

Determining the perceptions of pre-service science teachers regarding environmental problems through word association*

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Suggested Citation:

Ozata Yucel, E. & Ozkan, M. (2016). Determining the perceptions of pre-service science teachers regarding environmental problems through word association. *International Journal of Learning and Teaching*. 8(3), 164-173.

Received March 15, 2016; revised June 20, 2016; accepted July 15, 2016;

Selection and peer review under responsibility of Prof. Dr. Hafize Keser, Ankara University, Ankara, Turkey.

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Abstract

In this study, the Word Association Test (WAT) was administered to 123 pre-service science teachers in order to determine their perceptions regarding environmental problems. "Environmental Problems" was given as a key word to the pre-service teachers, and they were asked to write what came to their minds in terms of the WAT, and to write one sentence about this concept. The responses concerning the key word were examined under six themes: "causes", "effects", "types", "measures", "worry/pessimism", and "other". The pre-service teachers were seen to have stronger cognitive structures with regard to the causes of environmental problems in comparison to other themes. Most participants confused the concepts of environmental problems and environmental pollution. They mostly focused on the effects of environmental problems on human beings and expressed both worry and pessimism. Emphases laid by the pre-service teachers on environmental awareness, consciousness, and love in regard to the measures that can be taken against environmental problems demonstrate that they think education is important for the solution of environmental problems. The research results reveal that perceptions regarding environmental problems are not adequate on the part of the pre-service science teachers. This lack of perception among the pre-service science teachers, who are to play an important part in raising environmental awareness, can be eliminated only through effective environmental education.

Keywords: Perception of environmental problems, environmental education, science, word association, pre-service teachers

*This Study was presented as oral paper at the 4th International Conference on Education (ICED-2015).

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1. Introduction

The solution to environmental problems, which manifest themselves more with every passing day, is closely related to the attention to be shown by coming generations to the environment. Thus, it is important to cultivate individuals who have a high level of environmental consciousness and awareness, possess necessary environmental knowledge, display a positive environmental attitude, and take an active part in the solution of environmental problems. According to Yardımçı and Bağcı Kılıç (2010), it is a person's perception and understanding of events that shapes his/her consciousness, knowledge, and attitudes regarding such aspects. Therefore, it is significant that individuals' perceptions of environmental problems, their causes, and the problems they lead to, as well as their awareness of the measures that can be taken and the duties they need to fulfill, be investigated.

A review of the literature shows that students from different age groups associate environmental problems with garbage, global warming, factory waste, air pollution, noise, drought, forest destruction, and fire that are frequently emphasized in their immediate surroundings (Yardımçı & Bağcı Kılıç, 2010; Alerby, 2000; Ayvacı & Senel Corlu, 2009; Gulum, 2011; Oztas & Kalıpcı, 2009). It is stated in various studies that though students from different age groups are aware of current environmental problems, their knowledge is superficial (Abdullahi & Tuna, 2014; Ayvacı & Senel Corlu, 2009).

Yardımçı and Bağcı Kılıç (2010) report that 8th grade students are aware of the fact that environmental problems lead to various health problems such as cancer and dyspnea, and suggest solution such as planting a tree, warning those people who pollute the environment, and raising their awareness, saving water and electricity, not littering, and dumping factory waste in appropriate places. The university students participating in Gulum's study (2011) thought that education and an economical use of natural resources are solutions to the most important problems of the present time and the future. Those students were engaged in simple actions such as collecting garbage, using water economically, and warning people as part of individual measures, but many of stated that they did nothing in terms of engaging in measures against the problems. To Ozata Yucel and Ozkan (2015), it is particularly difficult to develop positive environmental attitudes in terms of feelings, thoughts, and willingness to take action among middle school 7th grade student. In this regard, it seems that students' perceptions of the environment and environmental problems should be determined and improved.

