

Full Length Research Paper

A study on young Turkish students' living thing conception

Sami ÖZGÜR

*Department of Biology Education, Necatibey Education Faculty, Balıkesir University, Balıkesir, Turkey.

Received 22 January, 2018; Accepted 9 February, 2018

The aim of this study is to find out young Turkish students' opinions about living thing concept in detail and to investigate the criteria used by the students to define this concept. The study sample consisted of randomly selected 140 students studying at the 3rd, 4th and 5th grades in four different primary and middle schools located in the western part of Turkey. The data of the study were collected with the help of "Living Thing Conception Questionnaire" which was adapted from Rolland (1994) and developed by the researchers. Qualitative methods were utilized in data analysis. As a result, of the analysis, it appeared was seen that the students tended to explain the concept of living things via anthropomorphism and a number of misconceptions were determined in at this respect. These misconceptions could be It is thought that those results can be originated from Turkish cultural structure and formal education system. In order to correct remove such misconceptions, teachers should consider them during teaching process and teaching/learning process should be supported with appropriate activities such as out of class activities. Thus, the misconceptions of the students related to living things with anthropomorphic roots can be overcome.

Key words: Living thing conception, misconception, anthropomorphism.

INTRODUCTION

In the history of science, the classification of living things is a controversial issue among scientists. Life on the Earth is reportedly divided into three kingdoms (Haeckel, 1866, cited in Scamardella, 1999), five kingdoms (Whittaker, 1969), six kingdoms (Cavalier - Smith, 2004) or more groups on domain based systems (Purves et al., 2004: 9). Among those proposals, five kingdoms on Earth agreed to belong to the monera, protists, fungi, plants and animals (Cavalier - Smith, 2004). This classification is mostly considered in biology learning in university

level. In addition, it can be concluded that this classification provides basis for primary biology learning. The concept of living things is introduced to young children from early grades in primary level because correct and full conception of the notion of living thing is desired for the students to provide a proper background for the learning in science and biology education. Besides, the research showed that non-equilibrium thermodynamics were introduced to life science students by focusing on organisms and cells (Popovic, 2017). The

E-mail: samiozgur@balikesir.edu.tr Tel: +9 0266 241 27 62. Fax: +9 0266 249 50 05.

Authors agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

introduction of living things to young children in Turkish primary science curriculum is provided with a system of four groups which include microorganisms, fungi, plants and animals (Akter et al., 2017). Although the topic – *living things* might seem simple at the first glance, Bahar (2002) study showed that education faculty of first year students had the least difficulty with the topics of science and scientific method, acids, bases and salts, carbohydrates, lipids and proteins, enzymes, vitamins and minerals. Rather, they were found to have the highest difficulty with the topics which examine living things in terms of molecular level and biological system.

The students' conceptual tendencies towards living things are significant in terms of science and biology education. Students' such tendencies are reported to be teleological, animistic or anthropomorphic tendencies (Kallery and Psillos, 2004). Hence, there are various studies in the literature which regard different aspects of the concept of living things. The research about this issue can be gathered to deal with the categorization/perception of things as living and non-living things; conceptions related to living things and the factors which influence the conception of things as living/non-living correctly whereas several studies might deal with more than one issue at the same time.

To begin with the categorization/perception of living things, Wax and Stavy (1987) investigated whether Israeli students could classify animals, plants and inanimate objects. The results indicated that students failed to classify plants correctly and no consistency arose in the connections between the classification and biological criteria. In another study, Caravita and Falchetti (2005) researched 7 to 18 years old Italian students' perceptions of bones as living things and they detected that majority of the participants considered bones in our body as non-living entities. Bahar (2003) researched 11 to 18 years old Turkish students' ideas about life concept with the help of structural communication grid. The results of the study showed that students indicated seven attributes (movement, nutrition, respiration, growth, reproduction, irritability, excretion) to living things. Also, the term *dormancy* was found to be unclear among students in addition to several misconceptions related to that term. For example, sun, clock and battery were the objects to be explained as living by the students. In another study, Palmer (2013) investigated 4 year old children's naming animals and plants with their sources. The results indicated that children's knowledge of plants was greater than knowledge of animals and they indicated home not school as a source of their knowledge. In addition, Villarroel (2013) researched 4 to 7 years old children's understanding of living being by testing their ability to distinguish living beings from inanimate objects. The research was conducted with pre-school and primary school children in Spain. This study showed that children classified things correctly as animal or plant in an increasing percentage with their growing age. However,

there was an exception for the correct classification of vehicles and atmospheric agents. The lowest percentage of correct classification for those items belonged to the ages 5 to 6 whereas year 4 to 5 children had more correct classification results than year 5 to 6. As a summary of the literature, it can be asserted that students' classification of things as living/non-living improves with their growing age; however, there are several exceptions in this case. Additionally, details of the students' opinions seem to gain importance to explain the reason of their classification.

As well as classifying things, several studies focused on a certain living things to find out students' opinions about it. For this reason, children's opinions about what was inside a tree were investigated with 3 to 6 year olds in Brazil (Bartoszeck and Dale Tunnicliffe, 2013) and with 5 year olds in Poland (Rybska et al., 2014) via drawings. Similarly, 7 year old students' opinions about inner structure of an earthworm in England (Dale Tunnicliffe, 2015); 5, 10 and 12 years old children's opinions about the inner structure of a crab in Brazil (Bartoszeck and Dale Tunnicliffe, 2017) and 4, 5 and 6 year old children's concepts of insects in Brazil (Bartoszeck et al., 2011) were investigated via drawings. The conducted research provided detailed information from children of different cultures.

Conception of living things is another issue addressed in the literature by conducting researches on different grade level students. Bahar et al. (2002) investigated the alternative opinion frames of kindergarten and primary level Turkish students about living and non-living things. As a result of the study, it was reported that all student groups have alternative opinions which were not scientific; however, the number of such conceptions were seen to decrease with increasing age. In addition, they thought a variety of characteristics about living and non-living things with growing age. Türkmen et al. (2002) constructed a reliable and valid concept test about the variety and classification of living things and they applied this test to Turkish high school level students to determine their misconceptions about the topic. The results indicated that students possessed a number of misconceptions supporting the previous literature. In another study, Cavas and Kesercioglu (2010) investigated the conceptions of the 11th grade level Turkish students about living cell in a qualitative study. The results indicated that the 11th graders had difficulty with structuring their knowledge about this concept and possessed various misconceptions such as "*plants are more ascendant things than the animals because of the photosynthesis*". In another study, Kurt (2013) investigated the cognitive structures of Turkish biology teacher candidates about living things qualitatively. As a result of the study, he collected the participants' responses related to living thing concept under 7 categories such as cells and its organelles, energy in living things. Also, the researcher determined some

misconceptions at this respect. Villarroel and Infante (2014) examined 4 to 7 years old children's conception of plant in a qualitative study in Spain. The researchers also addressed children's distinction of living and non-living. The results demonstrated that children made the drawing of a plant with the items related to it such as flowers, seeds with the highest percentage. Also, the highest percentage of correct distinction was found to belong to the animals in the distinction test whereas plants and vehicles came after it. However, the highest percentage was found to belong to insufficient understanding when students' responses about the notion of living things were examined. Martínez-Losada et al. (2014) conducted a research to find out the characteristics attributed to living things by 3 to 7 year old children. Their study showed that the children realized animals and human were alive, however there were problems related to the realization of plants as alive. The researchers also indicated that children utilized morphological and functional aspects to explain that the different specimens were alive. As can be seen from the literature, it can be concluded that students in all age groups have problems related to the full conception of living things.

