom environment. The first of these is the family environment. Economic and social conditions and the parents' educational degree is the basic characteristics of the home environment (Şahan,2021). Both negative and positive meanings can have an impact on how youngsters develop their language and concepts.

Children also are affected by their social environment they live in. Social environment determines their experiences. However, the quality of the teachers and the school, the opportunities provided by the school is another factor that affects concept learning.

2.4. Elementary School Science Curriculum in Turkey

Turkish scientific education underwent systematic modifications shortly after the republic's formation on October 29, 1923 (Okan, 1993). This predicament resulted mostly from Atatürk's prediction that education would have the greatest impact on the growth of the Turkish Republic (Güneş, 2007). For this reason, Atatürk enacted the Law of Unification of Education, which provided the unity of education and training, on March 3, 1924 (Akyüz, 1992). The progress of Turkish science education is impacted by this statute. The educational curriculum incorporated the science lesson known as "nature etude" in 1924, and the topics were divided into divisions under the heading of "material lessons (Okan, 1993).

The most important innovation brought by the 1926 Elemantry School Curriculum is the application of the principle of collective education. According to this method, lessons in the first semester of primary school were given within the scope of "Life Sciences" (Arslan, 2007). For this reason, while science education is included in the "Life Sciences" course in the 1st, 2nd, and 3rd grades, which is the first stage of primary school, it is given within the scope of "Nature" and "Objects" courses in the 4th and 5th grades, which is the second semester of primary school.

After the 1926 Primary School Program, different reforms were made in various fields in Turkey and as a result, new needs emerged. For this reason, changes were made in the 1926 program, which was in practice for ten years, and the 1936 Primary School Program began to be implemented (Arslan, 2007). In the 1936 Program, the "Nature" and "Goods" courses were combined and started to be given as a "Natural Knowledge" course in the 4th and 5th grades.

The themes connected to the scientific lesson were covered in the first level primary education classes' Life Studies units as well as the second level primary education classes' Agriculture Studies, Family Studies, and Nature Studies units. Children's direct acquisition of knowledge through experimentation and observation will be given significance in the curriculum, according to Gücüm and Kaptan (1992). Gücüm and Kaptan(1992) claim that the 1948 Primary School Life Studies curriculum prioritized social good over scientific inquiry.

Although the 1968 curriculum followed the unit model, behavioral targets for overall goals were not provided (Gücüm & Kaptan, 1992). Additionally, a significant amount of space was allocated to tasks including project studies, research and analysis, and problem solving, (Özdemir, 2006). Consequently, it can be observed that a teaching strategy fostering active student engagement was advised for the curriculum (Gücüm & Kaptan, 1992). In 1974 and 1977, the 1968 curriculum experienced two more revisions, the name of the program was changed to "Science" in 1974 and some changes were made in the contents of the unit. Although the scope remained the same in the 1977 curriculum, the places of some units were changed

(Gücüm & Kaptan, 1992). After the last changes made in 1977, the curriculum remained in practice until 1992, and in 1992 the "Primary Science Teaching Curriculum" was prepared. It is an innovation brought by this curriculum that for the first time there are sections with special goals and behaviors at each grade level (Çelenk, Tertemiz and Kalaycı, 2000).

The lesson's name was modified to "science and technology" in the 2004 Curriculum, and since 2005, after a pilot survey, it has been used gradually according to grade level (MONE, 2005). As a result of this new curriculum, relatively recent ideas like constructivism, student-centered teaching practices, and science and technology literacy began to surface on the agendas of both instructors and students.

In the 2012-2013 academic year, instead of the 8-year compulsory education system, with its general reference of "4+4+4" system: the twelve-year compulsory education, 4-year second stage secondary school and 4-year third stage high school. With this system change, new teaching programs have been developed to meet the needs of the system. One of the curricula developed and put into practice in this direction was the "Science Curriculum". The 2013 Curriculum has been implemented in the fiftth grades in secondary schools since the 2013-2014 education year, and in the third grades in primary schools since 2014-2015, and it has gradually started to be implemented throughout the country.

The 2017 Curriculum includes some differences in the stages of preparation and publication compared to the curriculums implemented so far. Before the 2017 curriculum was published, the draft curriculum was published within a month, presented to the public and stakeholders for their opinions and their suggestions were received. In line with the data collected in this way, the 2017 Curriculum was initiated for the implementation after the necessary corrections (Düzgünoğlu & Özcan, 2017).

The 2017 Curriculum is based on an interdisciplinary and inquiry-based learning approach. In line with this approach in the learning and teaching system in the program, the duty of the instructor is to "encourage and guide the person". On the other hand, the pupil is expected to assume the role of "individual who investigates, inquires, clarifies, and discusses the information's source before producing it. With the help of this procedure, which combines science with engineering, technology, and mathematics, pupils are encouraged to approach challenges from an interdisciplinary standpoint. For this purpose, teachers guide students through this process; it is effective in making them individuals who can think at a high level, develop products, make inventions and be innovative (MONE,2017). These individuals investigate the knowledge issues instead of accepting directedly.

As seen Table 2, there are four learning areas of science curriculum. These are information, skills, affective and science-engineering-technology-environment learning areas. This learning areas specify the expectations for all students. In information part, it is stated the general subjects of science. Their job-related talents fall within this skill category. These are arranged in the following order: watching, measuring, categorizing, recording data, formulating hypotheses, using data, and developing a model; variables of modifying and controlling; and conducting experiments. Affective domain part emphasizes the objectives which are related to emotions, values, appreciation, motivation and attitudes. Final field includes the integration of science with mathematics, technology and engineering, an interdisciplinary perspective on issues, elevating pupils to the level of invention and creativity, using their knowledge and talents to produce things, and coming up with ways to improve those products.

Table 2

Learning Areas in Science Curriculum (Tan,2019)

Information	a. Earth and Universe b. Living Things and Life c. Physical Events d. Matter and Change e. Implementation of Science and Engineering
Skills	a. Scientific Process Skills b. Life Skills Analytical Thinking, Decision making, Innovative Thinking, Entrepreneurship, Communication, Teamwork c. Engineering and Design Skills
Affective Domains	a. Attitude b. Motivation c. Values Universal values, National and cultural values, Scientific ethics d. Responsibilities
Science-Engineering-Technology-Society-Environment	a. Socio-scientific issues b. Nature of Science c. Relationship Between Science, Technology and Engineering d. Relationship Between Science, Technology and Society e. Sustainable Development Awareness f. Science and Career Awareness

Eskicumalı, Demirtaş, Erdoğan, and Arslan (2014) have research which is about the comparison of 2005 and 2013 science curriculum. In this research two curriculum are compared according to adopted approach and acquired skills. The name of science lesson was changed in the 2005 program as “science & technology”. It focused on the importance of technology. The final name of the lesson is specified as a science in the 2013 science curriculum. Whereas 2005 science curriculum is based on constructivist approach, 2013 science program is based on inquiry learning. It is stated that there are same scientific process skills in each science curriculum. However, the word of the scientist in Turkish spelling is changed as a science human

In Taşar’ doctoral study (2016), third grade science curriculum was evaluated. The participant teachers specified both positive and negative reviews. It was stated that starting teaching science in third grade has a positive influence on students’ education (Abir,2017). However, lack of students' learning books, lack of materials is a restrictive part of curriculum.

Özdemir and Arık (2017) carried out research about the teacher’s ideas about the science curriculum in 2013.It was stated that the teacher's opinions about improved science curriculum in 2013 were positive in the meaning of vision, content, process, and evaluation. Besides, they found out the opinions of the professors do not significantly differ from one another regarding the meaning of their branch, university, and seniority.

Ural (2018) conducted research which investigates the fifth-grade teachers’ opinions about science curriculum. According to research results, the teachers were happy about the improvements. They stated that a new science curriculum could increase the students’ success in PISA and TIMSS. Increased number of engineering learning areas provides students to learn subjects by doing and living. Also, lack of materials complicates the learning and teaching.

According to Saraç and Yıldırım's research (2019), the most attractive part of the new science curriculum was the implementation of science, engineering, and entrepreneurship. The participant teachers stated that there was not any objective about implementing entrepreneurship, engineering, and science. In the curriculum it was applied by science fair projects. Negative parts of the curriculum are similar objectives with previous science curriculum. Also, the schools' conditions, crowded classrooms, lack of materials have a negative impact on students' learning. These opinions are supported by research in the literature (Dindar & Yangın, 2007).

Ozcan and Kaptan (2019) studied the curriculums in the meaning of Bloom taxonomy. The number of objectives in the 2005 curriculum more than the 2013 and 2018curriculum. The number of objectives decreases for both 2013 and 2018 curriculum. When the objectives are evaluated according to Bloom taxonomy, the intensity of objectives can cause the decrease time of gaining high level skills.

According to Çevik's doctoral study (2020) result, the primary science curriculum is appropriate for students' academic level. The participant teachers evaluate the curriculum's good and poor parts. It is stated that subjects are arranged simple to complex and easy to hard. Also, the number of experiments is adequate for students. This provides students with meaningful learning rather than memorization.

Cangüven, Öz and Sürmeli (2017) compared the science curriculum of Turkey and Hong Kong. Scientific-literate people express the perspective of both nations' science programs in particular. It is clear that Hong Kong and Turkey's goals are to educate people who would develop to the level of sophisticated societies. When the goals of the scientific curricula in Turkey and Hong Kong are examined, it is seen that the objectives of both programs exhibit a high degree of consistency.

