European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3470237 Volume 6 | Issue 7 | 2019

PRE-SERVICE BIOLOGY TEACHERS' PERCEPTION OF THE CONCEPT OF ENVIRONMENT: A METAPHOR STUDY

Derya Çınar[i],
Hakan Kurt
Necmettin Erbakan University,
Turkey

Abstract:
The current study was conducted to reveal the pre-service biology teachers' perceptions of environment through metaphors. A total of 71 pre-service teachers (1st year, 2nd year, 3rd year and 4th year students) participated in the current study in 2006-2017 academic year. The data of the study were obtained by asking the students to complete the sentence "environment is like… because…" five times. The collected data were analyzed according to grade level by using both qualitative and quantitative data analysis techniques. The findings of the study have revealed that the 1st year pre-service teachers produced a total of 53 valid metaphors, the second year pre-service teachers produced 39 valid metaphors, the third year pre-service teachers produced 39 valid metaphors and the fourth year pre-service teachers produced 49 valid metaphors about the concept of environment. These metaphors were analyzed in terms of their common features and by using the conceptual categories developed by Aydın (2011), they were gathered under 10 categories. The pre-service teachers' metaphoric perceptions of the concept of environment were found to be categorically varying across the grade levels. As a result, it can be argued that metaphors can be used as effective measurement and evaluation tools in revealing pre-service biology teachers' perceptions and mental images of the concept of environment.

Keywords: environment, metaphor, pre-service biology teachers

1. Introduction

One of the positive results of globalization is that the dangers facing our world and the problems awaiting a solution are addressed in a global dimension rather than in a local dimension. In the process that started with the industrial revolution, the development of technology, increasing population and consequently increasing consumption and human intervention in the environment constitute the main source of environmental

[i] Correspondence: email deryacinar42@gmail.com

problems (Buell, 2004). Environmental pollution has exceeded the nature's self-renewal capacity, leading to various environmental problems such as global warming, soil pollution, air pollution, water pollution, reduced biodiversity and acid rain (Brown, 1991; Linden, 1997). These environmental problems have directly affected humanity and at the same time, the awareness of the global impacts of environmental problems has reached a level that affects not only our lives but also the lives of future generations (Cairns, 2002).

The concept of environment is now considered as a whole of natural, economic and cultural values (TÇV, 2001). Raising environmentally sensitive individuals to ensure that future generations live in a healthier and cleaner environment has become the priority of both government policies and education policies (Şahin, Cerrah, Saka and Şahin, 2004). Therefore, curriculums, schools, teachers, families and students should be important stakeholders of the phenomenon of environmental education for an effective and sustainable environmental education planning to occur (Atasoy, 2006). Individuals' perceptions of and attitudes towards environment and the problems posing a threat to environment and their reflecting these perceptions in their behaviours are of great importance for educators (Doğan, 2017). Therefore, the young generation is the most important target group of environmental education.

Being the subject of the current study, the concept of "environment" was evaluated through metaphor, one type of perception. Metaphor is a Greek word and it is the art of expressing a matter in another way (Keklik, 1990). Mevlana, in explaining the issues in his work Mesnevi, mostly preferred metaphorical expression; thus, presented a simple and easy to understand description by allowing the reader to adapt easily to the messages he wanted to give (Keklik, 1987). Metaphors are a means of perception and a source of thought that emphasize how concepts are perceived and individuality (Martinez, Souleda and Huber, 2001).

The field of biology is one of the richest branches of science in which students can use metaphors because the information in the field of biology can be the information of living things from within life, and it can often be abstract information that cannot be seen. Therefore, biology course allows students to use various metaphors (Ekici, 2016). The emergence of the concept of pollution in such a way as to cover most of the environmental problems and likening of a cell to a factory are just a few of the interesting metaphors. It is seen that metaphors are one of the most important tools in science fields and that they are used to explain and define concepts (Harrison and Treagust, 2006).