There are studies which examine the formation of living thing concept and the factors that influence this process. For instance, it was tested whether spontaneous movements caused the formation of living thing concept in pre-school students' minds in the USA (Opfer and Siegler, 2004). The results revealed that not all biological properties were extended from familiar animals to plants; some biological properties were first attributed to plants and then extended to animals. Babai et al. (2010) researched the effect of mobility on classifying things as living things in Israel. For this reason, the 10th grade students were asked to classify each presented object into living or non-living, as quickly and as accurately as possible. As a result of the study, the reaction rate of non-moving things was reported to be longer than moving things and it was concluded that despite prior learning in biology, the intuitive conception of living things persisted up to age 15 - 16 years, affecting related reasoning processes. Yeşilyurt (2003) conducted a pre-test and post-test study on understanding levels of living and non-living concepts of Turkish kindergarten and primary first year students and investigated the effect of pre-conceptions in understanding of those concepts (2004). The results of the study showed that primary first year students gave more correct answers than kindergarten level students. Kindergarten level students were reported to live conceptual conflicts about given items. Despite the fact that those studies are similar to the first group studies based on identification or classification as mentioned above, they focus on conceptual processes and influential factors more.

In addition to considered factors which influence the formation of living thing concept such as mobility as mentioned in the studies above, language is an

unignorable tool that helps students' conception formation. Several researches were encountered to address this issue. For example, Leddon et al. (2008) investigated the effect of language on the use of the term "living thing" focusing on the words "living thing" and "alive" with 4 - 10 years old children in the USA. The participants were divided into two groups and the use of the terms "alive" and "living thing" was researched. As a result, children were seen to misalign the term "alive" with animate things. However, the term "living thing" was seen to attribute life to plants as well as animals. In another study, Leddon et al. (2011) investigated the meaning of the words for the concepts of alive and die in two different languages, English and Indonesian. In their study, the researchers focused on children's everyday speaking to their parents. The results indicated that both language speaking children were faced with distinct problems, but that parental input in both languages did little to support the acquisition of broad, inclusive biological concepts.

The literature highlights various methods, especially out of class activities to improve students' learning about living things. Borsos et al. (2018) research revealed that teachers from Serbia and Hungary believed the importance of outdoor teaching; however, many of the teachers were found to indicate that conducting the classes indoors was easier. In one out of class study, students' attitudes towards plants were intended to support via a project by integrating botany, art and chemistry in Turkey (Çil, 2016). On the other hand, Sammet and Dreesmann (2017) used ants for secondary school children for in class observations in biology lessons.

In daily life, the term "living thing" might be conceived with the characteristics that only belong to human. Perceiving the things like human which are not human in real and attributing humanistic characteristics to the things is explained by anthropomorphism. The term "Anthropomorphism" comes from Greek. In Greek, "anthropos" means human and "morphe" means form. Hence, anthropomorphism means human form (Thullin and Pramling, 2009). Children might possess anthropomorphic tendencies for their living thing conception. Another tendency - animism has its roots in Piaget and it is defined as the tendency of children to regard objects as living and conscious (Kallery and Psillos, 2004). Also, teleology is defined as the tendency to attribute purpose to objects and beings that are not human, which enables them to arrive at rational decisions (Kallery and Psillos, 2004).

In the present study, we are mostly interested in anthropomorphic and animistic tendencies of children. Especially, anthropomorphism was defined as a learning obstacle since it could lead to many misconceptions by Bachelard (1983). Accordingly, Inagaki and Hatano (1987, cited in Thullin and Pramling, 2009), conducted studies with pre-school children; Tamir and Zohar (1991, cited in Thullin and Pramling, 2009) conducted studies

with high school students on anthropomorphic language use and as a result of those studies, it was found that such anthropomorphic language use was frequent among students. In another study, Thullin and Pramling (2009) found that 24 of 128 anthropomorphic speech belonged to 4 to 6 years old children whereas 104 of them were made by early year teachers. Those studies prove that anthropomorphic speech is frequent both among teachers and students. On the other hand, despite using it consciously or unconsciously, teachers were reported to hold the thinking that the use of animism and anthropomorphism in science might cause cognitive problems in young children as well as emotional problems in special cases (Kallery and Psillos, 2004). Also, Dale Tunnicliffe and Reiss (1999) highlight the decrease in UK students' knowledge of things other than human. Hence, using anthropomorphism and animism in science education has become another controversial issue whether it is good to use them in science instruction or not (Kallery and Psillos, 2004).

In addition to related literature summary, a brief look at the living thing concept in Turkish 3rd, 4th and 5th grade level science course books might be useful as a reflection of curriculum and can be interpreted in this respect as follows.

A look at the 3rd, 4th and 5th Grade Level Science Course Books

In Turkey, topics related to science are introduced to the students under the course *Life Sciences* in the 1st and 2nd grade levels at the primary school. Beginning from the 3rd grade level, *Science Course* is given to the students. When they are examined, in the 3rd grade level course book, it is seen that living things are exemplified with only plants and animals (Demiray and Köker, 2017: 178). Also, several substances are presented by giving them human characteristics such as a human face on an ice cube (p. 129). In the 4th grade level course book, it is realized that human characteristics are attributed to various things similar to the 3rd grade course book such as a fish talking with a speech bubble (Kaya, 2017: 148) and the Earth and Sun with a human face drawn on them (p. 177). When the 5th grade level course book is considered, it is seen that various human characteristics were attributed to different items as in the previous course books such as in a squirrel holding a cup of tea (Akter et al., 2017: 149).

As can be understood from the analysis of course books above, human attributed characteristics are not only given place in biology topics but also they are mentioned through physics and chemistry topics. This approach might influence the perspective of students in terms of their conception related to living things. Thus, it can be concluded that the course books involve a human centered approach (anthropomorphism) in presenting the course content.