2.5. Turkish Students' Science Success in The International Exams

The Science curriculum in Turkey has a vision of rising individuals who are scientifically literate (MONE, 2018). Scientific literacy means using knowledge to understand and define questions, acquiring new knowledge, understanding the features of science, making predictions about projects, and keeping an eye on scientific concerns and concepts depending on evidence (OECD,2013). In other words, there is a need for individuals who can understand, question and use science as much as being scientifically literate. At the end of the education process, measurement and evaluation are made to assess how much learning has occurred. The skills and knowledge of individuals can be measured and evaluated in international or national areas with measurement tools that measure various goals. The national exams held in Turkey to measure the success of students are LGS (High School Entrance Exam), international exams are PISA (Program for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study) exams can be given as an example (Acar & Ogretmen, 2012).

2.5.1. Science success in PISA and TIMSS

PISA is a program run by the OECD (Organization for Economic Cooperation and Development), which is held every three years and focuses on a different topic area.

PISA consists of three major subject areas. These are reading, mathematics and scientific literacy. The countries that are members of OECD can participate PISA examinations in specified years. According to OECD reports, the aims of PISA project are listed below:

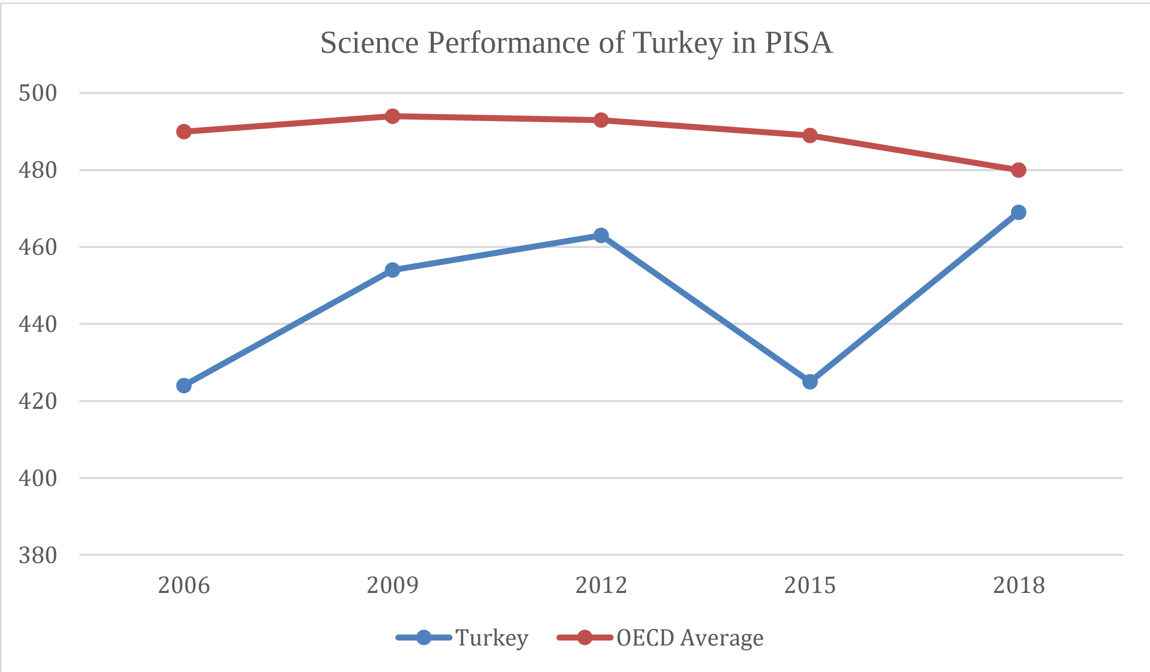
- Helping colleges in measuring a broader variety of 21st century skills outside of science, reading, and mathematics.
- Informing school leaders and teachers about their instructors' performance.
- Measuring pupils' knowledge, talents, and other abilities that will prepare them for academic achievement (OECD, 2018).

The PISA project provides opportunities for participant countries to evaluate their education system, to inform about their students' science, reading and math skills and to follow students' development of these skills over years. According to the PISA result, the governments make reforms to their education system. PISA programs are useful tools that may be used to improve educational efficiency, quality, and productivity and they describe common traits of colleges, pupils, and educational systems (Schleicher, 2007).

Turkey has participated in the PISA project since 2003. According to 2003, 2006, 2009, 2012, 2015 and 2018 PISA results, Turkey is under the average level of OECD countries. When science literacy scores are compared, Turkey has not shown a proper rise. It is seen that science literacy scores have increased between 2006 and 2012. In 2015, the students struggled to answer the questions. This situation reflected on the PISA result. According to final PISA results, the science literacy level has increased but not to the desired level. The OECD produces quarterly reports on the state of education around the world to share evidence of best practices and policies and to assist nations deliver the best feasible training for their pupils. As a result of these studies, the 2018 Turkey science PISA study results indicate that pupils' performance is lower than the average of OECD countries. Considering at the rank of success in science, Turkey placed 30th out of 37 OECD members while placing 39th out of 79 nations that took part in the study. Figure1 of the PISA study shows the trend in Turkey's scientific performance from 2006 to 2018.

Figure 1

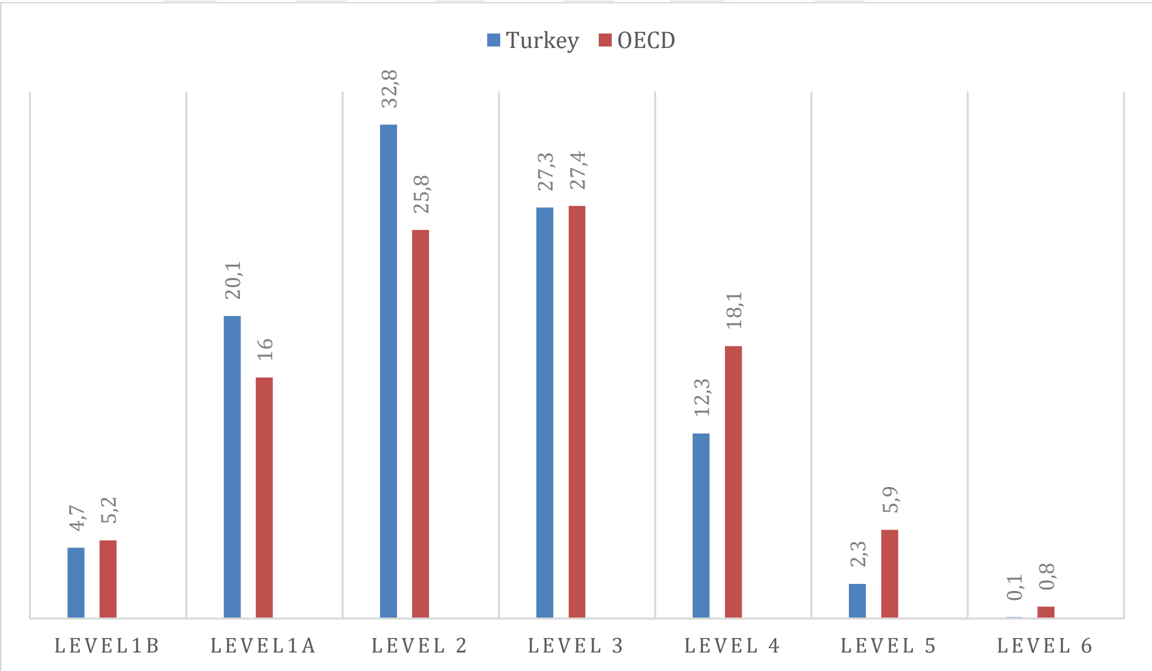
Science Performance of Turkey for years 2006-2018 (Ceran,2021)



When scientific test scores from 2006 to 2015 are considered, it can be claimed that Turkey caught an upward trend until that year but suffered a significant drop in 2015. The results of 2018 show that we have scored in a range that is comparable to the science scores from 2012.The trend that Turkey has shown based on all fields over the years is in the 2019 PISA report; “Looking at the results for all years, it is evident that the rather low 2015 PISA scores are unusual and that the decline between 2012-2015 and the recovery between 2015-2018 do not reflect a long-term trend”. In summary, this fluctuation in the tendency of Turkey in the PISA research over the decade constitutes a restriction in our ability to make precise future forecasts. The results of 2018 indicate that, despite being higher than in previous years, the percentage of pupils who do not meet the basic competency level in science has decreased. On the other hand, it demonstrates that the proportion of students who perform well is on the rise. In reality, according to the OECD, Turkey's scientific trend from 2006 to 18 has been good.

Figure 2

Ratios of 2018 PISA Research Science Scores by Proficiency Levels (%) (Ceran, 2021)



It is intended to identify what the students' results signify and to understand them meaningfully for each level shown in Figure 2. The knowledge and abilities needed to execute the activities at each competency level are specified. The abilities needed to properly finish each level get more difficult as you move closer to Level 6. A range of 80 points corresponds to each proficiency level. Accordingly, a discrepancy of 80 pts between two successive proficiency levels can be understood as such. According to the PISA 2019 data, there are on average 40 points amongst each grade level across all nations. In order to provide a meaningful and useful contribution to interpretation, the OECD underlines that this point value may be stated as "learning in one school year," but it is important to take into account the constraints imposed by the numerous factors that impact a country's performance.

According to the OECD, Degree 2 indicates the level of accomplishment in PISA and is the fundamental competency level when it comes to the skills in the science literacy dimension. The level of science competency at which pupils start to exhibit the skills necessary for productive and successful interaction with subjects connected to science and technology is considered to be Level 2. Although Level2 establishes a fundamental barrier at which children "usually need some guidance to cope with scientific-related topics, even in familiar circumstances," it does not define a sufficient level of science literacy (OECD, 2019b, p.114).

When looking at Figure 2, it is interesting to see that performance ratios have significantly dropped in comparison to the average of OECD members, notably from Level4. From this perspective, in the context of Science Literacy in Turkey, students;

• Organizing descriptions of less well-known events or processes using more intricate background information.

