

Pre-service teachers' visual images about biology

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ABSTRACT

The aim of this study was to investigate the visual images of pre-service teachers who take biology courses in undergraduate education about biology by analyzing their drawings. The research was conducted with 97 pre-service teachers, studying at the education faculty of a university in Turkey and taking biology course during undergraduate training. Science teaching and classroom teaching departments were included in the research. In the study, the data collection tool has been applied based on voluntariness of pre-service teachers. In the first part of the data collection, information about pre-service teachers' department, grade level and gender were collected. In the second part, pre-service teachers were given a blank A4 paper and asked to draw a picture explaining the concept of biology. Pre-service teachers completed their drawings in approximately 20 minutes. Content analysis was used in the analysis of the drawings. Categories and codes were first determined in the analysis of the data. Drawings were coded separately by two researchers. Then, in order to ensure inter-coder reliability, the codes were evaluated together, and a decision was reached. The analysis of pre-service teachers' drawings about biology shows that ecology and ecosystem concepts came to the mind of the majority when biology is mentioned. The general result of the research can be stated as the visual images of pre-service teachers about biology are mostly shaped within the framework of ecology.

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1. INTRODUCTION

Biology is a discipline that scientifically explores the nature of vitality/life [1]. Regarding the content standards of science education, it is seen that life sciences are included in eight categories of K-12 education [2]. Biology is one of these eight categories of science education. Therefore, it is inevitable that all students studying at K-12 level will take biology content in science education. For this reason, the knowledge, attitudes, opinions, perceptions and images of the teachers, who provide K-12 level science education, about biology are important.

In Turkey science education is given by classroom teachers in elementary school, by science teachers in middle school and by biology teachers in high school. For this reason, there are many researches in the literature that investigate the knowledge, attitudes, opinions, perceptions, and images of pre-service teachers and teachers about biology. Among them, there are many studies on the analysis of different concepts in biology by means of drawings. Kurt [3] used the drawing technique in order to reveal the cognitive structures of biology pre-service teachers about immunity. Jalmo and Suwandi [4] analyzed students of Biology Education's drawings of genetic concepts. Nugraha [5] analyzed science student teachers' drawings on human internal organs. Patrick and Tunnicliffe [6] worked on science teachers' drawings on the internal structures of the human body. Kurt, Ekici, Aktas and Aksu [7] analyzed biology

student teachers' drawings on concept of diffusion. Ormanci and Balim [8] worked on science teacher candidates' drawings on concept of cell. Bektasli [9] worked on pre-service science and biology teachers' drawings on archaeobacteria, bacteria and protista kingdoms. Yucel Cengiz and Ekici [10] used the drawing in order to reveal the visual images of pre-service biology teachers about laboratory. Kaya [11] analyzed pre-service science teachers' drawings on concepts of photosynthesis and cellular respiration. Alkan, Akkaya and Koksall [12] analyzed pre-service science teachers' drawings on concepts of mitosis and meiosis. Aksan, Harman and Celikler [13] worked on science teacher candidates' drawings on recycling of waste batteries. Kurt and Ekici [14] analyzed biology pre-service teachers' drawings on bacteria. In another study, Kurt and Ekici [15] worked on biology pre-service teachers' drawings on the concept of osmosis. Kurt and Ekici [16] also worked with biology pre-service teachers in another research, where they examined their drawings about virus. In a study analyzing the cognitive structures of biology pre-service teachers about enzymes, drawings of pre-service teachers were analyzed [17]. In another study conducted with pre-service biology teachers, their drawings about microbes were analyzed [18]. Regarding these studies, it can be seen that the drawings of concepts in biology were largely examined in the literature. However, there is no research on the drawings of the participants about biology as a whole.

Regarding the researches in the literature, it is seen that there are no studies in which pre-service teachers' opinions about the concept of biology are analyzed through drawings. Pre-service teachers' opinions about biology were generally examined through metaphors and interviews. Therefore, this research is thought to contribute to the literature. In this context, the aim of the research is to investigate the visual image of biology by analyzing the drawings of pre-service teachers who take biology courses in undergraduate education.

2. RESEARCH METHOD

2.1. Participants

The research was conducted with 97 pre-service teachers, studying at the education faculty of a university in Turkey and taking biology course during undergraduate training. Pre-service teachers from the first grade (n = 32), second grade (n = 19), third grade (n = 24) and fourth grade (n = 22) have participated in the study. There are many departments in the faculty of education in Turkey. However, not all of the teaching departments take biology courses in undergraduate education. Therefore, not all departments in education faculties were included in the research; science teaching and classroom teaching departments were included.

2.2. Research model and data collection tool

In the research, the data collection tool was applied based on voluntariness of pre-service teachers. While the total number of science and classroom teaching students was around 500, only 97 pre-service teachers have participated in the study. In the first part of the data collection, information about pre-service teachers' department, grade level and gender were collected. In the second part, pre-service teachers were given a blank A4 paper and asked to draw a picture explaining the concept of biology. Pre-service teachers completed their drawings in approximately 20 minutes.