2. Literature Review

When the research focusing on the issue of metaphor in the field of science is examined, it is seen that there are studies aiming to elicit metaphors about different concepts such as *"greenhouse effect"*, *"ozone layer"*, *"acid rain"*, *"bio-diversity"* (Selvi, 2007), "*biology*" (Yalmancı and Aydın, 2013), "microscope" (Ekici, 2016), *"climate"* (Coşkun, 2010), *"world"* (İbret and Aydınözü, 2011), *"global warming"* (Doğru and Saraç, 2013),

"environment" (Ateş and Karatepe, 2013; Aydın, 2011; Selvi, 2007; Yazıcı, 2013; Doğan, 2017), *"environmental education"* (Güven, 2014), *"nature"* (Deniş-Çeliker and Akar, 2015; Kahyaoğlu, 2015), *"evolution"* (Eilam, 2009). Eilam (2009) stated that biology teachers produce metaphors with their own self-criticism and these metaphors reveal the experiences of the teachers and their continuing professional development. Strauss (2009) reported that biology teachers can explain the complex structure of DNA by simplifying metaphors. Lancor (2013) determined that biology teachers produce metaphors about the concept of energy.

2.1. Purpose of the Research

The purpose of the current study is to reveal the pre-service biology teachers' perceptions of the concept of environment through metaphors. To this end, answers to the following questions were sought:

1) Through which metaphors do the pre-service biology teachers explain their perceptions of the concept of environment?
2) Under which categories are the metaphors proposed by the pre-service biology teachers in relation to the concept of environment gathered according to their common features?

3. Material and Methods

3.1. Research Design

The current study employed the phenomenological design, one of the qualitative research designs. Phenomenology focuses on discovering how people make sense of experience and how they transform experience into consciousness, both individually and in shared meaning. This focus requires methodological, meticulous and in-depth depiction and description of how they experience certain phenomena. In other words, it focuses on how people perceive the phenomenon, how they describe it, how they feel about it, how they judge it, how they remember it, how they make sense of it and how they talk to others about it. In order to collect such data, an in-depth interview should be conducted with people who have directly experienced the phenomenon of interest rather than with individuals who have indirectly experienced it (Patton, 2014). According to Marton (1986: 31), phenomenography is a qualitative research approach and *"it allows people to make sense of their experiences lived in relation to phenomena, to conceptualize, to perceive from different perspectives and to construct a structure through various qualitative ways."*

3.2. Study Group

The study group of the current research is comprised of a total of 71 pre-service teachers enrolled in the Biology Education Department in Ahmet Keleşoğlu Education Faculty of Necmettin Erbakan University. The participants were selected by using the purposive sampling method. What is important here is that those in the list should have similar characteristics (Çepni, 2007). The data of the study were collected through a

semi-structured form administered to the 71 pre-service teachers within a four-week period. As a result of the preliminary evaluation, it was determined that all of the 71 semi-structured forms were thoroughly completed and returned.

3.3. Data Collection

In order to elicit the participating pre-service teachers' metaphors about the concept of environment, they were each given a piece of paper with an uncompleted sentence "*Environment is like..... because .....*" on it. Then, they were asked to express their thoughts focusing on the concept of environment. In studies on metaphors (Saban 2004, 2008, 2009; Aydın, 2010; Coşkun, 2010; Kaya, 2010), the researcher generally use the word "*like*" to connotate the link between "*the subject of metaphor*" and "*the source of metaphor*". By including the word "*because*" in the sentence, the pre-service teachers were asked to present "a rationale" for their own metaphors. The pre-service teachers were given about 15 minutes to write their metaphors on the concept of environment. The compositions written by the pre-service teachers make up the main data source of the current study as documents.

3.4. Data Analysis and Interpretation

In the current study, content analysis technique was used in the analysis of the collected data. Content analysis is used to refer to any attempt of qualitative data reduction or of making sense of qualitative data so as to determine the basic consistencies and meanings in a sizeable qualitative material (Patton, 2014).

The main goal in content analysis is to reach concepts and relationships that can explain the collected data. The main operation performed in content analysis is to collect similar data around particular concepts and themes and then to organize and interpret them in such a way as to be understood by the reader (Yıldırım and Şimşek, 2006:27). Content analysis is inductive while revealing categories, patterns and themes. This is often referred to as open coding (Strauss and Corbin, 1998) to emphasize the importance of being open to data. After creating patterns, themes or categories with inductive analysis, it is important to carefully examine and approve data deviating or not fitting into the categories during the verification phase, which is the final stage of qualitative analysis (Patton, 2014).