• Creating tests with at least two independent variables in a constrained setting and demonstrating an experimental design.

• Analyzing data from a data set and applying relevant conclusions based on reasoning.

• The capacity to explain unfamiliar and complex occurrences, circumstances, and processes using abstract scientific concepts or ideas.

• Making predictions, using epistemic knowledge to assess various experimental designs, confirming their hypotheses, and interpreting data.

• Being able to assess potential scientific approaches to a problem and recognize constraints on how to interpret datasets, such as ambiguous influences and origins in scientific data.

• Capability to propose hypotheses about scientific phenomena, events, and processes that involve numerous phases or forecasts using epistemic knowledge,

• To differentiate between pertinent and unrelated material and to utilize information from sources beyond the scope of the classroom when assessing statistics and supporting evidence.

• To discern between arguments supported by scientific theory and evidence and arguments supported by other factors,

• To assess challenging experiments, field research, or simulations and support the choice of each (Aydın, 2021).

85.3% of pupils lack the knowledge and abilities mentioned above.

The purpose of TIMSS is to give crucial baseline knowledge that may be utilized to enhance science and math teaching and learning. The International Association for the Evaluation of Educational Achievement is behind the initiative. Every four years, it is held and is open to fourth and eighth grade kids. Indicators of the need for curricular changes may be found in the fourth-grade student assessments, and the success of these changes can be followed up on in the eighth grade, after 4 years.

TIMSS study measures students' proficiency in science using three fundamental dynamics. These start with content sections. At the 4th-grade level, 2019 TIMSS evaluated three science curriculum areas: life science, physical science, and earth science. At the 8th-grade level, 2019 TIMSS evaluated biology, chemistry, physics, and earth science (TIMSS, 2020, p.235). These subject-specific learning areas are covered by the questions used to evaluate scientific achievement. The second fundamental dynamic under the purview of the evaluation is "Cognitive Fields." According to TIMSS, pupils should use a variety of cognitive abilities when answering questions. The three cognitive process domains are knowledge, application, and reasoning. Knowing includes the techniques, theories, and facts that students should be familiar with in science. The learner must be able to put the information and notion into practice and build a conceptual understanding in order to apply it. Higher-order thought processes including study design, synthesizing, evaluation, creating, and proposing innovative and critical answers are all part of reasoning (TIMSS, 2020).

In the 2020TIMSS, Turkey is ranked 19th out of 58 participating nations at the science assessment of fourth-grade level, with an average score of 526. (p.80). With an averaged science result of 515, it was placed 15th among 39 nations at the eighth-grade level (p.213). These ranks are higher than the TIMSS cycle's midway. Since 2011, Turkey has participated in TIMSS at both grade levels. The TIMSS cycles from 2011, 2015, and 2019 show a consistent rising trend, and the fact that this growth is brought to a head in the 2019 cycle is a blatant sign of this improvement in performance (Suna & Özer, 2021)

Countries all around the world participate in PISA and TIMSS exams to be able to figure out their success in science and math. Such applications are an important source of data for each country to show where their students are in terms of education and how much progress they have made. In addition, these international assessments offer opportunities to examine student achievements with different teaching practices in different countries and to compare them with student achievements in other countries. It also reveals information about the effectiveness of the mathematics and science education programs implemented by the countries. In the recent TIMSS and PISA exams, it is evident that Turkish pupils' average test scores fall below those of OECD nations, and the outcomes are unsatisfactory (Uzun, Butuner and Yiğit, 2010).

It is possible to analyze the variations in science success in two dimensions when assessing the TIMSS and PISA results: student (home-family factors) and school-related differences. Students' socioeconomic characteristics have an important impact on their academic success. TIMSS research; showed that students with high economic status also have high scores in cognitive tests (MONE, 2019). According to the TIMSS (2020) findings, the rates of socioeconomic differences in affecting science achievement are very close to each other in both fourth and eighth grades. This finding shows us that children from low-income families at both primary and secondary school levels should be supported academically and socially.

Socio-economic characteristics, which have an undeniable effect on educational success, draw a similar picture with this difference in achievement between school types. In other words, students who are socio-economically disadvantageous go to schools with low academic success. TIMSS results also show that achievement performance is low in disadvantageous schools, and there is an average proficiency level difference between advantageous schools and disadvantaged schools (MONE), 2016a). However, if more than half of a school is at a disadvantage, there is a tendency for the success of students in that school to be lower. This situation makes the difference in socio-economic status between school types a striking risk factor. Also, socioeconomic status is described by the OECD as a potent determinant of results in science and mathematics in all nations participating in PISA, according to the OECD PISA report. (OECD, 2019d). In such a way that the socioeconomic level difference accounts for 11% of the change in Turkey's PISA 2018 science achievement (compared to the OECD average of 13%) (OECD, 2019c).

Turno (2004) aimed at investigating the science level of students who lived in Nordic nations in terms of social, cultural, and economic. Based on the research results, there is a weak relation between students’ science literacy level and parents’ economic level. However, there exists a strong link between pupils’ science literacy level and parents’ cultural level. Parents' cultural level consists of the education level of parents.

Taking advantage of the comprehensive data provided by PISA and TIMSS assessments is very important for a country like Turkey that needs to increase the academic success and well-being of students. Findings from these evaluations can support policy making processes at various points, such as determining the content of curricula and textbooks, and adopting different teaching methods.

2.6. Parent Involvement in Education

Given that both the home and school settings have an impact on a child's development, parental involvement in education is regarded as one of the most critical aspects in improving the effectiveness and quality of education. As a result, it may be claimed that family is a significant aspect of the educational setting.

In the research on parent engagement, the concept of involving parents has been covered. Reynolds (1992) said that because it is challenging to define parent engagement, it is challenging to observe the link between parent involvement and its impact upon the growth or education of students, such as academic accomplishment. Furthermore, according to Kohl, Lengua, and McMahon (2000), Fan and Chen (2000), Fan and Chen (2001), and Jeynes (2003a), parent engagement in research projects has not been used in a clear and consistent manner. As a result, there is no clear-cut description of what parent engagement is in the literature. To create a framework for parents' involvement in their children's education, several scholars have put forth some generic definitions of parent involvement. Jeynes (2005) provided a broad concept of parental participation. He defined parent engagement in his meta-analysis research as the involvement of parents in the educational experiences and processes of their children. There were also offered some more thorough definitions. For instance, parent involvement, according to Sosa (1997), is a group of educational activities parents start at home to help their kids succeed in school. These activities might include giving kids educational games, helping them with their homework, or having conversations with them about current events. Similarly, Şahin and Ünver (2005) defined parental involvement in whole organized activities which support child development. Parental involvement is a kind of participation which requires mutual, regular, and understandable communication and consists of school activities like helping students' journey of learning, participating school activities (Çağdaş, Özel & Konca, 2016).

However, parent engagement in a wider sense refers to more than just the participation-required events that are meant to include parents in their children's education. Instead, parent engagement, according to Wong and Hughes (2006), also refers to the parents' interests in child-related events, understanding of such activities, and desire to take part in those activities. To summarize, each of these concepts focuses on a different component of parental participation.

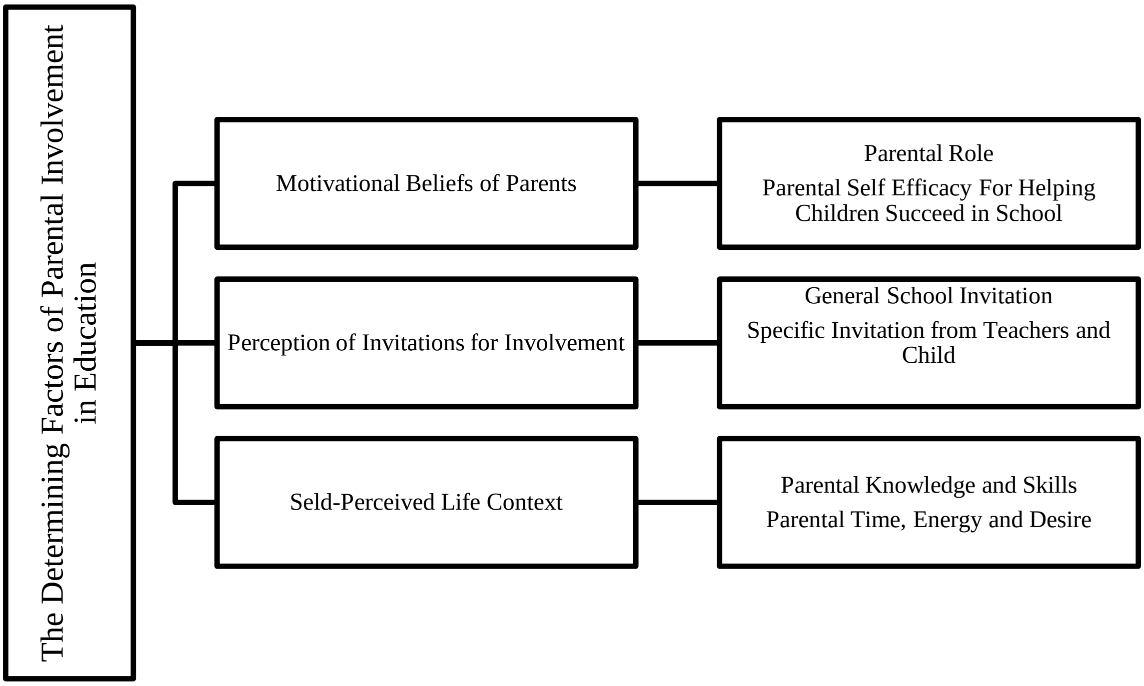
Parents aim to improve their child's performance and tasks in school. According to The Hoover-Dempsey model, when the parents think they have important power on the child’s learning, they are willing to be involved in the child's learning experiences. The teachers make connections between the school and parent to keep relationships smooth. When parents and schools work together, students' enthusiasm for courses and school increases (Lynch, 2016). It is obvious that the role of parents in the educational process affects students’ motivation, and success.