2.3. Data analysis

Content analysis was used in the analysis of the drawings. Categories and codes were first determined in the analysis of the data. Drawings were coded separately by two researchers. Then, in order to ensure inter-coder reliability, the codes were evaluated together, and a decision was reached. The results of the research were expressed as frequency and percentage.

3. RESULTS AND DISCUSSION

Regarding pre-service teachers' drawings about the concept of biology, as presented in Table 1, it was seen that more than half (58.8%) made drawings about ecology, shown in Figure 1. These drawings include ecosystem, food chain, water cycle and food pyramid, which are the components of ecology. 27.8% of the participants made drawings about the cell shown in Figure 2. Cell-related drawings mainly included DNA, plant cell, animal cell, organelles, mitochondria, mitosis and cell cycle. 9.3% of the pre-service teachers made drawings about the animal world, as illustrated in Figure 3. Although these drawings contain many features, they mostly included drawings about vertebrates, mammals, humans, organs, skeletons and invertebrates. 4.1% of the pre-service teachers who participated in the research made drawings about the protista world, shown in Figure 4. These drawings included protozoans, rhizopoda, amoeba, flagellate and euglena from the protista world.

Table 1. Analysis of pre-service teachers' visual images about the concept of "biology"

Categories Codes	Frequency	Percentage
Ecology	57	58.8
Ecosystem	52	53.6
Food pyramid	3	3.1
Water circle	2	2.1
Food chain	1	1.0
Cell	27	27.8
DNA	10	10.3
Plant cell	5	5.2
Animal Cell	4	4.1
Mitochondria	4	4.1
Organelles	4	4.1
Cell cycle	3	3.1
Mitosis	3	3.1
Metaphase	2	2.1
Nerve cell	2	2.1
Axon	1	1.0
Anaphase	1	1.0
Dendrite	1	1.0
Myelin sheath	1	1.0
Prophase	1	1.0
Cytokines	1	1.0
Telophase	1	1.0
Animal world	9	9.3
Vertebrates	7	7.2
Mammals	6	6.2
Humans	6	6.2
Organs	3	3.1
Skeleton	2	2.1
Invertebrates	2	2.1
Starfish	1	1.0
Echinodermata	1	1.0
Birds	1	1.0
Regeneration	1	1.0
Digestive system	1	1.0
Systems	1	1.0
Earthworms	1	1.0
Protista world	4	4.1
Protozoans	4	4.1
Rhizopoda	2	2.1
Amoeba	2	2.1
Flagellate	1	1.0
Euglena	1	1.0

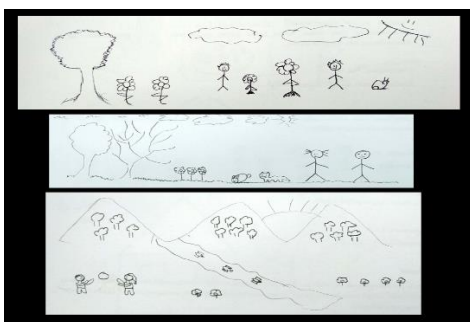


Figure 1. Drawings of pre-service teachers about the concept of "biology" in the ecology category

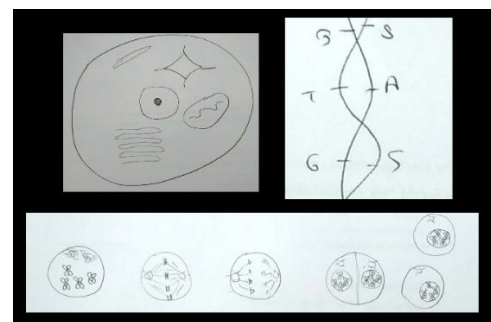


Figure 2. Drawings of pre-service teachers about the concept of "biology" in the cell category

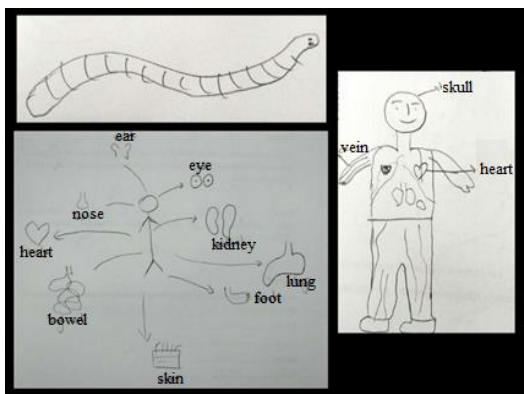


Figure 3. Drawings of pre-service teachers about the concept of "biology" in the animal world category