The analysis and interpretation of the metaphors developed by the pre-service teachers were carried out in five stages. These stages are: 1) Stage of Naming, 2) Stage of Sorting Out (Elimination and Purification), 3) Stage of Category Development, 4) Stage of Establishing Validity and Reliability and 5) Stage of Entering Data into Computer.

1) Stage of Naming

Firstly, a temporary list of metaphors produced by pre-service biology teachers was made in alphabetical order. For this purpose, it was examined whether the metaphors were clearly stated in the writings of the pre-service teachers. The metaphors expressed in the paper presented by each pre-service teacher were coded (for example, school, house, factory… etc.). Papers without any metaphors were marked.

2) Stage of Sorting Out (Elimination and Purification)

In this stage, the metaphors written by the pre-service biology teachers were read and reviewed one by one and each metaphor was analyzed in terms of (1) the subject of the metaphor, (2) the source of the metaphor and (3) the relationship between the subject of the metaphor and the source of the metaphor. In the current study, after the elimination of the weak structured metaphors produced by the 71 pre-service teachers, a total of 180 valid metaphors were obtained.

3) Stage of Category Development

The metaphors produced by the pre-service teachers were examined in terms of their common features related to the concept of environment. During this process, by considering the metaphor list created with 180 metaphors, it was investigated how each metaphor conceptualized the phenomenon of environment. For this purpose, a total of 10 different conceptual categories were created by associating each metaphor produced by the pre-service teachers with a specific theme according to their environmental perspective. These conceptual categories were formed on the basis of Aydın (2011).

4) Stage of Establishing Validity and Reliability

In order to establish the reliability of the study, the expert opinion (two faculty members; one specialized in the field of science education and the other in biology education) was used to confirm whether the metaphors given under the 10 conceptual categories created in the current study represented any conceptual category. For this purpose, two lists were given to experts: (a) a list of 180 sample metaphors in alphabetical order; (b) a list of names and properties of 10 different conceptual categories. Then the experts were asked to match the metaphors given in the first list with the 10 conceptual categories given in the second list (without leaving any metaphor outside these categories). Then the matchings of the experts were compared with that of the researcher. In this comparison, the numbers of agreements and disagreements were found and then the reliability of the study was calculated by using the Miles and Huberman's formula (1994: 64) *(Reliability = agreement / agreement + disagreement)*. In qualitative studies, reliability is achieved at the desired level when the agreement between expert and researcher evaluations is 90% and above (Saban, Koçbeker and Saban, 2006; Saban, 2009). In the current study, this rate of agreement was found to be 92%. The experts, who were consulted within the scope of the reliability study, placed 7 metaphors (factory, nature, laboratory, core, playground, game, family) in a different category than the researcher did. Thus, it was found that Reliability = 180 / (180 + 7) = 0.96.

5) Stage of Entering the Data into Computer

After the determination of 180 metaphors and the development of 10 conceptual categories out of these metaphors, the number (f) and percentage (%) of the participants were calculated after all the data were transferred to computer.

4. Results

4.1 Categories Formed by the Metaphors Possessed by the Pre-service Biology Teachers about the Concept of Environment

The metaphors possessed by the pre-service biology teachers about the concept of environment were gathered within 10 categories and these metaphor categories are presented in Table 1.

Table 1: Categories of the metaphors possessed by the pre-service biology teachers about the concept of environment, the number of metaphors, the total number of metaphors and percentage values