When the relevant literature is searched, so many factors that affect parental involvement are found. In the studies, the intensity of the working hours of the parents, their educational and economic backgrounds are predominantly included. Nowadays, both mother and father work to meet children’s needs. Because of the excessive number of working hours, parents have a difficulty in spending time with children and they do not participate in their kids' schoolwork. In addition, the frequency of parental participation rises in proportion to the time and energy available to parents (Wlaker et al.,2005). For parental participation, another determinant is the parents' educational background. Parents with low educational levels are suspicious of themselves when it comes to participation in school activities. Additionally, it has been discovered in some studies that parents with greater levels of education are more engaged in their kids' education than parents with lesser levels of education. (Fantuzzo, Tighe & Childs, 2000). Studies on the socioeconomic factor, which is one of the factors affecting family participation, show that compared to middle- or high-socioeconomic-status parents, low socioeconomic status parents are often less active in their children's educational institutions (Dornbusch & Ritter, 1988).

According to another study, there are various factors that determine the parental involvement. As seen in the Figure 3, factors are divided in to three main groups. These include the parents' motivating ideas, how people interpret requests for participation, and how people see their own lives. Parents' personal ideas that drive them to determine whether or not to get involved in their child's education are reflected in their motivating beliefs about parent participation in education. Parental self-efficacy views can be classified as either general parenting or specific parenting in terms of classification. Self-efficacy and parenting with a special focus self-efficacy (Coleman & Karraker, 2000).

Figure 3

Determining Factors of Parental Involvement in Education (Hoover Dempsey and Sandler,2005 p.57)



2.6.1. Parental involvement in student success

The vast majority of studies show a beneficial relationship between parent participation in children's education and accomplishment. Additionally, evidence demonstrates that parental involvement in their children's education has a positive impact on academic attainment. This is true for all forms of parental participation in their children's education as well as for students of all kinds and ages.

The research also demonstrates that parent participation will have a stronger impact the sooner in a child's learning system it starts. The importance of the family and home environment in influencing a child's performance in school is widely emphasized by educators, and it seems that the sooner this impact is "harnessed," the higher the possibility that student accomplishment will be.

Another research discovered that parental involvement at a lower educational level was crucial to students' academic success (Epstein, 2001). Parental involvement, as well as measures aimed at strengthening community school relationships, have been demonstrated to boost student attendance, academic success, and behavior (Epstein & Shetdon, 2002). As further reasons for the seeming decline in parental involvement in education, several social scientists have cited the existence of more parents in the workforce, the rapid speed of contemporary life, and the diminishing significance of the family.

Studies at all levels of education supports the significance of parental participation in education, with an emphasis on the primary grades. Elementary grades were found to be a reliable indicator of high and mid-school grades in studies (Hill & Tyson, 2009). As a result, elementary school is critical in a student's educational career. The major concepts of the lesson should be learnt in direct meaning to remove difficulty in the learning process.

2.6.2. Language development in the family

Language is an important tool for communication which enables people to communicate each other. It is used for sharing emotions, feelings, information, thoughts. Language has a critical role for establishing powerful communication. The range of words, the way of using language have a decisive influence on individual's future relationship. This situation reveals the importance of acquisitions of language. Language is acquired in the period of early childhood. Because the majority of a child's time is spent with their parents and caregivers at the childhood, they have a direct impact on language development. The amount and quality of the activities assist parents in encouraging their children's linguistic development.

It is necessary to understand the components that influence students' language acquisition. The degree of education of the parent, the amount of time spent with the child, the home literacy environment, and promotional activities can all be considered important variables. The first 3 years of children's lives are significant for future objectives because their first three years are characterized by rapid advances in all areas of development, involving the acquisition of language competence (Hoff, 2009).

Parents who are capable of learning new subjects are more involved in their children's development. The degree of education of the child's parents has a considerable impact on his growth. Mothers with higher levels of education converse and engage with their children in ways that help them develop their linguistic skills. According to better educated mothers, less educated mothers cannot afford to provide their children with more advanced activities.

One of the most important environmental influences in a child's mental development is the education level of the child's immediate family. It may be seen not only in the child's active caring but also in infrequent dialogues, debates, criticism, play, and other behaviors. Additionally, it has an impact on the language environment of the house and the intellectual life of the family, particularly the kinds of active cultural interests.

According to Kail (1990), the degree of education held by the child's family relatives has an important role on child’ mental development. Another research result shows that at 15 months, youngsters have more sophisticated communication abilities. and express themselves at 36 months (Pancsofar, 2010). Also, he stated that higher level of education of the mother and father is linked to more developed expressing language development. at 36 months of age.

The literacy environment of the household is another crucial aspect in language development. The literacy environment in the home has a significant effect on children's language and reading abilities. The child's eventual literacy level is determined by his or her home environment. The child imitates the actions of its parents. Children's literacy levels are boosted by their parents' reading habits at home. Furthermore, the family structure has an impact on language development. Children from families who perform well in democratic conduct use language more effectively. When parents are supportive and tolerant, they can help their children's language development. (Ocak, 2017). Stability of the routines and behaviors provide persistent change of the language in a positive meaning (Reay, 2019).

When young infants are at the language development stage of single-word, facilitative language practices like imitation and extension may improve language learning. Children start to learn new words in the means of their experiences with their parents. Interactions between them help children to hear different words. According to Holf-Ginsberg (1997), the key factor is on caregiver linguistic input. Language skills of the children are significantly related to number of words and quality of their linguistic input (Girolametto, Wietzman, Wiigs & Pearce ,1999). The quality and the quantity of the activities play a decisive role on fostering language of children. Desjardin (2006) is separated facilitative language techniques into two categories. These are higher level and lower-level facilitative language techniques. Detailed information about these techniques is given in the Table 3 and 4 below:

Table 3

Definitions of Higher Level of Facilitative Language Techniques (Desjardin, 2006)

Higher level of facilitative language techniques	Definition
Parallel talk	Providing linguistic input about directly what the mother or child is doing as long as child is looking at activities.
Expansion	Repeating the immediate preceding child utterance approximation or verbalization by adding one or more morphemes or words.
Recast	Repeating the immediate preceding child utterance approximation or verbalization in a question format.
Open-ended question	Stating a phrase or question that the child can answer in a two-to-three-word phrase or more.

Table 4

Definitions of Lower Level of Facilitative Language Techniques (Desjardin, 2006)

Lower level of facilitative language techniques	**Definition**
Label	Labeling a toy or picture. (child may or may not be looking directly at the object)
Linguistic mapping	Putting into words or interpreting the child's intended message using the context as a clue.
Close-ended question	Stating a question that the child can answer with only one word.
Imitation	Direct repeat or imitation of child's preceding vocalization or verbalization without adding any new words.
Comment	Stating a comment to keep the conversation going or to positively reinforce the child.
Directive	Telling the child to do something or commanding a behavior.

As can be seen in the table, specific approaches are necessary for children's language development in order to build a more complicated language. Recasting (Fey et al., 1999) and open-ended questioning (Lilly & Green, 2004) are two facilitative language approaches that promote discussion and elicit more advanced syntactic and grammatical abilities. Once children have mastered more complex levels of lexical and grammatical knowledge, these approaches are applied more often (Hulit & Howard, 1997). In contrast, methods like linguistic mapping and imitation are more didactic in character and essential for kids whose language development is at the prelinguistic and one-word stage (Girolametto et al., 1999).

3.RESEARCH METHOD

In this section, the design of the study, the study group, the measurement tools used statistical analyses methods are explained.

3.1. The Designed of The Study

The research aimed at to figure out parents' daily use of scientific concepts students' science success. A descriptive research design using quantitative data collection tools was applied. It can be argued that the descriptive survey represents the situation related to the research area with its findings (King & He,2005). The survey is defined as a "means for gathering information about the characteristics, actions, or opinions of a large group of people" (Pinsonneault & Kraemer,1993). A survey which is called Scientific Concept Scale has been formed on the frequency of occurrence of scientific concepts by parents. A 5-point Likert type survey was used. A scientific concept test has been created to measure how well the students know about science concepts and was applied to the students.

3.2. Participants

This research was conducted with 379 fourth grade students and their parents in 4 public schools and a private school in Ümraniye which is a district of İstanbul. The participants were randomly chosen.

The distribution of gender and education level from personal characteristics of students and parents was examined, descriptive analyzes were made for personal characteristics and presented in tables.

Table 5

Gender Distribution of the Parents

	Parent Gender	f	%
Gender	Male	110	29,0
	Female	269	71,0
	Total	379	100,0

According to the analysis results in Table 5, it is seen that 71.0% of the parents who participated in the families' use of scientific concepts survey were female and 29.0% were male. Only one female or male parent form one family attended.

Table 6

Gender Distribution of Students

	Student Gender	f	%
Gender	Male	177	46,7
	Female	202	53,3
	Total	379	100,0

According to the analysis results in Table 6, it is seen that 53.3% of the students who participated in the scientific concepts test were girls and 46.7% were boys.

Table 7

Distribution of Parents' Education Levels

	Education Level	f	%
Education Level	Primary School	76	20,1
	Secondary School	111	29,3
	High School	91	24,0
	University	70	18,5
	Postgraduate	31	8,2
	Total	379	100,0

According to the results of the analysis in Table 7, 29.3% of the parents who participated in the survey on using the scientific concepts of families were graduated from secondary school, 24.0% from high school, 20.1% from primary school, 18.5% from university, 8.2% were postgraduates.

3.3. Instruments

In this study, there are two instruments which are applied to students and their parents, and both prepared by a researcher. These instruments are called as "Scientific Concept Scale and Scientific Concept Test".