In summary, the research has shown that students even limit the characteristics related to living things to certain things (Wax and Stavy, 1987; Caravita and Falchetti, 2005) or they may have animistic, anthropomorphic or teleological tendencies towards sensation of living things (Kallery and Psillos, 2004). Several misconceptions were also determined about this concept (Türkmen et al., 2002; Bahar et al., 2002). Despite the fact that there are various studies conducted with students and teachers which resulted in different consequences in terms of science education, a number of problems is still present in students and teachers as well for the instruction of the concept of living thing. Hence this paper aims to investigate the 3rd, 4th and 5th grade level Turkish students' opinions about living things in detail. Here, the classical biological definition for the living things as stated by Turkish National Science Course Books is accepted and taken into consideration for the present study. In this definition, living things are explained as the things whose common traits are stated to be growing, nutrition, movement, reproduction, respiration, giving reaction and excretion (Demiray and Köker, 2017: 180). For this reason, the following research questions are considered in the present study:

- 1) What are the conceptions of the 3rd, 4th and 5th grade level students about living things?
- 2) What are the criteria used by the participants to classify the things as living or non-living?

The results of the study are expected to present students' conceptions about living things. These will be discussed by relating to national curriculum and students' grade levels. In the light of the findings, particular contribution to science education, curriculum developers and science teachers are expected.

METHODS

Participants

The sample of this study consisted of randomly selected 140 primary and middle school students. The students studied at the 3rd grade (45), the 4th grade (47) and the 5th grade (48). The 3rd and 4th graders were primary school students whereas the 5th graders were middle school students. One of the primary school and one of the middle school at which the students studied were in the urban area whereas the other schools were in the rural area of a city in the west part of Turkey. The ages of the 3rd grade students corresponded to 9; the 4th grade students corresponded to 10 and the 5th grade students corresponded to 11 years. 72 of the participants were girls and 68 of them were boys.

Purposeful sampling method has been utilized in the determination of the study sample. Purposeful sampling provides the researchers with study cases which carry rich information related to the issue to be investigated (Yıldırım and Şimşek, 2008). In this study, the participants' ages and their developmental stage have been considered in terms of the aim of the study. The ages of students match with a period which falls to the end of Piaget's Concrete Operational Stage and to the beginning of Formal

Operational Stage. The ages of the participants coincide with a transition period between those concrete and formal operational stages. Since formal operations and accordingly abstract concepts have not developed in those children, their opinions related to living thing concept have been expected to be revealed with the present study. In this respect, the sample has been selected via convenience sampling (Yıldırım and Şimşek, 2008). This method supplied facility for the researchers in terms of planning time and effort.

Data gathering instrument

"Living Thing Conception Questionnaire" was utilized in order to collect the data of this study. The questionnaire was originally developed by Rolland (1994). In order to implement it on Turkish students, the instrument was adapted from Rolland (1994) by the researchers of the study. Firstly, it was translated from French into Turkish and several modifications were made on it to give a final state (Appendix).

The questionnaire consisted of three parts. In the first part, the students were asked to write down all the things they realize when they think of the term "living thing". In the second part, the students were asked to define the term "living thing" in their own words. In the third part, the students were given the names of a total of forty-four living and non-living things such as elephant, cloud, ocean and memory card. The students were asked to classify those things as "living", "non-living" or "I don't know" by providing a reason for their answers. In addition, students were asked two open ended questions related to the third part. In the first question, the students were asked whether any of the given things could be a more living thing and its reason. In the second question, the students were asked the opposite – whether any of those could be a less living thing and its reason.

The adapted form of the questionnaire was checked by two experts in biology education and assessment and evaluation. Before the application of the questionnaire in the real study, a pilot study was conducted with its first form. The pilot study was applied to the students in different classrooms of the schools which were not included in the real study with the same grade level (3rd, 4th and 5th grades). Hence, the characteristics and conditions of the participants in pilot study could be concluded to be the same as the participants of the real study. The pilot study revealed that the first and second parts of the questionnaire were sufficiently clear for gathering data. However; the pilot study results indicated that the third part, especially open ended questions were not sufficiently comprehended by the students. Hence, upon the findings of the pilot study, the third part of the questionnaire was reworded and reorganized. After making appropriate corrections on the questionnaire, it was applied to a pilot sample for the second time and its intelligibility was checked. Thus, the final version of the questionnaire was formed.

Data collection and analysis

"Living Thing Conception Questionnaire" was administered by the researchers to each student groups in the study sample in the supervision of their class-teachers. Before the application of the questionnaire, necessary permission was asked from school administration. Data collection process elapsed about 1 course hour.

Data collected in the study were analyzed in terms of qualitative methods. For analysis of the first and second question, content analysis was utilized. Content analysis aims to reach common themes in order to explain data collected (Yıldırım and Şimşek, 2008, p. 227). As a result of the content analysis, themes obtained were quantified by providing frequency distributions.

In the analysis of data obtained from the third part, firstly frequency distributions were made for the diagnosis of given listed things as living, non-living or I don't know. Moreover, students' reasons related to their responses were addressed qualitatively. For this reason, descriptive analysis which allows summarizing and interpreting collected data according to the themes which were constructed previously were utilized (Yıldırım and Şimşek, 2008, p. 224). In this process, the themes constructed by Rolland (1994) were followed. The themes arranged in the form of a table were used to fit students' reasons. Each criterion was coded with numbers in order to make the grouping easier. The criteria used to explain the students' reasons and their codes are provided on Table 1.

In addition to the classification of the things, each student's reason was diagnosed as positive or negative answer. Those reasons were demonstrated in the form of tables showing the frequencies of criteria used to explain by the students. For instance, if the student indicated that the Earth was a living thing, this meant a negative answer. If the student said that the Earth was a non-living thing, this meant a positive answer. Or the student might say that she/he did not know whether the Earth was a living or non-living thing. Hence, the answers were analyzed separately to investigate the positive and negative answers in detail. Next is a presentation of the analysis of item "mountain" to illustrate the analysis of the items in the third part of the questionnaire.

According to the analysis of item "mountain", 103 students classified mountain as non-living (positive answer). On the other hand, 22 of them stated that mountain was living (negative answer) and 15 students indicated that they did not know. Table 2 demonstrates the reasons of the students for their positive and negative answers.

As can be seen on Table 2, the frequency distributions of the criteria for students' positive and negative answers are shown. For positive answers, the most common reason stated by students was that mountain was a non-living thing because it did not move. This reason was followed by the fourth criteria which said it was non-living since it did not respire. Thirdly, students supposed that it was present in the nature so it was non-living. Other reasons are also given with their codes and relative frequencies on Table 2. When the negative answers are considered, the most common explanation provided by the participants for the liveliness of mountain was that it had relationships with other living-things. Secondly, it was found that students connected this term with characteristics related to plants. Hence, they supposed that mountain was living. This was followed by it grew and it allowed us to breathe. The other reasons are also present on Table 2.

The final part of data analysis dealt with the open ended questions in the questionnaire. The analysis of those questions which deals with students' considerations whether there are more living or less living things among living things are presented in the form of frequency and percentage distributions on one table. A total of 280 responses are presented in this table since there are 2 questions and 140 participants in the study. Also, students' statements with their own words were given to prove data presented in the table. In addition, frequency distribution of the responses with respect to grade level was presented to see the trend in students' responses with changing grade levels.