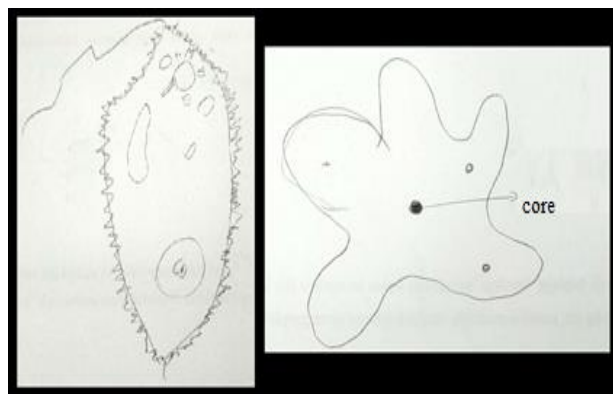


Figure 4. Drawings of pre-service teachers about the concept of "biology" in the protista world category

Table 1 shows the visual images of pre-service teachers about the concept of biology. The analysis of pre-service teachers' drawings about biology shows that ecology and ecosystem concepts come to the mind of the majority when biology is mentioned (Figure 1). Approximately one-third of pre-service teachers made a cell-related drawing when biology was mentioned (Figure 2). The analysis of these drawings showed that pre-service teachers' made drawings explaining biology with the parts the cell or species, such as DNA, plant cell, animal cell, mitochondria, and organelles. On the other hand, a small number of pre-service teachers have associated biology with the concepts of vertebrates, mammals and humans, included in the animal world. The drawings of the remaining four pre-service teachers included protozoans, rhizopoda, amoeba, flagellate and euglena from the protista world.

In this study, visual images of pre-service teachers about biology were analyzed through their drawings. As a result of the analysis, it was found that pre-service teachers associate the concept of biology with ecology, cell, animal world and protista world.

More than half of the pre-service teachers have made drawings associating the concept of ecology and biology. A similar result was found in a study examining pre-school pre-service teachers' metaphorical perceptions of chemistry, physics and biology concepts. It has been found that the concepts of living things and plants were among the first three images that appeared in the minds of pre-service teachers regarding biology [19]. Gürbüzöğlü, Yalmançı and Aydın [20] have analyzed the metaphorical perceptions of pre-service teachers about the concept of biology. In the research, the three metaphors mostly developed by pre-service teachers about biology were the followings; life, living beings and world. Koseoglu and Pehlivan [21] have analyzed the metaphorical perceptions of high school students about the concept of biology and biology teacher. In the research, metaphor mostly developed by high school students about biology were the followings; life. Ulukok, Bayram and Selvi [22] have analyzed the metaphorical perceptions of pre-service science teachers about the concept of biology. In the research, the two metaphors mostly developed by pre-service science teachers about biology were the followings; live and nature. Harman and Seker [23] have analyzed the metaphorical perceptions of pre-service science teachers about the concept of biology experiments. In the research, the some metaphors developed by pre-service science teachers about biology experiments were the followings; live, nature, life. Atas [24] have analyzed the metaphorical perceptions of pre-service science teachers about the concept of biology. In the research, the mostly metaphors developed by pre-service science teachers about biology were the followings; nature, environment, life. Ozarslan [25] have analyzed the metaphorical perceptions of students about the concept of biology. In the research, the mostly metaphors developed by students were the followings; life, live.

Approximately one-third of pre-service teachers produced cell-related drawings. Some of these pre-service teachers explained the concept of biology with drawings including concepts such as DNA, cell types, cell division. A similar result was found in the study of Harman and Çökelez [19]. It was found that the topic of divisions (mitosis and meiosis) came to pre-school pre-service teachers' minds at the second rank when it comes to biology.

In the research, it was found that the third concept that pre-service teachers made drawings about biology was related to the animal kingdom. With regard to the animal world, pre-service teachers mostly drew vertebrates, mammals and human figures. In Harman and Çökelez's [19] study, the concepts from the animal world such as animals, people and systems were among the images that appeared in the minds of preschool pre-service teachers regarding the concept of biology.

It was found that the category where the teacher candidates included the least number of drawings about biology was related to the protista world. In Harman and Çökelez's [19] research, it was also observed that the concepts about living things in the protista world were low in the pre-school pre-service teachers' mental images about biology.

4. CONCLUSION

The general result of the research can be stated that the visual images of pre-service teachers about biology are mostly shaped within the framework of ecology. When this result is taken as a reference, interdisciplinary studies related to biology can be established in higher education institutions that train teachers, and it can be ensured that pre-service teachers associate biology with various disciplines other than ecology. Because biology is a field of science that is also associated with different disciplines.

In other studies, to be conducted in the literature, the reasons underlying visual images of pre-service teachers about biology can be investigated. In this way, teacher training institutions can allow pre-service teachers to diversify their biology-related images.

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