3.3.1 Scientific Concept Scale

Scientific Concept Scale is an instrument aims to occur the frequency of scientific concepts in daily life by parents. There are 36 scientific concepts in scale and these concepts are chosen according to elementary school science curriculum. Scientific concepts are created according to third grade science subjects and first term subjects of fourth grade curriculum. These subjects were rocks, matter, force, and motion, light and sound. To investigate the reliability of the questionnaire items, a pilot study was conducted for small sample which consisted of fifty parents. According to Cronbach alpha value, which was .92, the reliability of data was obtained. This value show that the scale is quite and highly reliable and there is no obstacle to its use in the analysis. Four science teachers investigated the items of the scale, and they stated that scientific concepts in the scale are appropriate and valid for science curriculum. A 5-point Likert type survey was used. Each parents' answers were valued according to their choices, and they got a score. Scores were between 1 indicating *'never'* to 5 indicating *'always*. According to the frequency of use of scientific concepts of parents the score was valued. When the top score was 180, the minimum score was 36.

3.3.2 Scientific Concept Test

Another instrument is a Scientific Concept Test which measures how well the students know about scientific concepts and was applied to the fourth students. There are 40 multiple choice questions and each question' value was 2.5. Each student's score was specified for their answers. Four science teachers were investigated each question whether they are valid or not. They specified all questions are valid and suitable for measuring scientific concepts. Before applying whole participants, fifty participants were chosen in order to get Kuder Richardson value. When the Kuder Richardson value KR-21 was examined, it was observed that the value was is .80. This value showed that the test is quite reliable. Current internal consistency analysis was conducted for the expressions of the scientific concepts test, which is preferred as a data collection tool, and the families' use of science concepts scale.

3.4. Data Collection

This research was conducted in spring semester of the 2021-2022 academic year with the participant of 379 fourth-grade students which are studying at 4 public schools and one private school. Before starting to collect the data, it was applied to Yeditepe University Ethics Committee. The committee approved the research. Then, research permission was obtained from the Ministry of National Education. Information about the research was given to teachers. The teachers distributed the Scientific Concept Scale to students for their parents. Scientific Concept Test was applied to students in one lesson hour. Finally, the researcher interpreted the collected data.

3.5. Analysis of Data

All statistical analyzes were performed using the IBM SPSS 25.0 program and statistical data analysis methods to examine the relationship between research variables. The data transferred to the computer environment were checked for missing/wrong values and outliers.

First of all, whether the scientific concepts test and the families' use of scientific concepts survey scales comply with the normal distribution hypothesis was determined by looking at the skewness and kurtosis coefficients, and parametric test methods were preferred (Table 8).

Table8

Skewness and Kurtosis Values of the Scale and its Sub-Dimensions

Scale	N	Skewness	Kurtosis
Scientific Concepts Test	379	-,604	,966
Use of Scientific Concepts by Parents	379	-,087	,722

Seçer (2015) evaluated that it is a more accurate approach to evaluate the normal distribution assumption by looking at the values of 'skewness and kurtosis'. Tabachnick and Fidell (2013) agree that normal distribution is achieved when skewness and kurtosis values are between +1.50 and -1.50. As a result of the analysis carried out, it was determined that the variables showed normal distribution.

The descriptive analysis findings of the scientific ideas test and the families' usage of scientific concepts survey were reviewed after studying the socio-demographic profile of the participants. The "independent sample t test" was used in two-group comparisons of the variables that provided the normal distribution assumption, and

"ANOVA" was used in comparisons of three or more groups to examine the differentiation status of the group scores of the variables according to the personal information of the participants. Additionally, "Pearson Correlation" analysis, one of the parametric test methods, was preferred when examining the relationship between families' use of scientific concepts and the scientific concepts test, and linear regression analysis was used to investigate the impact of families' use of scientific concepts on children's success with scientific concepts. All of the results were assessed for statistical significance at the 0.05 level.

4.RESULTS

In this section, the findings obtained as a result of the analysis of the collected data are presented according to the sub-problems of the research.

4.1. Frequency of Parents' Use of Scientific Concepts by the Parents

First sub question is "What is the frequency of parents' use of scientific concepts?". While this question is answered, frequency analyses were examined. The analyses were shown in Table 9.

Table 9

Survey on Parents' Use of Scientific Concepts

Questions	Never		Rarely		Sometimes		Often		Always	
	f	%	f	%	f	%	F	%	F	%
Atmosphere	42	11,1	103	27,2	136	35,9	48	12,7	50	13,2
Mass	54	14,2	135	35,6	118	31,1	48	12,7	24	6,3
Volume	52	13,7	118	31,1	139	**36,7**	44	11,6	26	6,9
Melting	15	4,0	40	10,6	115	30,3	143	37,7	66	17,4
Freezing	15	4,0	35	9,2	92	24,3	159	42,0	78	20,6
Core	61	16,1	106	28,0	100	26,4	60	15,8	52	13,7
Earth crust	82	21,6	123	32,5	107	28,2	35	9,2	32	8,4
Dark Layer	129	34,0	91	24,0	80	21,1	44	11,6	35	9,2
Water Layer	111	29,3	92	24,3	102	26,9	42	11,1	32	8,4
Flexible Substance	57	15,0	82	21,6	128	33,8	69	18,2	43	11,3
Hard Substance	242	**63,9**	81	21,4	26	6,9	20	5,3	10	2,6
Transparent	65	17,2	77	20,3	128	33,8	66	17,4	43	11,3
Opaque	146	38,5	113	29,8	77	20,3	25	6,6	18	4,7
Shiny	11	2,9	37	9,8	48	12,7	160	**42,2**	123	32,5
Mat	15	4,0	41	10,8	81	21,4	141	37,2	101	26,6
Rough	4	1,1	30	7,9	87	23,0	151	39,8	107	28,2
Smooth	4	1,1	30	7,9	115	30,3	123	32,5	107	28,2
Thick	2	0,5	8	2,1	59	15,6	158	41,7	152	40,1
Solid	2	0,5	8	2.1	48	12,7	141	37.2	180	47,7
Liquid	2	0,5	7	1,8	36	9,5	153	40,4	181	47,8
Gas	6	1,6	29	7,7	60	15,8	123	32,5	161	42,5
Force	2	0,5	34	9,0	70	18,5	147	38,8	126	33,2
push-pull	8	2,1	63	16,6	83	21,9	121	31,9	104	27,4
Natural Environment	11	2,9	40	10,6	81	21,4	116	30,6	131	34,6
Artificial Environment	44	11,6	103	27,2	107	28,2	65	17,2	60	15,8
Electricity Supply	30	7,9	87	23,0	77	20,3	102	26,9	83	21,9
Rock	129	34,0	135	35,6	73	19,3	30	7,9	12	3,2
Mine	55	14,5	112	29,6	115	30,3	72	19,0	25	6,6
Fossil	104	27,4	139	36,7	70	18,5	49	12,9	17	4,5
Magnetic field	142	37,5	150	**39,6**	64	16,9	21	5,5	2	0,5
Natural Sound Source	64	16,9	95	25,1	91	24,0	72	19,0	57	15,0

Artificial Sound Source	89	23,5	89	23,5	100	26,4	61	16,1	40	10,6
Natural Light Source	43	11,3	80	21,1	93	24,5	95	25,1	68	17,9
Artificial Light Source	67	17,7	95	25,1	98	25,9	75	19,8	44	11,6
Sound	4	1,1	16	4,2	30	7,9	105	27,7	224	59,1
Energy	2	0,5	11	2,9	37	9,8	117	30,9	212	55,9
Light	2	0,5	8	2,1	27	7,1	97	25,6	245	**64,6**

According to the analysis results in Table 9, 63.9% of the families never use hard substance, 39.6% rarely use magnetic field, 36.7% sometimes use volume, 42.2% often use shiny and 64.6% always use light from the scientific concepts. When the results were investigated detailed, it was found that the parents always use the light concept and never use hard substance. Hard substance is the opposite meaning of flexible substance. Also, parents do not use concept of opaque and magnetic fields much in their life. On the other hands, the concept of light and sound are mostly used. This is because people are faced with these concepts in every day. Also, shiny, mat, rough and smooth concepts are commonly used. It is not surprising result, because these concepts are taught subject of the properties of matter. When the parents describe the matter, they utilize the concepts. There is a surprising result and that is concept of rock and fossil is rarely used by parents. It is known that some children are very keen on investigating dinosaurs and how they got fossilized. However, the parents are not as much as interested in these concepts.

4.2. The Relationship between Parents’ Use of Scientific Concept and Students’ Science Success

The second research question is “What is the relationship between parents’ use of scientific concepts in daily life and students’ science success?”. To investigate the relationship between students' achievement in scientific concepts and the level of parents' use of scientific concepts in daily life by Pearson Correlation Analysis was used, one of the parametric test methods

Table 10
Pearson Correlation Analysis Results

		Use of Science Concepts by Parents
Scientific Concepts Test	r_p	,860
	P	,000**

** p<0.01

Looking at the Pearson Correlation test results in Table 10, a positive and high-level correlation (r =.86, p<0.05) was found between students' success in scientific concepts and their families' levels of using scientific concepts in daily life.