Category	Metaphors	The total number of metaphors	Percentage (%)
Expression of the importance	school (8), human body (5), factory (4), nature (3), brain (2), soil (2), telephone (2), breath (2), domino (2), machine (2), watch (1), money (1), society (1), pencil (1), biology (1), car (1), father (1), chain of rings (1), atmosphere (1), teacher (1), writing (1), team (1), warehouse (1), loop (1), recycling bin (1), gears in a machine (1), source of energy (1), kitchen (1), driving licence (1), endless road (1)	52	20,8
Expression of the place	house (16), school (6), aquarium (2), laboratory (2), university (1), my neighbourhood (1), the place which I frequently visit (1), classroom (1), place of observation (1), place of interaction (1), home (1), camp (1), tortoise shell (1), our own room (1)	36	14,4
Expression of the variety	book (6), library (5), encyclopaedia (2), play dough (2), core (2), electric circuit (1), space (1), universal set (1), money box (1), shopping centre (1), garden (1), chameleon (1), greens (1), world (1), stop (1), family (1), green grocer (1), cradle of liveliness (1), cinema (1)	31	12,4
Expression of reflectivity	labyrinth (3), friend (3), house (2), mirror (2), human (2), science (1), electric current (1), friend (1), television (1), harvest (1), open system (1), endless source (1), clean paper (1), river (1), technology (1), field (1), soil (1), time (1), boomerang (1)	26	10,4
Expression of protection	mother (3), tree (3), child (2), house (2), lady bag (1), war environment (1), newly born baby (1), iron (1), TEMA (1), mechanical pencil (1), dress (1), elderly (1), heritage (1), enemy (1), clothes (1), natural environment (1), monster (1), shopping centre (1), father (1)	25	10
Expression of happiness and peace	peace (3), amusement park (3), fun place (3), forest (2), happiness (2), play ground (2), dream (2), potato pie (1), bed (1), game (1), music (1), radiator (1), sleep (1), cinema (1), freedom (1)	25	10
Expression of life	human (10), life (5), living thing (3), life (3), society (1)	22	8,8
Expression of love	family (4), child (4), teacher (3), mother-father (1), friend (1), mother (1), love (1), pal (1), baby (1)	17	6,8
Expression of	container (1), danger (1), garbage (1), factory (1), telephone that is about to run out of battery (1), snow (1), toilet (1), ruined	9	3,6

pollution	place of residence (1), water (1)		
Expression of beauty	park (1), painting (1), psychologist (1), beautiful (1), sky (1), magnificent building (1), landscape picture (1)	7	2,8
Total		250	100

4.2. Conceptual Categories

Examples in the Category of Expression of Importance:

"*Environment is like the human body because it has a large-scale balance that is very difficult to disintegrate in itself; it is very complex. But it is also so neat and harmonious*." (Biology 1-21)

"*Environment is like a school because it teaches people new things every day*." (Biology 2-45)

"*It is like a chain of rings because all the events occur connected to each other*." (Biology 2-38)

"*Environment is like a domino because everything will be damaged if the balance of an entity in the environment is disturbed*." (Biology 3-9)

"*Environment is like a factory because every part of it is functional and results in the existence a whole*." (Biology 5-54)

Examples in the Category of the Expression of the Place:

"*Environment is like a home because it is a place where we live, shelter, feed*." (Biology 1-33)

"*Environment is like a class because it is crowded sometimes and it is quiet sometimes. It finds a different direction with existing people*." (Biology 2-52)

"*Environment is like a home because it is a living space*." (Biology 3-9)

"*Environment is like a place of interaction because people communicate with each other*." (Biology 3-8)

"*Environment is like an aquarium because it is a living space where the fish living in it must necessarily establish good relationships in order to survive.*" (Biology 5-57)

Examples in the Category of Expression of Variety:

"*Environment is like play dough because you can put it in any shape you want*." (Biology 1-29)

"*Environment is like a shopping centre because you can find everything there.*" (Biology 1-30)

"*Environment is like the world because it is so diverse that millions of species live there*." (Biology 2-42)

"*Environment is like a book because it has many things we don't know. But as we explore, we get different information."* (Biology 3-7)

"*Environment is like a library because it has many different books on various topics. There are many living and non-living species in our environment*." (Biology 5-66)

Examples in the Category of Reflectivity:

"*Environment is like an electric current because man is like a conductive material. He receives and transmits electricity. That is, environment affects people*." (Biology 2-26)

"*Environment is like science because it teaches us research. Science finds out what is unknown. Environment offers us things that exist but we do not know. Whether we see them or not depends on us.*" (Biology 1-32)

"*Environment is like a mirror because it shows how much care, importance and value society gives to other races."* (Biology 2-37)

"*Environment is like clean paper because it is clean if we don't write something on the paper. But if we don't protect it, it will get dirty*." (Biology 3-6)

"*Environment is like a field because you reap what you plant; it makes you happy if you make good use of it*." (Biology 5-63)

Examples in the Category of Expression of Protection:

"*Environment is like a war environment because there are living creatures that destroy each other through interaction. Human beings destroy each other in war and in environment as well*." (Biology 1-23)

"*Environment is like a newborn baby because it is unprotected*." (Biology 1-35)

"*Environment is like an inheritance because it is the place which we need to value for future generations and for our life without even thinking about how it was inherited to*

us; it is the place that we need to leave to future generations even in better conditions." (Biology 2-39)

"*Environment is like a mother because it is a shelter for some living things.*" (Biology 3-13)

"*Environment is like a monster because I think if we don't protect it, it will eventually destroy us.*" (Biology 5-55)

Examples in the Category of Expression of Happiness and Peace:

"*Environment is like an amusement park because it invites you to have fun with everything.*" (Biology 1-32)

"*Environment is like a cinema because sometimes you feel like sitting and watching it*." (Biology 1-25)

"*Environment is like happiness because it has more good sides than bad sides*." (Biology 2-47)

"*Environment is like peace because the sounds of birds and rustling of trees give peace*." (Biology 3-1)

"*Environment is like a dream because we can change it as we want*." (Biology 5-70)

Examples in the Category of Expression of Life:

"*Environment is like a human being because it develops, grows, progresses or vice versa. Sometimes it can go backwards instead of moving forward. Growth shrinks*." (Biology 1-24)

"*Environment is like a living thing because it grows, shrinks, is born, dies*" (Biology 1-33)

"*Environment is like life because the environment is often active. There is always a mobility, a bustle*" (Biology 2-43)

"*Environment is like life because nature produces and consumes to exist. Because it is a struggle for survival*" (Biology 2-42)

"*Environment is like a community because every part of it is a cause in itself and all of its parts represent a whole entity*" (Biology 5-54)

Examples in the Category of Expression of Love:

"*Environment is like a mother because she loves and cares for what she has inside*." (Biology 2-45)

"*Environment is like love because it grows if you like it, offering people a living space*." (Biology 2-49)

"*Environment is like a family because it can host many enjoyable and beautiful things*." (Biology 3-14)

"*Environment is like a friend because it keeps company with you*." (Biology 3-16)

"*Environment is like a baby because it requires attention, compassion*." (Biology 5-71)

Examples in the Category of Expression of Pollution:

"*Environment is like a container because some areas are very dirty*." (Biology 1-25)

"*Environment is like garbage because unconscious people throw everything unconsciously, pollute the air, pollute the water, and make the environment like garbage.*" (Biology 1-24)

"*Environment is like a factory, because even if it produces something and is useful, there is always noise and stench in the end."* (Biology 1-27)

"*Environment is like a phone that is almost out of charge because day by day the battery of our environment is running out and the unpleasant things have multiplied."* (Biology 2-44)

"*Environment is like a dump because there's too much pollution*." (Biology 5-69)

Examples in the Category of Expression of Beauty:

"*Environment is like a park because it is the only place where we see trees and green*." (Biology 2-50)

"*Environment is like a picture because it has a unique harmony and beauty*." (Biology 3-7)

"*Environment is a magnificent building because you will admire it when you look at it…*" (Biology 5-55)

"*Environment is like a ball that changes colour because it changes to different colours in different seasons.*" (Biology 5-56)

"*Environment is like a landscape picture because when I hear the word environment, I think of a clean, beautiful nature*." (Biology 5-69)

5. Discussion

The current study was designed to reveal the metaphors possessed by the pre-service biology teachers about the concept of environment and to collect these metaphors under particular conceptual categories. The findings of the current study have revealed that the participating pre-service biology teachers from different grade levels produced a total of 180 metaphors on the concept of environment.

The pre-service teachers produced highly different metaphors about the concept of environment such as "*school*", "*house*", "*book*", "*labyrinth*", "*mother*", "*peace*", "*human*", "*family*", "*container*", "*park*". This shows that it is not possible to explain the concept of environment as a whole with only one metaphor (Aydın, 2011). This finding supports the findings of many studies conducted for different concepts (Aydın, 2011; Kaya, Coşkun and Aydın (2010; Yazıcı, 2013; Doğan, 2017; Akgün, Duruk, Gülmez-Güngörmez, 2016). When the literature on the concept of environment is reviewed, it is seen that Kaya et al., (2010) found that university students produced 60 different metaphors, Aydın (2011) found that university students produced 92 different metaphors, Yazıcı (2013) found that geography teachers produced 49 different metaphors, Doğan (2017) reported that middle school students produced 25 different metaphors and Akgün et al. (2016) found that middle school students produced 71 different metaphors.