Science teachers play a key role in the development of the right perception of the environment and environmental problems. The perspective of teachers with regard to the environment and environmental problems, and their ability to perceive ecological concepts in a holistic way, will make students accurately construct these concepts in their minds and cause them to develop appropriate attitudes towards the environment (Ozata Yucel & Ozkan, 2014). Lang (2000) highlights the view that developing teachers' skills regarding environmental education may improve the quality of environmental education. However, Oztas and Kalıpcı (2009) carried out a study on pre-service biology, science, and primary school teachers, and determined that most pre-service teachers have limited eco-friendly knowledge; they are not aware of some pollutants such as plastics and noise, and some environmental problems such as decreased biodiversity and noise pollution as well as their possible effects; and most of them have never participated in a meeting, a symposium, or an activity related to these matters. Therefore, the views of pre-service teachers about environmental problems should be determined, and deficiencies (if any) should be remedied. Research on this topic is very limited.

Data are collected via surveys and interviews in most of the studies aiming to determine the perception of environmental problems. In the present study however, data were collected through Word Association, which is one of the methods that can be used for determining students' comprehension and perception of a specific concept. This method requires students, in a specific time, to give responses containing one or two words which they associate with a key word they are given.

The number of their responses to the key word and the kinds of such responses are used to evaluate their understanding of any topic. It is accepted that the ordered response of a student to a key word reveals the links between the concepts in his/her cognitive structure, and indicates semantic similarity. The closer two concepts are in the cognitive structure, the faster a response emerges (Bahar, Johnstone & Sutcliffe, 1999; Bahar & Ozatli, 2003; Tsai & Huang, 2002; Shevelson, 1974; Gunston, 1980). Both the number of the responses given and the degree of association of such responses with the given concept should be taken into consideration in word association analysis (Shevelson, 1974). Gunston (1980) provides an improved version of Shavelson's technique by making students make one sentence about the key word after they have finished the word association in order to determine the nature of the relationship established between the key word and the given response. The present study aims to determine pre-service teachers' perception of environmental problems through word association.

2. Method

Only one case and only one unit of analysis, holistic single case design (Yin, 1994), which is a qualitative research method, is used in this study.

Maximum variation sampling is used in this study. Maximum variation sampling is a purposeful sampling method that aims to enlarge the variety of participants in defining the central themes (Patton, 1990). There are 123 pre-service science teachers participated in this study. Pre-service science teachers attended a number of courses about the environment as ecology, during the third and fourth years of the school. And these courses may affect their perception with regard to environmental problems. For this reason the working group was selected both from students in the second year of the program who had never been in courses and in fourth year of the program who had taken these courses. In this way it was hoped to suggest various perceptions of environmental problems.

To determine the participants' perceptions of environmental problems a Word Association Test (WAT) was used. "Environmental Problems" was given as a key word in this test. The students were then asked to make a sentence containing their responses. An example page layout is given below.

Environmental Problems:
Environmental Problems:
...
...
...
Environmental Problems:
An example sentence related to Environmental Problems:.....

The responses concerning the key word "Environmental Problems" were examined under five themes: "causes", "effects", "types", "measures", and "other". The sentences they made about the key word were examined under six themes (the sixth theme is "worry/pessimism" in addition to the above-mentioned five themes).

WAT was arranged in such a way that each of the responses to the key word would be written on a separate line. By this means, an attempt was made to achieve high reliability by ensuring that a particular response would be affected as little as possible by previous responses. While the responses to the key word were being listed, the sentences made by the pre-service teachers were also examined. In this way irrelevant and the random responses were noticed and excluded from the analysis. To ensure reliability, the responses given and the sentences made were classified by two researchers separately, and draft themes were determined. The percentage of agreement was 84.2% for the responses and 97.4% for the sentences. A percentage of agreement not less than 70% is considered acceptable (Miles & Huberman, 1994). The codes on which there was a disagreement were

re-examined, and the main themes were re-arranged after the researchers had reached an eventual agreement. Moreover, the participants' responses were tabulated, and sample sentences were entered.

3. Findings

Of the responses of the pre-service teachers participating in the study, 32 were evaluated under the theme of "causes", 15 under the theme of "effects", 14 under the theme of "types", 7 under the theme of "measures", and 37 under the theme of "other". 4 responses (i.e. living beings, rough roads, difficulty in transportation, and marshy ground), on the other hand, were excluded from the analysis because they involved misconceptions.