4.3. Parents' Use of Scientific Concepts According to Education Level

The third research question is "Does the frequency of parents' use of scientific concepts change according to education level of the families?". To investigate the frequency of parents' use of scientific concepts change according to education level of the parents' one-way ANOVA was selected and applied. In the Table 11, there is seen the score of the parents according to the education level. One-way ANOVA results shown in Table 11, pointed out there was a statistically meaningful yet slight difference among different education level. (F= 3.116, p=0.48, p≤0.05)

Table 11
Parents' Use of Scientific Concepts According to Education Level

Variables	Education Level	N	S	SD	*F*	*P*
Use of Scientific Concepts by Parents	Primary School	76	113	,51	3,116	**,048**
	Secondary School	111	114	,68		
	High School	91	113,4	,51		
	University	70	120,2	,48		
	Postgraduate	31	109	,49		

When the Table 11 was examined, it is seen that the mean value of parents who were graduated from university was 120,2 which was the highest score. Parents who got university education use scientific concept in daily life more than the parents who were graduated from primary, secondary school, high school and postgraduate. The score of parents who were post graduated got lowest score. It was clearly observed that students' success in scientific concepts test and their families' use of scientific concepts differ statistically significantly according to the education levels of the parents ($p<0.05$). In other words, the education level of the parents affects the students' scientific concept test scores and the parents' use of scientific concepts.

Tukey analyze was conducted to understand whether there was a significant difference between education levels. When the analyze result was investigated, the significant figures between education levels were found bigger than the value 0.05. These results as seen in Table 12 showed that that there was no difference between the groups. It was expected that the sources of differences between the groups had been explained by Tukey test. However, Tukey test didn't show the statistically significant difference between groups. This can be interpreted as there is a difference between the groups, but since the F value is significant at the $p=0.48$ level, its source cannot be determined.

Table 12

Tukey Analyze Results

	(I) Education level	(J) Education level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Primary school	Secondary school	,88039	3,02756	,998	-7,4186	9,1793
		High School	,16353	3,15989	1,000	-8,4981	8,8252
		University	-6,62218	3,36869	,285	-15,8562	2,6119
		Postgraduate	4,59211	4,33356	,827	-7,2868	16,4710
	Secondary school	Primary School	-,88039	3,02756	,998	-9,1793	7,4186
		High School	-,71686	2,87564	,999	-8,5994	7,1656
		University	-7,50257	3,10363	,113	-16,0100	1,0049
		Postgraduate	3,71171	4,13088	,897	-7,6116	15,0350
	High School	Primary School	-,16353	3,15989	1,000	-8,8252	8,4981
		Secondary school	,71686	2,87564	,999	-7,1656	8,5994
		University	-6,78571	3,23284	,223	-15,6474	2,0759
		Postgraduate	4,42857	4,22882	,833	-7,1632	16,0203
	University	Primary School	6,62218	3,36869	,285	-2,6119	15,8562
		Secondary school	7,50257	3,10363	,113	-1,0049	16,0100
		High School	6,78571	3,23284	,223	-2,0759	15,6474
		Postgraduate	11,21429	4,38704	,081	-,8112	23,2397
	Postgraduate	Primary School	-4,59211	4,33356	,827	-16,4710	7,2868
		Secondary school	-3,71171	4,13088	,897	-15,0350	7,6116
		High School	-4,42857	4,22882	,833	-16,0203	7,1632
		University	-11,21429	4,38704	,081	-23,2397	,8112

4.4. The Frequency of Parents' Use of Scientific Concepts According to Students' Gender

The fourth research question is "Does the frequency of parents' use of scientific concepts change according to the student's gender?". While searching the answer to this question, t-test was used.

Table 13
Parents' Use of Scientific Concepts According to Students' Gender

Variables	**Students' Gender**	**F**	**S**	**SS**	***t***	***P***
Use of Scientific Concepts by Parents	Male	177	105	,55	-3,36	**,013**
	Female	202	114	,57		

The Table 13 was investigated, the scores of families using science concepts differ statistically significantly according to the gender of the students (p= ,013, p<0.05), and the scores of using scientific concepts of families with daughters are higher than those of families with sons. According to results in Table 13 families having male students use scientific concepts less than families having female students. (Male students S=105, Female students S=114).

4.5. The Use of Scientific Concepts According to The Parents Gender

The fifth research question is "Which parents' gender uses scientific concepts more frequently?". To examine this question, t-test was used. Analysis results were given below in the Table 14.

Table 14

The Use of Scientific Concepts According to The Parents Gender

Variables	Parents' Gender	F	X̄	SD	*T*	*P*
Use of Scientific Concepts by Parents	Male	110	110	,58	-1,956	**,041**
	Female	269	115	,55		

According to the results of the analysis (See Table 14), the families' scores on using science concepts differ statistically significantly according to their gender ($p<0.05$), and the scores on using scientific concepts of the female participants were higher than the male participants. (Male parents' score= 110, female parents' score=115) In other words, the gender of the parents affects the parents' use of scientific concepts. This may be related to the mother's taking on a greater role in childcare and child development.

4.6. Regression Analysis

The sixth research question is "Does the use of scientific concepts by parents predict students' scientific success?". To reveal this question linear regression analysis was used. Linear regression analysis was conducted to evaluate the effect of families' use of scientific concepts on children's scientific concept achievement.

Table 15

The Effect of Parents' Use of Scientific Concepts on Their Children's Scientific Concepts Achievement

	Non-standardized coefficients		Standardized coefficients			F	R^2
	B	**Std. error**	**B**	**T**	**P**		
Constant	3,596	,186		19,385	,000	13,031*	,188
Use of Scientific Concepts by Parents	,102	,057	,860	5,176	,000		
Dependent Variable: Scientific Concepts Test							

* p<0.01

It is clear that this model is statistically significant based on the regression analysis findings in Table 15, and parents' use of scientific concepts can explain 18.8% of the variance of students' success in scientific concepts (R^2=,188; $F_{(1,377)}$ =13,01, p<0.001). According to the results, it was determined that the use of scientific concepts by parents predicted students' scientific concept success in a statistically significant and positive way (β=0.860, t=5.176, p<0.001). In other words, the use of scientific concepts by families positively affects students' success in scientific concepts. Furthermore, when the regression equation is analyzed and other predictors are maintained constant, a one-unit rise at the level of families' use of scientific concepts will provide an increase of 0.102 in the success of students in scientific concepts.

5. CONCLUSION AND DISCUSSION

The aim of this research was to investigate parents' use of the scientific concepts in daily life and students' science success. Furthermore, the effect of the educational levels and gender of the parents on using scientific concepts frequencies in daily life with their children was examined. In this direction, some questions were asked and the answers to these questions were searched.

The first research question was to look into frequency of the parents' use of scientific concepts. It was found that some 63.9% of the parents never use hard substance, 39.6% rarely use magnetic field, 36.7% sometimes use volume, 42.2% often use shiny and 64.6% always use light from the scientific concepts. Also, parents do not prefer to use concept of opaque and magnetic fields much in their life. On the other hand, the word of sound and light were more preferential and commonly used by parents. When the results were investigated, it can be said that in daily life words are used more. This is because parents are more exposed to these words. Moreover, another finding is that the frequency of the use the concepts related to properties of matter like shiny, rough, smooth etc. is high. Everything around people is created a matter and so the parents are frequently used.

Furthermore, the findings of first question can support that the concepts are learned concrete to abstract. The frequency of the use of abstract concepts is lower than the concrete ones. For example, the most rarely used concept was found as a magnetic field. Magnetic field is hard to observe and experience. Therefore, the parents rarely chosen this concept. It can be deduced that since students encounter abstract concepts less in their daily lives, they have difficulty in learning these concepts. Vygotsky (1962) claimed the notion that social interaction is crucial in the process of gaining better understanding of concepts. When social interaction between parents and children is increased, parents are supposed to use abstract concepts frequently and children can learn these concepts easily. As Maltese and Tai (2011) point out, parents play an important role in providing children with early experience in developing skills through science-related activities, as science-related home activities are seen as good support. For this reason, families need to instill the culture of science at home by helping their children develop their skills by doing simple experiments at home. Thus, children will be nourished by early scientific experience. Also, informal parental encouragement of their kids' participation in science. This is due to the fact that informal science learning fosters enthusiasm in addition to providing experience, abilities, attitudes, and a willingness to participate in STEM fields (Archer et al., 2012).

Second research question was searched the relationship between parents' use of scientific concepts in daily life and students' science success. It was determined that there was a positive and high-level relationship between students' success in scientific concepts and their families' levels of using scientific concepts in daily life. In today's world, great importance is given to science teaching and the effectiveness of science teaching requires the contribution of the instructor from the individual's immediate environment. This environment is their parents. Parents who are involved in the learning process by using scientific concepts at home can improve their children's science literacy. Thus, they encourage their children to explore the field of science. Stevenson and Baker (1987) states that there are many forms of parent involvement in science education, and it has been stated by researchers that parental involvement encourages and helps children to learn.

The results of the research reveal that the contributions of the parents to the learning process have a positive effect on the individual's perception of the scientific concept.

This research supports the findings of other research results (Assefa & Sintayehu, 2019; Spkies, 2017; Topor, Keane, Shelton & Calkins, 2010). It has been discovered in the past that parent participation and student accomplishment are positively correlated. Additionally, scholastic achievement and kids' views of cognitive effectiveness were both substantially correlated with parental participation. Additionally, Eccles and Harold (1993) emphasize that researchers have data showing the advantages of parents participating in the educational process. In addition to, when parents devote their time, opportunity, and efforts for their children education, it is expected increase in students' achievement.

Åkerblom and Thornshag (2021) have research about the students' scientific sense making and concept development. They found that preschool science education provides various opportunities for creating science concepts. However, they drew attention to parents' involvement in preschool education. Most parents think that schools are the best place to learn science. Kaya (2017) states that due to poor self-efficacy and a lack of home-school communication, parents are often less active in their children's scientific education than they are in their children's math education. This situation is not enough to create a big change in science literacy. The results imply that successful home, school and community partnerships can raise children's science education levels.

This research, additionally, provides an explanation for why science literacy is not at the expected level. It can be said that the contribution of the parents of the students from this study is low. Because the contribution of parents is very important to encourage and support science learners. Yahya (2007), who states that parents' positive perceptions towards science will encourage and facilitate their children to choose a science field, has a parallel view. Accordingly, it has been accepted that positive supports such as developmental advice increase children's self-confidence in making decisions about science.