FINDINGS

Results obtained from the first part of the questionnaire– Initial concepts related to living thing

The analysis of the first part of the questionnaire exhibited the frequency distribution of the initial concepts

Table 1. The criteria and their codes used in the classification.

Code	Criteria
1	Life
2	Mobility
3	Growing
4	Respiration
5	Nutrition
6	Involving organic/inorganic matters
7	Using expressions related to being animal
8	Using expressions related to being plant
9	To be in nature
10	Activities except mobility
11	Working from itself
12	To be in relation with other living things
13	To cause disease
14	Integrity
15	Circulating liquids (blood...)
16	To have organs
17	Reproduction
18	Death
19	Emotional communication
20	Cognitive condition (brain, memory...)
21	Relation with time
22	Anthropomorphism

Table 2. Students' reasons for the classification of the item "mountain".

	Codes	1	2	3	4	5	6	8	9	10	12	17	19	22	Total
f	Positive	7	44	7	16	5	5	-	8	2	3	3	3	-	103
	Negative	-	1	2	-	1	-	3	-	-	13	-	-	2	22

Table 3. Frequency distribution of the students' initial concepts about living things.

Concepts	f
Characteristics related to living things	240
Animal	184
Plant	170
Human	95
Non-living	27
Microorganism	11
Fungi	4
Total	731

suggested by the participants related to living things. The findings were demonstrated on Table 3.

According to the students' initial concepts about living

thing, it was found that students mostly considered characteristics related to living things such as nutrition, respiration and movement when they were told the term

Table 4. Frequency distribution of the characteristics mentioned by the students to define living things.

Characteristic	f
Moves	74
Respires	55
Grows	32
Feeds	29
Lives	29
Excretes	23
Reproduces	19
Develops	14
Reacts	14
Digests	12
It is a plant / animal / human	11
Talks	9
Thinks	9
Caused by God	8
Possess organs	6
Have emotions / imagination	4
Occupies in nature	1
Produces own food by themselves	1
Total	350

“living thing”. This concept was followed by animals. Thirdly, students considered plants and then humans in this respect. In this analysis, human was dealt as a separate theme to see its frequency. Those concepts were followed by non-living things (such as telephone, mountain, sun, fire, world) and microorganisms. Fungi were the least considered thing by the students at this respect. As can be seen in Table 3, the total frequency of the written concepts is not equal to the number of participants since each participant responded to the question with more than one concept.

Results obtained from the second part of the questionnaire – Definition of living thing in students’ own words

Table 4 demonstrates the findings obtained from the analysis of the second part of the questionnaire. According to the results, it was seen that students defined the living thing concept by using different characteristics with a similar approach as in their initial concepts for living things. Movement was the most mentioned characteristic in this respect, followed by respiration and growth. In addition, students expressed characteristics such as talking, thinking and having emotions which belong to human beings in addition to reproduction, development, excretion.

Similar to the findings of the first part, each student suggested more than one characteristic while making

definitions. Hence, the total of frequencies in Table 4 is more than the number of participants.

Results obtained from the third part of the questionnaire

Living/non-living distinction

The third part of the questionnaire involved 44 different items for the students to classify as living/non-living/I do not know. As a result of the analysis of the classification of 44 items, it was seen that a number of students failed to determine things correctly as living or non-living. Also, various students were determined to not suggest any idea related to the classification of the items. Table 5 demonstrates the frequency distribution related to students’ classifications of selected items.

According to Table 5, more than half of the participants failed to classify the teeth in our mouth and mushroom as living things. On the other hand, the Moon and the Sun were found to be the items classified as living things with the highest frequencies among the non-living things. When a comparison is made, it can be said that students had more difficulty with the classification of various living things than non-living things. As well as classifying the items as living/non-living incorrectly, various students were found to not introduce any idea about the classification of given items. As can also be seen on Table 6, fossils, burnt out volcano, exploding volcano,

Table 5. Frequency distribution for the classification of the selected items.

Items	Non-living instead of living frequency	Items	Living instead of non-living as frequency	Items	I do not know frequency
The teeth in our mouth	94	Moon	45	Fossils	67
Mushroom	87	Sun	28	Burnt out volcano	52
Egg	63	Car on motion	26	Exploding volcano	45
Bean	49	The planet Earth	25	Planet Earth	43
A branch of roses	43	Exploding volcano	23	Egg	42
Mosses	25	Mountain	22	Virus	37
Tree	19	Fire	15	Thunder	36
Cactus	16	Ocean	14	Lightning	35
Microbe	12	Water in the stream	14	Bean	34
Violet in the pot	2	Thunder	9	Sun	28
Fish	2	Star	5	Moon	24

Table 6. Frequency distribution of students' reasons for the classification of the selected items.

Criteria Code	Frequency (f)					
	Mushroom		Lightning		Mosses	
	Positive	Negative	Positive	Negative	Positive	Negative
1	7	10	23	2	7	4
2	-	15	21	1	12	10
3	-	13	5	2	11	-
4	5	14	21	-	14	5
5	-	8	5	-	4	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	7	-	-	20	-
9	11	-	2	-	6	-
10	6	-	2	7	14	-
11	-	-	2	-	-	-
12	-	-	-	-	-	-
13	-	1	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	4	-	-	-	-
17	8	2	-	-	2	-
18	-	-	-	-	-	2
19	-	-	2	-	-	4
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22	-	13	10	-	4	-
Total	37	87	93	12	94	25

Planet Earth and egg were the items about which the students had difficulty to decide its classification.

Why living? Why non-living?

In addition to the analysis of the classification, in this part,

the criteria used by the students in the classification of the items were investigated in detail. Since giving place to all items in this paper is not possible, the most striking three items (mushroom, lightning and mosses) were selected to present the results obtained from the third part of the questionnaire. The findings were shown on Table 6 with the codes of their reasons for three items in

the questionnaire and relative frequencies for the positive and negative answers.

According to the analysis of the classification for the item “mushroom” as living, non-living or I don’t know, 37 of the participants stated that mushroom is living (positive answer) whereas 87 of them classified mushroom as non-living (negative answer). Also, 16 participants said that they did not know. According to Table 6, students thought that mushroom was living since it was present in the nature. This reason was followed by reproduction and life concept. On the other hand, Table 6 revealed that mostly students considered mushroom as non-living due to immobility of it. Also, they supposed that it did not respire and did not grow. From the anthropomorphic approach, they believed that it was non-living because it was eaten by human beings. Other aspects are also displayed in Table 6.