The pre-service science teachers made 116 sentences about the key word (i.e. "Environmental Problems"). Of the sentences made, 39 were evaluated under the theme of "causes", 24 under the theme of "effects", 11 under the theme of "types", 28 under the theme of "measures", 8 under the theme of "worry/pessimism", and 15 under the theme of "other". 10 sentences were evaluated under more than one theme.

3.1. The causes of environmental problems

The biggest number of different kinds of responses (N=32) were given by the pre-service teachers with regard to the theme of "causes" following the theme of "other". In addition, the total frequency of the responses evaluated under the theme of causes is high (f=288). The responses of the pre-service teachers show that they mostly think the main reasons for types of environmental problems are waste/garbage and industrialization/industrial waste. These are followed by human beings, noise, various gases, and motor vehicles (Table 1).

Table 1. The responses in the theme of "causes" and their frequency (N=32)

Response	F	Response	f
Waste /garbage	59	Overhunting	3
Industrialization/industrial waste	42	Migration	2
Human	20	Rude/harmful behaviors	2
Noise	19	UV rays	2
Gases (e.g. spray, perfume, C2O, methane.)	18	Lack of education	1
Motor vehicles/exhaust	18	Lovelessness	1
Traffic	14	Lack of comprehension	1
Natural disaster (e.g. landslide, flood, volcano)	12	Covetousness	1
Fire	11	Ambition	1
Cigarettes/butts	10	Social conflict	1
Unawareness/negligence/improper behaviors	10	Disrespect	1
Thermal/nuclear power plant, dam	9	Insecurity	1
Carelessness/Disorder	8	Light	1
Unconsciousness	7	Sewerage	1
Tree cutting	5	Lack of care	1
Fuel (coal, lignite)	5	Overconsumption	1
		Total	288

Of 116 sentences made by the pre-service teachers, 39 were about the causes of environmental problems. As is seen in the examples given below, the pre-service teachers think that human beings are the main cause of environmental problems in general.

There are a lot of problems caused by human beings in our environment.
Environmental problems are the product of human beings.
Various problems emerge in the environment due to people's lack of awareness.
The cause of environmental problems is covetous people.

The pre-service teachers indicated factories, industrial waste, and garbage as the other causes of environmental problems. Some examples are given below.

Smoke caused by exhaust or factory chimneys leads to environmental problems.
The main reason for environmental problems is pollution caused by garbage and waste.
Noise and environmental pollution occur as factories and industry are just in the part of human life.

3.2. The types of environmental problems

14 of the pre-service teachers' responses were about the types of environmental problem. The responses in this theme have the highest frequency (f=196), following those related to the theme of "causes". The most frequent response on the part of the students with regard to this theme are air pollution, land pollution, water/sea pollution, and noise pollution. The least frequent responses of the students in terms of this theme are greenhouse effect, visual pollution, light pollution, and acid rain (Table 2). The pre-service teachers have a low perception of other environmental problems such as unconscious urbanization, global warming, overpopulation, and ozone layer depletion. None of the pre-service teachers made mention of radioactive pollution, agricultural pesticides, and wrong fertilization.

Table 2. The responses in the theme of "types" and their frequency (N=14)

Response	F	Response	f
Air pollution	45	Excessive increase in population	5
Pollution/environmental pollution	39	Erosion	4
Water/sea pollution	33	Ozone layer depletion	3
Noise pollution	29	Acid rains	2
Unconscious urbanization	13	Light pollution	2
Global warming	11	Noise pollution	1
Soil pollution	8	Greenhouse effect	1
		Total	196

The various types of environmental problem were touched upon only in 11 sentences, in contrast to the large number of responses. In 10 of these sentences, the pre-service teachers emphasized environmental pollution as being an environmental problem.

Today's biggest problem is air pollution and noise pollution.
Pollution is the most important problem for the environment.

There are a lot of environmental problems such as air pollution and soil pollution.

Apart from the afore-mentioned, population increase and global warming were stressed in one sentence, and fire was stressed in another sentence.