Third research question was focused on answering whether the frequency of parents’ use of scientific concepts change according to education level of the families or not. It was expected that the parents who got higher education used more frequently. Because they have more information about concepts, and they are more likely to use concepts in daily life. Since encouraging parents’ engagement in their children's education is made possible through parental education, Parents' engagement in their children's education increases with their level of education. According to An, Wang, Yang, and Du (2018), parents' educational attainment has the most impact on their children's academic performance. It may be argued that parents with greater levels of education are more assured in their ability to support their kids' academic success. Correspondingly, parents who were graduated from university was 120,2 which was the highest score. It was proven that parents who got university education use scientific concept in daily life more than the parents who were graduated from primary, secondary, and high school. The results obtained are consistent with the results of the studies of other authors. It was stated that the education of parents significantly affects the development of their children's phonological awareness (Begić, Mrkonjić, Sitarević & Kunić, 2019). That is, parents play a fundamental role in the speech - language development of a child. This language development has an influence on concept creation. The research shown that parents with higher education are more involved in child education (Begić et al.,2019). Moreover, there are some research results about which parents’ gender are more likely to affect their children education. According to these results, the educational level of the father has a greater effect on the development of the phonological awareness of the first- and second-year primary school students than the education level of the mother (Begić et al.,2019). This finding is consistent with other study result. Aličković (2019) found that while there is no statistically significant difference in primary school kids' social skills according to their mother's education level, there is a statistically significant difference in primary school students' social skills according to their father's education level. On the other hand, according to Vellymalay's (2011) study did not reveal a strong relationship between parents' education and their involvement in their children's education. This finding is coherent to current research. It was found that the score of parents were post graduated were low than the parents who got high school education. This result was so interesting because it was expected that the higher level of parents' education level, the higher score of parents' use of scientific concepts.

The fourth research question was examined whether the frequency of parents' use of scientific concepts change according to the student's gender or not. Whereas families having male students got 105 points, families having female students got 114 points. It was clearly observed that the scores of using scientific concepts of parents with daughters are higher than those of families with sons. In other words, the gender of the students affects the scores of the students on the scientific concept test and the parents' use of scientific concepts.

This finding can be related to communication between parents and students. According to previous research results about parent child communication, it was found that better child-parent communication reduced depression symptoms and promoted the psychological well-being (Li et al.,2022). The frequency of communication changes to the gender of child. The girls more tend to share their daily activities and communicate frequently.

In the light of result, it can be said that parents having daughters can be more likely to use scientific concepts in daily life experience. This situation makes female students more exposure to scientific concepts. Their science success can be positively affected. Bursal (2013) states that girls score relatively higher than boys as grade level increases due to a sharper decline in boys. This finding is convenient to international TIMMS result (Martin et al., 2008). In TIMMS results girls have greater science success than boys. Namely, it can be related to female students' science success and their parents' use of scientific concepts. However, Horzum and Ayfer (2006) and Çakır (2002) also observed in their research that gender does not have a significant effect on students' science success.

The fifth research question emphasized on revealing that which parents' gender uses scientific concepts more frequently. It was clearly found that the scores of families in using science concepts show statistically significant differences according to gender ($p<0.05$). Whereas male parents' score was 110, female parents' score 115. It was obviously seen that mothers uses scientific concepts more than fathers. This result can be explained by greater role of mothers in childcare. A special relationship is established between mother and child from birth. Children grow up to be dependent on their mother's attention and care until a certain period. This situation causes the mother to spend more time with the child. Moreover, this may be due to the excessive working hours of the father. Therefore, fathers have less time to spend with their children, they have less experience. On the other hand, Ünal and Kılıç (2020) and Dere and Ünlü (2002) observed in their research that parental gender did not have a significant effect on the frequency of using scientific concepts.

The sixth question was focused on answering whether parents' use of scientific concepts predict students' science success or not. According to the results of research, parents' use of scientific concepts can explain 18.8% of the variance of students' success in scientific concepts. This result means that the frequency of parents' use of scientific concepts is significant in determining students' science success. There are several factors that affecting students' science success and parents' use of scientific concepts have an impact on this. Şahan (2021) has research about home based parental involvement and parenting style as predictors of student success. According to the result, home-based parent involvement explained 15.8% of the total variance in school achievement. Parental involvement at home and parental sensitivity has an important effect on increasing adolescent school success. This finding is coherent to current research result. Furthermore, the findings are similar to studies showing that there is a significant relationship between parents' sensitivity and their children's academic achievement. (Marchant, Paulson & Rothlisberg, 2001; Paulson, 1994).

5.1. RECOMMENDATION

In this part, some recommendations are presented for parents, teachers and further research.

- For this study, the importance of parent involvement can be seen the success of students. Therefore, it is recommended that parents spend more time with their children, especially asking questions about school activities, expectations for academic success, the importance of getting good results, and the importance of homework and encouraging them. Parents need to be involved in the home science learning process by giving their children homework that requires parental involvement. By doing this, parents will indirectly fulfill their responsibility to foster a love of science among their kids within the context of the family unit. Additionally, parents must exercise caution when selecting books and programs for their kids to read. This will make it possible for parents and kids to have in-depth conversations about science subjects at home and foster a culture of science there. The government could also increase the tax deduction for parents who buy their kids' books and resources in the sciences, as this will inspire parents even more.
- A parent program called SARANA, which encourages parents' engagement in their children's education both during and after school, was successful in increasing parent involvement in their children's education in Malaysia (MONE, 2015). An alternate model of parental responsibilities for developing interest in science and jobs connected to science is presented in light of the research's findings.
- For further research, the subject of parents' use of scientific concepts can be investigated. There has not been enough research in this area. Conducting research on the frequency of use of scientific concepts by families will improve the literature. Also, it can be searched why post graduated parents use scientific concepts less than lower education level of parents.

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APPENDICES

APPENDIX A

SCIENTIFIC CONCEPT TEST

FEN KAVRAMLARI TESTİ

1) Aşağıdakilerden hangisi kütlenin tanımıdır?

A) Maddenin boşlukta kapladığı yere denir.
B) Maddeyi hareke geçiren etkiye denir.
C) Maddenin değişmeyen miktarına denir.
D) Maddenin birim zamanda yer değiştirmesine denir.

2)Maddelerin boşlukta kapladığı yere verilen isim aşağıdakilerden hangisidir?

A) Kuvvet B) Hacim C) Kütle D) Alan

3) Aşağıdakilerden hangisi maddenin ölçülebilir özellikleridir?

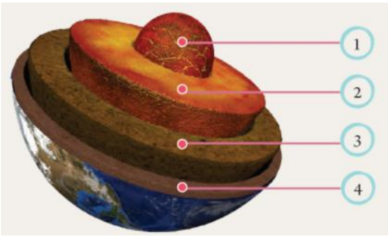
A) Saydamlık-Opaklık
B) Suyu emme-suyu emmeme
C) Mıknatıs tarafından çekilme-Kütle
D) Kütle-Hacim

4) Dünya'nın etrafını saran gaz tabakasına verilen isim nedir?

A) Hava durumu
B) Atmosfer
C) Oksijen
D) İklim

5) Şekilde Dünya'nın iç katmanları verilmiştir. Şekildeki 1 ve 4 numaralı katmanlar nelerdir?

A) 1-Dış çekirdek, 4-Yer kabuğu
B) 1-İç çekirdek, 4- Manto
C) 1-Dış çekirdek, 4-Manto
D) 1-İç çekirdek, 4-Yer kabuğu



6) Aşağıdakilerden hangisi kara katmanında bulunan unsurlardan değildir?

A) Okyanus
B) Dağ
C) Okul
D) Hastane

7) Okyanuslar, denizler, göller, nehirler, kutuplardaki buzullar hangi katmanı oluşturur?

A) Kara katmanı
B) Su katmanı

C) Hava katmanı
D) Manto

8) Aşağıdakilerden hangisi kuvvet uygulandığında şekli değişen kuvvet ortadan kalktığında eski haline dönen maddelerden biridir?
A) Kağıt
B) Sünger
C) Cam bardak
D)Oyun hamuru

9)Su, gözlük camı gibi ışığı geçiren maddelere verilen isim aşağıdakilerden hangisidir?
A) Parlak
B) Mat
C) Saydam
D) Opak

10) Aşağıdaki maddelerden hangisi opak maddedir?
A) Cam bardak
B) Hava
C) Kitap
D) Kolonya

11) Üzerine düşen ışığı; İyi yansıtan maddelere verilen isim aşağıdakilerden hangisidir?
A) Saydam
B) Opak
C) Mat
D) Parlak

12) Yandaki resimde verilen maddelerin ortak özelliği aşağıdakilerden hangisidir?
A) Yumuşak
B) Parlak
C) Mat
D) Esnek

13)Ceviz ve pencere camının yüzeyleri arasındaki fark ne olabilir?
A) Birinin sıvı birinin katı olması
B) Birinin pürüzlü birinin pürüzsüz olması
C) Birinin sert diğerinin yumuşak olması
D) Birinin parlak diğerinin mat olması

14) Aşağıdakilerden hangisi katı bir madde değildir?

A) Cam şişe
B) Süt
C) Buz
D) Toz şekeri

15) Akışkan olan, sıkıştırılamayan, belli bir hacmi olan maddeler hangi halde bulunur?
A) Sıvı
B) Gaz
C) Katı
D) Plazma

16) Gazların özellikleriyle ilgili aşağıdaki bilgilerden hangisi doğrudur?
A) Akışkandırlar.
B) Sıkıştırılamazlar.
C) Belirli bir hacimleri vardır.
D) Kütlesi yoktur.