When the students’ negative answers for mushroom were investigated in detail, the codes of the reasons and their frequencies in parentheses are as follows with respect to their grade level: For 3rd graders: 1 (10), 2 (7), 3 (13), 4 (6), 5 (8), 8 (7), 13 (1), 16 (4), 17 (2), 22 (13). For 4th graders: 2 (3), 4 (4). For 5th graders: 2 (5), 4 (4). It is clear that the 3rd graders state negative answers more than the 4th and 5th graders related to mushroom.

According to the results obtained from the analysis of the classification for the item “lightning”, it was found that 93 of the participants stated that lightning was non-living (positive answer) whereas 12 of them classified lightning as living (negative answer). Also, 35 participants said that they did not know. As can be seen in Table 6, most of the students who defined lightning as a non-living thing stated that lightning did not have life. Hence it was non-living. The following reasons were provided as no respiration and no movement characteristics of the lightning. In term of the theme – activities except mobility, *giving light* was considered by the students to explain the non-liveliness of the lightning. Another reason was stated to be caused by God given under the theme 11 – *worked from itself*. Also, causing fear in human was stated in term of the last reason as can be seen on Table 6. When the negative answers were considered, its light was given as the main reason for its liveliness under the theme activities except mobility.

When the grade levels were considered, it was found that the students who indicated that lightning was living (negative answers) came only from the 3rd graders. However, there were the 4th and 5th graders who responded the item as “I do not know” as well as the 3rd graders.

The analysis of the item “mosses” showed that 94 of the participants classified it as living (positive answer) whereas 25 participants indicated that it was non-living (negative answer). Also, 21 students were found to not know the classification of mosses. Table 6 indicated that connecting with statements related to plants is the main reason of mosses’ liveliness. This was followed by the

activities except mobility such as making photosynthesis, excreting and so on. There were 4 expressions which focused on human centered characteristics to explain the liveliness of mosses such as drinking water. Also, as can be seen from Table 6, students’ negative answers were due to the fact that mosses did not move and respire. In addition, not talking, not having emotions and not thinking were also reasoned at this respect. In addition, the students supposed that mosses did not die hence they were non-living.

When students’ negative reasons for mosses were examined in detail, the 3rd and 5th graders seemed to propose more reasons than the 4th graders for this item. Those reasons codes with their frequencies provided in parenthesis with respect to grade levels are as follows: For 3rd graders: 1 (2), 2 (7), 4 (2) and 18 (2). For 4th graders: 2 (2) 4 (2) For 5th graders: 1(2) , 2 (1), 4 (1) and 19 (4). It is seen that the 3rd graders had more negative answers and reasons as similar to previous findings.

Are there more living /less living things among given items?

In addition to the classification of given items, participants were asked two open ended questions related to their answers whether there might be more living or less living things among given items. The analysis of those questions was demonstrated together on Table 7.

According to Table 7, 28% of students’ responses showed that there were more living things among the things students selected as living things. However, 22% of the participants’ responses showed the opposite. Also, 23% of the students’ responses indicated that there were less living things among the given. On the contrary, 21% of the participants’ responses demonstrated that there were not less living things. Besides, 6% of them did not respond to the question.

Students’ responses for the question “*Are there more living / less living things among given items?*” were also examined with respect to the grade level. The findings were shown in Table 8.

According to Table 8, it is clear that the percentage of the 3rd and 5th grade students who believed that *there were more living things* were more than those who did not believe that *there were more living things*. On the other hand, the opposite situation was valid for the 4th graders. The distribution for the question whether *there were less living things* also showed a similar tendency. The percentage of the 4th graders who believed that there were not less living things was more than those who believed that there were less living things.

Reasons for more/less living things provided by the students

Reasons of the students related to their responses as

Table 7. The analysis of the open ended questions in the third part.

Responses	f	%
Yes, there are more living things.	79	28
Yes, there are less living things.	63	23
No, there are not more living things.	62	22
No, there are not less living things.	60	21
Not responded	16	6
Total	280	100

Table 8. Frequency distribution related to the analysis of open ended questions with respect to grade level.

Grade Level	Are there more living things?		Are there less living things?		No Response	Total
	Yes	No	Yes	No		
3	27	10	23	21	9	90
4	18	33	15	23	5	94
5	34	19	25	16	2	96
Total	79	62	63	60	16	280

shown on Table 7 can be introduced and interpreted as follows:

Reasons for the presence of more living things

Students 11: *Human has got the mind. Human is more intelligent than the others and think. Hence, it is more living than the other things.*

Student 5: *For instance, we are more living than the turtles.*

Student 23: *I think of human. Because human being is more gifted than all the other living things.*

Student 14: *Rabbits move rapidly while turtles move slowly. Hence rabbits are more living than the turtles.*

As can be understood from the statements above, being human was an important factor for the students in order to be more living. Also, mobility appeared to be another factor to explain their living thing concept.

Reasons for the presence of less living things

Student 18: *Microbes are less living because they die when they are washed with soap.*

Student 26: *Cactus is less living since it cannot change its place.*

Student 57: *Bean is less living because it is a sleeping*

living thing.

Student 88: *Snail. Because it drags slowly.*

Student 39: *Dried plants. Because they still have their roots in the soil.*

According to the students' statement, mobility seemed to be an important factor for the students to explain the reason of less living things similar to the explanation of more living things. Also, dormancy was mentioned to be a reason of less living for the students.

Reasons for the presence of no more/less living things

Student 110: *Because every living thing has the same characteristics. For instance, a snake moves fast but an elephant moves slowly. Anyway, both of them move.*

Student 121: *For example, again, an elephant gives birth by breeding but a snake gives birth with eggs. Anyway, both of them reproduce.*

Student 72: *A rabbit breathes or an animal breathes. I breathe too.*

Student 133: *All living things are equal. Both human and mushroom are equally alive.*

According to the students' statements who responded to the question by indicating there was no more/less living things, student thought that all living things were equal

despite having different characteristics for mobility, reproduction or their other functions.

DISCUSSION

The present study revealed early grade level Turkish students' conceptions related to living things. In the study, students' conceptions were examined from different perspectives. To begin, the results of the first part of the study indicated that characteristics related to living things such as breathing, feeding constitute an important place in students' minds in terms of their initial considerations as found in the findings of Martínez-Losada et al. (2014) study which showed children to associate several functions with living things. Next, students were found to point out animals, plants and human respectively. This result was consistent with the finding of Babai et al. (2010) study which reported the 10th graders determined animals as living things more quickly than plants. Also, In Kurt's (2013) study, biology teacher candidates were determined to assert animals, human and plants in terms of living things respectively. This result was also similar to the present study in terms of students firstly focusing on animals as living things more than plants and animals. On the other hand, Palmer (2013) found out that 4 year old children's knowledge of plants was greater than animals.

Despite the fact that human fall into the category of animals, in the present study, it was presented as a separate category to exude its specific frequency as in Kurt's (2013) study. So, when the total frequency of animals and human were considered together in the present study, animals/human were found as the most frequently mentioned concept as in the study of Kurt (2013). The finding that mentioning animals, plants and human might stem from the fact that young children observe animals, plant and human in their environment mostly. Hence, this might be affective on their considerations related to living things. On the other hand, microorganism and fungi were seldom mentioned in their responses similar to the findings of Kurt (2013).