The fact that the pre-service biology teachers produced too many metaphors about the concept of environment stems from the fact that the concept of environment is broad, partly confusing and abstract. A total of 180 metaphors were produced by the pre-service teachers. The most frequently produced metaphors are "*house*", "*school*", "*book*", "*human body*", "*library*", "*factory*", "*labyrinth*", "*nature*". The metaphors of the pre-service biology teachers about the concept of environment were collected in 10 different conceptual categories. It was found that 20.8% of the pre-service teachers perceived the concept of environment as "*expression of importance*", 14.4% as "*expression of the place*", 12.4% as "expression of variety", 10.4% as "expression of reflectivity", 10% as "*expression of protection*", 10% as "e*xpression of happiness and peace*", 8.8% as "*expression of life*", 6.8% as "*expression of love*", 3.6% as "*expression of pollution*", 2.8% as "*expression of beauty*". This result is not supported by Aydın (2011) reporting that 27.5% of the university students producing a total of 92 different metaphors perceived the concept of nature as "*expression of life*". Similarly, Kaya et al. (2010) found that 60 metaphors produced by high school students were gathered under 7 conceptual categories and that perception of environment as the expression of pollution, beauty and life was very popular among the students.

In a study they conducted on the concept of nature with the participation of middle school students, Kahyaoğlu (2015) and Deniş-Çeliker and Akar (2015) found that the metaphors most frequently produced by the students are "*the place where people live*", "*source of life*" and "*altruistic*". Similarly, in the current study, the participating pre-service teachers produced the metaphors "*school*", "*human body*", "*factory*" and "*nature*" as the expression of importance; "*house*", "*school*", "*aquarium*" as the expression of the place and "*human*", "*life*" and "*living thing*" as the expression of life.

In a study by Doğan (2017), it was found that a great majority of the middle school students defined the concept of environment under the *"category of environment in terms of pollution*". However, in the current study, only 3.6% of the pre-service biology teachers perceived environment as the expression of pollution. Thus, it is difficult to claim that the pre-service teachers have better perceptions and sensitivity of environmental pollution and that they have more positive perceptions of and attitudes towards the protection of environment compared to middle school students. The metaphors produced by the pre-service biology teachers emerged as the expression of importance and the place.

As can be seen, the pre-service biology teachers who participated in the current study emphasized the importance of environment, place and variety in their metaphors about environment. Yet, only 10% of them pointed to the necessity of the protection for the existence of environment.

6. Recommendations

In environmental education, it is very important to distribute environmental issues across different grade levels and to place the environment in the contents of different courses in the biology education undergraduate curriculums. In addition, raising awareness and sensitivity of environmental issues and organizing environmental activities and field trips can be suggested to positively affect environment-related conceptual knowledge and attitudes. As a result of the current study, it can be said that metaphors can be used as an effective tool to determine pre-service biology teachers' perceptions of the phenomenon of environment. A good perception of environment can be imparted to students in biology undergraduate education curriculum.

7. Conclusion

The pre-service teachers' metaphoric perceptions of the concept of environment were found to be categorically varying across the grade levels. The fact that the pre-service biology teachers produced too many metaphors about the concept of environment stems from the fact that the concept of environment is broad, partly confusing and abstract. A total of 180 metaphors were produced by the pre-service teachers. The most frequently produced metaphors are "*house*", "*school*", "*book*", "*human body*", "*library*", "*factory*", "*labyrinth*", "*nature*". The metaphors of the pre-service biology teachers about the concept of environment were collected in 10 different conceptual categories. It was

found that 20.8% of the pre-service teachers perceived the concept of environment as "*expression of importance*", 14.4% as "*expression of the place*", 12.4% as "*expression of variety*", 10.4% as "*expression of reflectivity*", 10% as "*expression of protection*", 10% as "*expression of happiness and peace*", 8.8% as "*expression of life*", 6.8% as "*expression of love*", 3.6% as "*expression of pollution*", 2.8% as "*expression of beauty*". As a result, it can be argued that metaphors can be used as effective measurement and evaluation tools in revealing pre-service biology teachers' perceptions and mental images of the concept of environment.