17) Cisimleri harekete geçiren veya hareket eden cisimleri durduran etkiye ne denir?
A) Hareket
B) Kuvvet
C) Hızlanma
D) Yavaşlama

18) Televizyonu açmak için kumandaya bastığımızda hangi kuvveti uygulamış oluruz?
A) İtme
B) Çekme
C) Basma
D) Kaldırma

19) 

Şekildeki olaylarda uygulanan kuvvet aşağıdakilerden hangisinde doğru bir şekilde verilmiştir?
A) İtme-çekme-itme
B) İtme-itme-çekme
C) Çekme-çekme-itme
D)İtme- çekme- çekme

20) a) Orman b) Buzdağı c) Havuz Yukarıda verilen çevrelerin sınıflandırılması aşağıdakilerden hangisinde doğru verilmiştir?

A) a ve c doğal, b yapay
B) a ve b doğal, c yapay
C) a doğal, b ve c yapay
D) b doğal, a ve c yapay

21) Aşağıdakilerden hangisinde farklı bir hal değişimi gerçekleşmiştir?
A) Çantamızda unuttuğumuz çikolatanın ambalaja yapışması
B) Kışın göllerin buz tutması
C) Ocağa konulan tereyağın hal değiştirmesi
D) Güneş'te kalan dondurmanın erimesi

22) Şehir elektriği, pil ve akünün ortak özelliği nedir?
A) Elektrik kaynağı olmaları
B) Elektriği iletmeleri
C) Elektrikli araç olmaları
D) Elektriği ışık enerjisine çevirmeleri

23) Kayaçların oluşumu sırasında, yapılarında bulunan maddeler onlara farklı özellik kazandırmıştır. Bu farklı özelliklere göre kayaçlar değişik adlar alır.- **Kayaçların birbirinden farklı olmasını sağlayan ve yapılarını oluşturan maddelere ne ad verilir?**
A) Kum
B) Mineral
C) Toprak
D) Granit

24) Kayalar ile ilgili aşağıdaki ifadelerden hangisi doğru değildir?
A) Yapısında mineral denilen maddeler bulunur.
B) Farklı renk, sertlik veya yumuşaklıkta olabilirler.
C) Çeşitli etkenlerle parçalanarak taş, çakıl ve kuma dönüşürler.
D) Dünyanın manto tabakasını oluştururlar.

25)Altın gibi ekonomik değeri yüksek olan kayaçlara ne isim verilir?
A) Kayaç
B) Maden
C) Fosil
D) Kömür

26) Fosiller ile ilgili aşağıdaki bilgilerden hangisi yanlıştır?
A) Ölen canlının vücudunun hava ile teması kesilir.
B) Fosiller geçmişte yaşamış canlılar ile ilgili bilgiler verir.

C) Su altında yaşayan bir canlının fosili oluşmaz.
D) Fosiller dünyanın yaşı hakkında bilgi verir.

27) Işık ve ses ile ilgili aşağıdaki bilgilerden hangisi doğrudur?
A) Işık ve ses bir maddedir.
B) Her ışığı ve sesin bir kaynağı vardır.
C) Ses tek bir yöne yayılırken ışık her yöne yayılır.
D) Ses boşlukta yayılır.

28)Aşağıdakilerden hangisi doğal bir ses kaynağıdır?
A) Gitar sesi
B) Motor sesi
C) İnsan sesi
D) Korna sesi

29)Işık kaynakları ile ilgili olarak hangi bilgi doğrudur?
A) Yıldırım doğal bir ışık kaynağı değildir.
B) Ateş böceği doğal bir ışık kaynağıdır.
C) Güneş yapay bir ışık kaynağıdır.
D) Sahne ışıkları yapay bir ışık değildir.

30)Aşağıdakilerden hangisi yapay bir ses kaynağı değildir?
A) Gökgürültüsü
B) Mikrofon
C)Keman
C) Davul
31)Uzun yıllar önce yaşamış canlıların günümüzde de tanınmasına yardımcı olan kalıntılarına ne denir?
A) Petrol B) Kömür C) Fosil D) Mineral

32) Fosilleşmenin meydana gelebilmesi için kalıntıların hava ile temasının hemen kesilmesi gerekmektedir. Buna göre aşağıdaki ortamların hangisinde fosilleşme gerçekleşmez?
A) Buzul ortam B) Bitki reçinesi C) Kireç taşı D) Toprak yüzeyi

33)Donma olayı nasıl gerçekleşir?
A) Katı haldeki bir maddenin ısı alarak sıvı hâle geçmesiyle
B) Sıvı maddelerin dışarıya ısı vererek katı hâle geçmesiyle
C) Sıvı maddelerin ısı alarak gaz hâline geçmesiyle D) Soğuk olan maddenin sıcak olan maddeden ısı almasıyla

34) Aşağıdakilerden hangisi kayaçlardan elde edilen madenlerden üretilmemiştir?

A) Deterjan B) Toz şeker C) Ayna D) Elektrik teli

35)Boşlukta yer kaplayan, kütlesi ve hacmi olan ayrıca beş duyu organımızdan en az birisi ile hissedilebilen, canlı ve cansız varlıklara madde denir. Buna göre aşağıdakilerden hangisi madde değildir?

A) Taş B) Hava C) Su D) Işık

36)Aşağıdakilerden hangisi maddenin katı hâlinin özelliklerinden değildir?

A) Akışkan değildir.

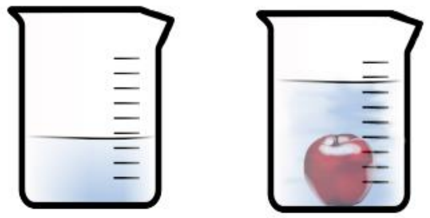
B) Belirli bir şekli vardır.

C) Konuldukları kabın tamamına yayılır.

D) Dışarıdan bir etki olmadıkça şekilleri değişmez.

37)

Ali, dereceli kaba su koyup içine elma atarak suyun ne kadar yükseldiğini not almıştır.

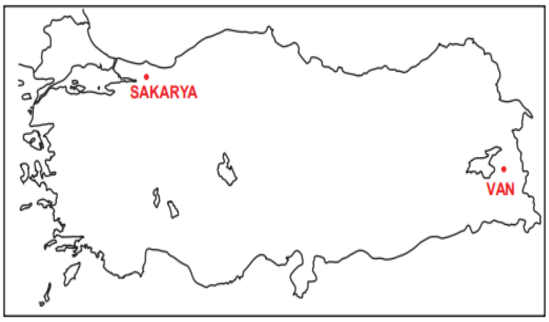


Ali'nin bu deneyi yapma amacı hangisidir?

A) Suyun hacmini ölçmek
B) Elmanın hacmini hesaplamak
C) Suyun ağırlığını hesaplamak
D) Elmanın kütlesini ölçmek

38)

Şekildeki Türkiye haritasında Van ve Sakarya illeri gösterilmiştir. Sakarya'da güneş doğmaya başlarken Van'da güneş çoktan doğmuştur.



Bu durum bize neyi gösterir?

A) Dünya'nın Güneş etrafında dolandığını
B) Bir günün 24 saat olduğunu
C) Mevsimlerin oluşumunu
D) Dünya'nın batıdan doğuya doğru döndüğünü

39) Bir cismin kütlesini ölçmek istediğimizde aşağıdaki araçlardan hangisini kullanırız?

A) Dereceli silindir
B) Eşit kollu terazi
C) Metre
D) Dinamometre

40) Elektrikle ilgili aşağıdaki ifadelerden hangisi yanlıştır?
A) Elektrik hayatımızı kolaylaştırır.
B) Elektrik bir maddedir.
C) Elektrik bir enerjidir.
D) Elektrikle çalışan birçok araç vardır.

APPENDIX B

SCIENTIFIC CONCEPT SCALE

"Ailelerin Günlük Hayatta Fen Kavramlarını Kullanma Anketi" ailelerin okul yaşamı dışında çocuklarıyla kurdukları iletişimde fen kavramlarını kullanma sıklıklarını öğrenmek için oluşturulmuştur. Bu anket Yeditepe Üniversitesi Eğitim Bilimleri Enstitüsünde yürütmekte olduğum yüksek lisans tez çalışması içindir. Ankete çocuğu ilkokul 4.Sınıfa giden veliler katılabilir. Her kelime için sadece bir şık işaretlenmelidir. Anket sonuçları herhangi üçüncü bir kişiyle paylaşılmayacaktır.

Anketi Yapan Velinin Eğitim Düzeyi:

İlkokul ☐ Ortaokul ☐ Lise ☐ Üniversite ☐ Yüksek lisans ☐

Anketi Yapan Velinin Cinsiyeti:

Kadın ☐ Erkek ☐

Öğrencinin Cinsiyeti:

Kız ☐ ☐ Erkek

Sıra No	Kelimeler	Her zaman	Sık sık	Bazen	Nadiren	Asla
1	Atmosfer					
2	Kütle					
3	Hacim					
4	Erime					
5	Donma					
6	Çekirdek					
7	Yer kabuğu					
8	Kara katmanı					

9	Su katmanı					
10	Esnek madde					
11	Berk madde					
12	Saydam					
13	Opak					
14	Parlak					
15	Mat					
16	Pürüzlü					
17	Pürüzsüz					
18	Katı					
19	Sıvı					
20	Gaz					
21	Kuvvet					
22	İtme-çekme					
23	Doğal çevre					
24	Yapay çevre					
25	Elektrik kaynağı					
26	Kayaç					
27	Maden					
28	Fosil					
29	Manyetik alan					
30	Doğal ses kaynağı					
31	Yapay ses kaynağı					
32	Doğal ışık kaynağı					
33	Yapay ışık kaynağı					
34	Ses					
35	Enerji					
36	Işık					