When the students' definitions related to living thing concept were handled, movement came out to be the favorite characteristic at this perspective. This finding was not a surprise when the results obtained from the other parts of the present study were considered. Also, associating mobility with living things was encountered in the findings of the previous literature (Babai et al., 2010; Bahar, 2003; Martínez-Losada et al., 2014). Respiration, growing, feeding and similar body functions were other characteristics used by the students in their explanations as in Bahar's (2003) study. Also students were found to indicate possessing organs in their explanations related to living things similar to morphological aspects addressed in Martínez-Losada et al. (2014) study. On the other hand, although respiration had an important place

in students' explanations in the present study, breathing was as the least frequently mentioned characteristic in Martínez-Losada et al. (2014) study.

The characteristics mentioned by the students could also be observed by them in daily life and in the environment. However, defining living things due to the fact that it *talks, have emotions/imaginations or thinks* indicated that those children considered human being while making their definitions because such characteristics belong only to human. Hence such perspectives of students suggest anthropomorphic tendencies (Kallery and Psillos, 2004).

Another reason of children for explaining living things was mentioning God in their responses. This reason indicated that students were influenced from the social and cultural structure of the society to provide such an explanation. Similarly, in another study, a misconception like "God makes rain and clouds" was obtained from 5 year old children in Cyprus (Briggs and Cassidy, 2011). Different results might be obtained about living thing concept from children with diverse cultures. Cultural aspects were highlighted for learning science (Palmer, 2013). In addition, differences in the language were also reported on students' conceptions at this respect. In one study, living thing concept was handled in terms of English and Indonesian language which examined children belonging two different cultures (Leddon et al., 2011). Such studies are thought to be original and beneficial because children's knowledge might be in different relations with cultural aspects.

The study results showed that most of the students classified the items correctly as living/nonliving. This finding was consistent with previous literature (Bahar, 2003). Characteristics similar to their general explanations related to living things were reasoned by children to support their classifications. For example, reproduction was also asserted in this respect as found in Martínez-Losada et al. (2014) study from primary school children. However, various students failed to determine things as living or non-living correctly. This finding was consistent with the literature which shows children's lack of understanding in differentiating living and non-living things (Villarroel, 2013; Villarroel and Infante, 2014). For example, the result showing that the teeth in our mouth were non-living in the present study showed similarity to the students thinking that the bones in our body were non-living in Caravita and Falchetti's (2005) study. In addition, younger children aged 3-7 year old were reported to fail realizing plants were alive (Martínez-Losada et al., 2014); an 8 year old children was found to indicate a cut flower non-living (Deighton et al., 2011) and 5 year old children thought that trees were not living organisms (Rybska et al., 2014) similar to the classifications of several plants such as a branch of roses, mosses, tree and cactus as non-living in the present study. Besides, several students stated mushroom was non-living since it was eaten by human.

This finding was similar to a child's explanation of a cut flower as non-living due to the fact that it was taken away from its family with an anthropomorphic approach (Deighton et al., 2011). Also, various students saw celestial bodies such as the Sun, Moon and Earth as living things despite the fact that they are non-living. In addition, "car on the motion" and "exploding volcano" were other emerging items indicated as living things although they are non-living. Those findings indicated problems related to living thing conceptions of the students as parallel to the previous literature which report persistent misconceptions among different grade level students (Babai et al., 2010).

Beside incorrect classification of the items, various students were determined to be unsure about their response. Such students were also encountered in Villarroel's (2013) study as indeterminate. Those items could be illustrated such as fossils, burnt out volcano, exploding volcano which are hard to observe in the daily life of the students. Also, in the literature there were students who could not assert an opinion related to the liveliness of those items (Caravita and Falchetti, 2005). In addition, the items egg, bean was also asserted at this respect. Those items require the concept of dormancy for the students to decide about its liveliness. Dormancy appears as a problem for liveliness concept in the literature also (Bahar, 2003).

In the present study, the students were also asked theoretical open ended questions as well as posing them questions by giving place to the items from daily life. As a result of the analysis of those questions, more than half of the students' opinions (51%) indicated that they believed that there were more/less living things. On the other hand, 43% of their opinions revealed the opposite view – there were no more/less living things. The finding that more than half of the opinions of the students hold such a view is another surprising result which indicates the idea that children do not have sufficient conception related to living things as mentioned in the previous research results (Cavas and Kesercioğlu, 2010; Villarroel, 2013).

When a comparison was made among the grade levels for the analysis of the questions mentioned above, the 3rd and 5th graders believed that there are more living and less living things more than 4th graders. Such animistic tendencies can be accepted as a normal thing for the 3rd graders due to their younger age. In Villarroel's (2013) study it was found that no full distinction was present for living and non-living entities in 4-6 years old children while there was not such a problem for 6-7 year old children. The result that was reached in the present study seemed consistent with Villarroel's (2013) study. In general, it is expected that the degree of students who believe that there are more living or less living things to decrease with respect to grade level since they move from concrete operational stage to formal operational stage with growing age as explained by Piaget. Yet there

was a contradictory situation in the present study. The same tendency was also valid in student explanations for specific items' liveliness or non-liveliness. The 3rd and 5th graders seemed to provide more reasons both in number and range when compared to 4th graders. However, their animistic views in 5th grade reappeared despite their growing age and grade level. The reason of this situation might be a number of things which causes such a triggering on students' conceptions. This problem can be recommended as another study topic to be searched in detail with different populations.

The students proposed several reasons for the items to be more/less living to support their responses. To put in order, human, animals and plants were listed to be more alive by most of the students. Being human, things which grow rapidly, things which change place rapidly or things which have large body were suggested to be more alive than the things which grow slowly, the things which change place slowly or the things which have got small bodies. On the other hand, cactus, mushroom and some plants were expressed to be less living when compared to other living things. It was reasoned that they did not move, died rapidly, and grew slowly. Martínez-Losada et al. (2014) study also showed that lack of movement was reasoned for not considering plants alive. In here also anthropomorphic and animistic tendencies of children were obvious as mentioned by Kallery and Psillos (2004) previously.

Conclusions

Therefore, it can be stated that students give human a remarkable place among living things. This result might be related to Turkish cultural structure and formal education system. Teaching in school and explanations and visuals in course books mostly focus on human (Aker et al., 2017; Demiray and Köker, 2017; Kaya, 2017). For instance, biological systems such as digestion system and respiratory system are figured out on human body in science textbooks. Also, human's inner organ models in science laboratories and human skeleton model as well as the pictures which show that one's hair stands at one end about electrostatic topic in science textbooks support the result of this study. Hence, this situation naturally triggers students thinking about human concept when they are told "respiration" or "digestion". Consequently, this anthropomorphic approach creates a learning obstacle for learners. For this reason, anthropomorphic approach of Turkish education system can be recommended to investigate it in itself in the future studies. Because obtaining such anthropomorphic approaches from students' views can be acceptable when such aspects of science curriculum and education system are considered, this situation might provide an example for other countries' education system as well.