About the Author(s)

The researchers work in the fields of educational sciences, teacher training and science education.

References

Akgün, A., Duruk, Ü. ve Gülmez-Güngörmez, H. (2016). Ortaokul Öğrencilerinin Çevre Eğitimi Kavramına Yönelik Metaforları. *Dicle Üniversitesi Ziya Gökalp Eğitim fakültesi Dergisi*, 28, 215-224.

Atasoy, E. (2006). *Çevre için eğitim: Çocuk doğa etkileşimi*. Bursa: Ezgi Kitabevi.

Ateş, M. ve Karatepe, A. (2013). Üniversite öğrencilerinin "çevre" kavramına ilişkin algılarının metaforlar yardımıyla analizi. *The Journal of Academic Social Science Studies*, *6*(2), 1327-1348. Doi: 10.9761/JASSS_642.

Aydın, F. (2010). Ortaöğretim Öğretmen adaylarının Coğrafya Kavramına İlişkin Sahip Oldukları Metaforlar. *Kuram ve Uygulamada Eğitim Bilimler Dergisi (KUYEB*), 10(3), 1313-1322.

Aydın, F. (2011). Üniversite Öğrencilerinin "Çevre" Kavramına İlişkin Metaforik Algıları. *Eastern Geographical Review*, 26, 25-43.

Brown, L. (1991). *The new world order*. In State of the world 1991: A Worldwatch Institute Report on progress toward a sustainable society (3-20). New York: W.W. Norton & Co.

Buell, F. (2004). *From apocalypse to a way of life: Environmental crisis in the American century.* New York: Routledge.

Cairns, J. (2002). Sustainability and sacred values. *Ethics in Science and Environmental Politics,* 13, 15-27.

Coşkun, M. (2010). Lise Öğrencilerinin "İklim" Kavramıyla İlgili Metaforları (Zihinsel İmgeleri). Turkish Studies International Periodical for The Languages, *Literature And History of Turkish or Turkic*. 5(3), 919-940.

Çepni, S. (2007). *Araştırma ve proje çalışmalarına giriş*. Trabzon: Celepler matbaacılık.

Deniş Çeliker, H. ve Akar, A. (2015). Ortaokul öğrencilerinin doğaya ilişkin metaforları. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *16*(2), 101-119.

Doğan, Y. (2017). Ortaokul Öğrencilerinin Çevre Kavramına İlişkin Sezgisel Algıları: Bir Metafor Analizi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi* (KEFAD),18 (1), 721-740.

Doğru, M. ve Saraç, E. (2013). Metaphors of primary school students relating to the concept of global warming. *Educational Research and Reviews*, 8(21), 2071-2082.

Eilam, B. (2009). The secrets of successful veteran biology teachers: metaphors of evolution, regeneration, and adaptation. *Teachers and Teaching: Theory and Practice*, *15*(4), 493–513.

Ekici, G. (2016). Biyoloji Öğretmeni Adaylarının Mikroskop Kavramına İlişkin Algılarının Belirlenmesi: Bir Metafor Analizi Çalışması. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi* (KEFAD). 17(1), 615-636.

Güven, E. (2014). Fen ve teknoloji öğretmen ve öğretmen adaylarının çevre eğitimine ilişkin metaforik algıları. *Eğitim ve Öğretim Araştırmaları Dergisi*, *3*(3), 26-37.

Harrison, A. G. & Treagust, D. F. (2006). Teaching and learning with analogies: Friend or foe? In P. J. Aubusson, A. G. Harrison, & S. M. Ritchie, (Eds.), *Metaphor and analogy in science education* (pp.11- 24). Dordrecht, The Netherlands: Springer.

İbret, Ü. ve Aydınözü, D. (2011). İlköğretim 2. kademe öğrencilerinin "dünya" kavramına ilişkin geliştirdikleri metaforlar. *Kastamonu Eğitim Dergisi*, 19(1), 85-102.