Relating the reason of living with the cause of God

might originate from religious and socio cultural structure in the participants' society. Especially, connecting relationship with God is encountered in lightning and thunder which cause fear in human. When the students' criteria to explain living and non-living things were considered, no explanations such as "The reason of living things is God", "God caused living things" were encountered in science programs or in other written sources. It is thought that the reason of the fact that children's statements involving God might stem from social, cultural and family respects apart from science program or course books. Additionally, in Turkey people attribute the reason of challenging cases to God when they can provide no explanation for it. For example, statements such as "God knows", "God caused", "It is an estimation of God" can be given in this respect. It is thought that this situation emerges as a learning barrier.

To overcome misconceptions and insufficient knowledge of students about living things, in science courses it should be highlighted that living things do not consist of only human. For this reason, other living things should be mentioned both in the lessons and in science textbooks. Science education should refer to all living things besides human and science course books should be prepared by being in equal distance to all living things. Also, out of class activities are very important as stated by Borsos et al. (2018). Examination of various living things in the nature might be beneficial at this respect (Bartoszeck et al., 2011; Çil, 2016; Dale Tunnicliffe, 2015; Rybska et al., 2014). The students can be taken to natural history museums and science centers (Bartoszeck and Dale Tunnicliffe, 2017). Additionally, inter discipliner relations might be constructed by focusing on living organisms in science (Popovic, 2017). Moreover, more attention should be paid to laboratory activities since they can make students acquire experience in this respect and make students' correct apprehension easier as shown by Sammet and Dreesmann (2017). By this way, the misconceptions of the students related to living thing concept with anthropomorphic roots can be overcome.

SUGGESTIONS

The present study aimed to get an idea about the opinions of 9-11 years old children who are in the transition period from Piaget's Preoperational Stage to Formal Operational Stage about living things. Hence, the study findings were analyzed as a whole. However, in the future, it is possible to suggest enriching such studies by making comparisons between genders. Also, the study can be organized to supply data from the urban, suburban and rural area and compare them. In addition, data can be obtained from the participants via drawings to make triangulation (Bartoszeck et al., 2011; Bartoszeck and Dale Tunnicliffe, 2013; Rybska et al.,

2014; Dale Tunnicliffe, 2015; Bartoszeck and Dale Tunnicliffe, 2017; Villarroel and Infante, 2014). Furthermore, data can be collected from gifted students about this concept since there is a need for conceptual studies in the area of gifted students' science education (Ürek and Arıkil, 2013; Ürek and Dolu, 2015).

EDUCATIONAL IMPLICATIONS

This study proved that children somewhat differentiated living and non-living things. However, their criteria used in this differentiation prove that they possess misconceptions as found in the previous research (Bahar et al., 2002; Cavas and Kesercioğlu, 2010; Kurt, 2013; Villarroel, 2013). Misconceptions are children's opinions which are consistent while explaining their environment but they are different than the scientifically acceptable explanations. Thus, the characteristics attributed by children in terms of explaining them as living or non-living might create a barrier especially to their future learning. From this point, teachers should be aware of students' criteria about differentiating living and non-living things in terms of this concept and they should utilize them in the removal of misconceptions.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

REFERENCES

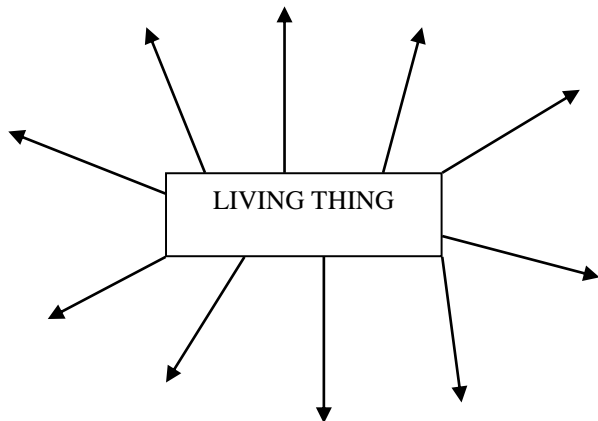
- Akter S, Erslan HB, Şimşek M (2017). Ortaokul Fen Bilimleri Ders Kitabı [Middle School Science Course Book]. In M. Taş, A. E. Bozdoğan and A. Tekbıyık (Ed.) Ankara: MEB.
- Babai R, Sekal R, Stavy R (2010). Persistence of the Intuitive Conception of Living Things in Adolescence. *J. Sci. Educ. Technol.* 19:20-26.
- Bachelard G (1983). *La formation de l'esprit scientifique* Librairie Philosophique, Vrin, Paris.
- Bahar M (2002). Students' learning difficulties in biology: Reasons and solutions. *Kastamonu Educ. J.* 10(1):73-82.
- Bahar M (2003). A Study of Pupils Ideas About the Concept of Life. *Kastamonu Educ. J.* 11(1):93-104.
- Bahar M, Cihangir S, Gözün Ö (2002). Okul Öncesi ve İlköğretim Çağındaki Öğrencilerin Canlı ve Cansız Nesnelere İlgili Alternatif Düşünce Kalıpları [Alternative Frameworks of Pre-School and Elementary Level Students related to Living and Non-living Things]. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Bildiri Kitabı [Proceeding of 5th National Science and Mathematics Education Congress. pp. 1-5.
- Bartoszeck A, da Silva BR, Dale Tunnicliffe S (2011). Children's concept of insect by means of drawings. *J. Emerg. Sci.* 2:17-24.
- Bartoszeck A, Dale Tunnicliffe S (2013). What do early years children think is inside a tree? *J. Emergent Sci.* 6:21-25.
- Bartoszeck A, Dale Tunnicliffe S (2017). What do children think is inside a crab? *J. Emergent Sci.* 13:20-28.
- Borsos E, Patocskai M, Boric E (2018). Teaching in nature? Naturally!. *J. Biol. Educ.* pp.1-11.
- Briggs M, Cassidy M (2011). Children's misconceptions and the teaching of early years' science: a case study. *The J. Emerg. Sci.* 2:7-16.