Kahyaoğlu, M. (2015). İlköğretim öğrencilerinin doğa kavramına ilişkin algılarının metaforlar yoluyla incelenmesi. *Turkish Studies International Periodical for the Languages, Literature and History of Turkish or Turkic*, *10*(11), 831-846. Doi: 10.7827/TurkishStudies.8526

Kaya, H. (2010). Metaphors Developed by Secondary school students towards "earthquake" Concept. *Educatioanl Research and Revie*w, 5(1), 712-718.

Kaya, H., Coşkun, M. ve Aydın, F. (2010). The Analysis of High School Studenst's Perceptions Towards "Environment" Concept. *African Journal of Agricultural Research*, 5(13), pp:1591-1597.

Keklik, N. (1987). *"Mevlânâ'da Metafor Yoluyla Felsefe"*, Felsefe Arkivi, sayı: 26, İstanbul.

Keklik, N. (1990). *Felsefede Metafor,* Edebiyat Fakültesi Basımevi, İstanbul.

Lancor, R. A. (2013). The many metaphors of energy: Using analogies as a formative assessment tool. *Journal of College Science Teaching, 42* (3), 38-45.

Linden, E. (1997). *A world awakens*. Time, 80-81.

Martinez, M., Sauleda, N., & Huber, G. (2001). Metaphors as blueprints of thinking about teaching and learning. *Teaching and Teacher Education*, 17, 965-977.

Marton, F. (1986). Phenomenography: A research approach to investigating different understandings of reality. *Journal of Thought,* 2(3), 28-49.

Miles, M.B. ve Huberman, A.M. (1994). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage.

Patton, M, Q. (2014). *Nitel araştırma ve değerlendirme yöntemleri.* (Çev. M.Bütün, S. B. Demir). Ankara: Pegem Akademi.

Saban, A. (2004). Giriş Düzeyindeki Sınıf Öğretmeni Adaylarının "Öğretmen" Kavramına İlişkin İleri Sürdükleri Metaforlar. *Türk Eğitim Bilimleri Dergisi*, 2(2), 131-155.

Saban, A., Koçbeker, B.N. ve Saban, A. (2006). Öğretmen Adaylarının Öğretmen Kavramına İlişkin Algılarının Metafor Analizi Yoluyla İncelenmesi. *Kuram ve Uygulamada Eğitim Bilimleri* (Educational Sciences: Theory & Practice) ,6(2), 461-522.

Saban, A. (2008). İlköğretim I. kademe Öğretmen ve Öğretmen adaylarıinin Bilgi Kavramına İlişkin Sahip Oldukları Zihinsel İmgeler. *İlköğretim Online*, 7(2), 421-455.

Saban, A. (2009). Öğretmen Adaylarının Öğrenci Kavramına İlişkin Sahip Olduğu Zihinsel İmgeler. *Türk Eğitim Bilimleri Dergisi*, 7(2), 281-326.

Selvi, M. (2007). *Biyoloji öğretmen adaylarının çevre kavramları ile ilgili algılamalarının değerlendirilmesi*. Yayınlanmamış Doktora Tezi, Gazi Üniversitesi, Ankara.

Strauss, A., & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* Thousand Oaks, CA: Sage Publications, Inc.

Strauss, S. (2009). A metaphor for DNA? *New Scientist,* 201 (2696), 22.

Şahin, N. F., Cerrah, L., Saka, A. ve Şahin, B. (2004). Yüksek Öğretimde Öğrenci Merkezli Çevre Eğitimi Dersine Yönelik Bir Uygulama. *GÜ, Gazi Eğitim Fakültesi Dergisi,* Cilt 24, Sayı 3 (2004) 113-128.

Türkiye Çevre Vakfı. (2001). *Ansiklopedik Çevre Sözlüğü.* Ankara: TÇV Yayınları.

Yalmancı, S. G., & Aydın, S. (2013). Öğretmen adaylarının biyoloji kavramına yönelik metaforik algıları. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 10 (21), 208-223.

Yazıcı, Ö. (2013). Coğrafya öğretmenlerinin "çevre" kavramına ilişkin algıları: Bir metafor analizi çalışması. *The Journal of Academic Social Science Studies, 6*(5), 811-828

Yıldırım, A. ve Şimşek, H. (2006). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri. Ankara: Seçkin Yayınevi.*