- Caravita S, Falchetti E (2005). Are Bones Alive? *J. Biol. Educ.* 39(4):163-170.
- Cavalier - Smith T (2004). Only Six Kingdoms of Life. *Proceedings of the Royal Society B Biological Sciences*, 271:1251-1262.
- Cavas B, Kesercioglu T (2010). Aqualitative study on student' understanding and misconceptions regarding the living cell. *e-J. New World Sci. Acad.* 5(1):321-331.
- Çil E (2016). Instructional integration of disciplines for promoting children's positive attitudes towards plants. *J. Biol. Educ.* 50(4):366-383.
- Dale Tunnicliffe S, Reiss MJ (1999). Building a model of the environment: how do children see animals?. *J. Biol. Educ.* 33(3):142-148.
- Dale Tunnicliffe S (2015). What's inside an earthworm? The views of a class of English 7 year-old children. *J. Emergent Sci.* 9:42-48.
- Deighton K, Morrice M, Overton D (2011). Vocabulary in four to eight year-old children in inner city schools. *J. Emergent Sci.* 6:7-13.
- Demiray K, Köker Ö (2017). İlkokul Fen Bilimleri 3 Ders Kitabı [Primary Science 3rd Grade Course Book]. In M. Taş, A. E. Bozdoğan, A. Tekbıyık and S. Yaman (Ed). Ankara: MEB.
- Kaya T (2017). İlkokul Fen Bilimleri 4 [Primary Science 4]. In N. M. Yıldız (Ed.). İstanbul: Fenbil Yayıncılık.
- Kurt H (2013). Biology student teachers' cognitive structure about "living thing". *Educ. Res. Rev.* 8(12):871-880.
- Leddon EM, Waxman SR, Medin DL (2011). What does it mean to 'live' and 'die'? A cross-linguistic analysis of parent-child conversations in English and Indonesian. *Brit. J. Dev. Psychol.* 29(3):375-395.
- Leddon ME, Waxman RS, Medin LD (2008). Unmasking "Alive": Children's Appreciation of a Concept Linking All Living Things. *J. Cognition Dev.* 9(4):461-473.
- Martínez-Losada C, García-Barros S, Garrido M (2014). How children characterise living beings and the activities in which they engage. *J. Biol. Educ.* 48(4):201-210.
- Opfer EJ, Siegler SR (2004). Revisiting preschoolers' living things concept: A microgenetic analysis of conceptual change in basic biology. *Cognitive Psychol.* 49:301-332.
- Palmer I (2013). The recognition and naming of plants and animals by 4 year-olds from differing backgrounds in an English Foundation Stage learning area. *J. Emergent Sci.* 6:12-19.
- Popovic M (2017). Living organisms from Prigogine's perspective: an opportunity to introduce students to biological entropy balance. *J. Biol. Educ.* pp.1-7.
- Purves WK, Sadava D, Orians GH, Heller HC (2004). *Life: The Science of Biology*. Sunderland: Sinauer Associates, Inc.
- Rolland A (1994). *Epistemologie du concept de vie. Analyse historique du concept. Analyse des criteres de vie d'eleves entrant en Sixieme.* Universite Joseph Fourier, Grenoble, Memoire D.E.A.
- Rybska E, Dale Tunnicliffe S, Sajkowska ZA (2014). What is inside a tree? The ideas of 5 year old children. *J. Emergent Sci.* 8:7-15.
- Sammet R, Dreesmann D (2017). What do secondary students really learn during investigations with living animals? parameters for effective learning with social insects. *J. Biol. Educ.* 51(1):26-43.
- Scamardella JM (1999). Not plants or animals: a brief history of the origin of Kingdoms Protozoa, Protista and Protoctista. *Int. Microbiol.* 2:207-216.
- Thullin S, Pramling N (2009). Anthropomorphically speaking: on communication between teachers and children in early childhood biology education. *Int. J. Early Years Educ.* 17(2):137-150.
- Türkmen L, Çardak O, Dikmenli M (2002) Lise Öğrencilerinin Canlıların Çeşitliliği ve Sınıflandırılması Konusundaki Kavram Yanılgılarının Belirlenmesi [Determination of Misconceptions of High School Students about Variety of Living Things and Their Classification]. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Bildiri Kitabı [Procedia of 5th National Science and Mathematics Education Congress]. pp. 1-4.
- Ürek H, Arıkıl G (2013). A Look at dissertations related to gifted students in Turkey between the years: 1995-2011. *Int. J. New Trends Arts Sports Sci. Educ.* 2(2):21-26.
- Ürek H, Dolu G (2015). Conceptual understandings of seventh grade gifted students regarding several situations involving chemical changes. *J. Educ. Instructional Stud. World* 6(1):22-32.
- Villarroel JD (2013). Environmental judgment in early childhood and its relationship with the understanding of the concept of living beings. *Springer Plus*, 2(1):87.
- Villarroel JD, Infante G (2014). Early understanding of the concept of living things: an examination of young children's drawings of plant life. *J. Biol. Educ.* 48(3):119-126.
- Wax N, Stavy R (1987). Children's Conceptions of Plants as Living Things. Paper presented at Biennial Meeting of the International Society for the Study of Behavioral Development, July, Tokyo, Japan.pp.12-16.
- Whittaker RH (1969). *New Concepts of Kingdoms of Organisms*. Science New York 163:150-160.
- Yeşilyurt S (2003). Ana Sınıfı Öğrencileri ve İlköğretim 1. Sınıftaki Öğrencilerinin Canlı ve Cansız Kavramlarını Anlama Düzeyleri Üzerine Bir Araştırma. [A Study on the Comprehension Level of Pre-school and Elementary 1st Year Students' Living and Non-living Concepts]. *Erzincan Eğitim Fakültesi Dergisi* 5(2):83-96.
- Yıldırım A, Şimşek H (2008). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri [Qualitative Research Methods in Social Sciences]*. Ankara: Seçkin Yayıncılık.

APPENDIX

Living Thing Conception Questionnaire

A. What comes to your mind when you are told “living thing”? (You can add your own arrows if they are not sufficient for you...)



B. What is the meaning of living thing for you? Can you explain it?

C. Put (X) for each of the things as “living”, “non-living” or “I don’ know” and explain the reason of your answer.

Item	Living	Non-Living	?	The reason of your answer
Elephant				
Cloud				
Rag doll				
Spider				
House				
Microbe				
Star				
Stopped car				
Teeth in the mouth				
Virus				
Mountain				
Computer				
Exploding volcano				
Burnt out volcano				
Tree				
Fossil				
Telephone				
Fire				
Snail				
Violet in pot				
Egg				
A brunch of roses				
Crow				
The planet earth				
Fish				
Lamp				

Stone				
Sun				
Bean				
Cactus				
Snake				
Water in the glass				
Water in the stream				
Moon				
Ocean				
Moving car				
Mushroom				
City				
Memory card				
Play station game				
Moss				
Human				
Lightning				
Thunder				

1. Do you think that there are more living things in the list above you marked as “living”?

If yes, please check “yes” and explain your reason; if no, please check “no” and explain your reason.

Yes () No ()

Which one /ones? Why? Which one /ones? Why?

2. Do you think that are there less living things in the list above you marked as “living”?

If yes, please check “yes” and explain your reason; if no, please check “no” and explain your reason.

Yes () No ()

Which one /ones? Why? Which one /ones? Why?