*They are problems such as increase in human population, population, and global warming.
Fire is the main environmental problem.*

3.3. The effects of environmental problems

15 different responses were evaluated under the theme of “effects”. However, the total frequency of these responses is very low. The responses with the highest frequency are loss/damage/extinction, drought, and death (Table 3).

Table 3. The answers in the theme of “effects” and their frequency (N=15)

Response	f	Response	f
Loss/damage/extinction	6	Wildness	1
Lack of water/drought	5	Balance disorder	1
Death	4	Trouble	1
Illness	3	Making the life difficult	1
Decrease in biodiversity	2	System breakdown	1
War	1	Lack of green areas	1
Unhappiness	1	Disorder	1
Unproductiveness	1		
		Total	30

Of the sentences made by the pre-service teachers, 24 are about the “effects” of environmental problems. However, a great majority of these sentences are about the negative effects of these problems on human beings.

*Environmental problems affect our life negatively
Damage to the ozone layer puts our future in danger.
Environmental problems are disadvantageous for human life and society.
People are affected by environmental problems.
People blowing the horns in their cars to annoy apartment residents.*

Only a few pre-service teachers emphasized the effects of environmental problems on living beings other than people by giving up anthropocentric views.

*Environmental problems are the elements threatening the lives of living beings such as air pollution and soil pollution.
Environmental problems put the lives of living beings in danger by disrupting the balance of the ecosystem.*

3.4. The measures that can be taken against environmental problems

The smallest number of different kinds of responses (N=7) and the lowest frequency of responses (f=13) are in the theme of “measures”. In their responses, the pre-service teachers stressed educational measures such as awareness and consciousness, besides physical measures such as recycling (Table 4).

The number of sentences stressing the measures that can be taken against environmental problems (N=28) was the biggest following related to sentences explaining the causes of environmental problems, compared with the small number of responses. In the sentences on this subject, the pre-service teachers laid an emphasis on keeping the environment clean, being conscious, aware, and careful, and recycling.

Everyone should be aware of environmental problems.

One of the best solutions to environmental problems is raising the awareness of people.

Environmental problems can be solved only through love and education.

If we make our waste recyclable, we contribute to both our environment and our country.

Table 4. The responses in the theme of “measures” and their frequency (N=7)

Response	f	Response	f
Recycling	4	Awareness	1
Forestation	3	Love	1
Keeping clean	2	Respect	1
		Consciousness	1
		Total	13

3.5. Worry and Pessimism

The sentences made by 8 students show that they are worried or pessimistic about environmental problems, as can be seen in the examples below:

A frightening future is waiting our children due to environmental problems.

Environmental problems have become unavoidable.

3.6. Other

Table 5. The responses in the theme of “other” and their frequency (N=37)

Response	f	Response	f	Response	f
Ozone layer	9	Sea	2	Natural gas	1
Animal	8	Oxygen	2	Vultures	1
Life/right to life	7	Psychology	2	Country	1
Water	6	Environment	2	Children	1
Atmosphere	5	Dilovası	2	Theft	1
Nature	4	Kocaeli	1	Society	1
Greenery	3	Istanbul	1	Rubbish bins	1
Air	3	Resource	1	Ecosystem	1

Trees	3	Land	1	Paper	1
World	2	Fight	1	Alcohol	1
Soil	2	Azote	1	Natural gas	1
Cycle	2	Natural resource	1		
Building	2	Cultivation areas	1		
				Total	85

37 different responses that did not fit the above-mentioned themes (f=85) were evaluated under the theme of “other”. Among these responses, the most frequent answers are ozone layer, animal, life/right to life, water, and atmosphere (Table 5). Animal, water, soil, and dustbins may have been indicated because the pre-service teachers frequently interact with these objects in their immediate surroundings; ozone layer and atmosphere may have been indicated because they are frequently associated with environmental problems in TV, radio, newspapers, books, and so on; and Kocaeli, Dilovası, and Istanbul may have been indicated because they are areas where environmental problems are experienced intensely in their immediate surroundings.

4. Conclusion and discussion

The pre-service teachers provided a large number and a great variety of responses, and created many sentences regarding the causes of environmental problems. Since the variety and the number of responses to a key word in WAT are important signs of the comprehension of such a concept (Bahar, Johnstone & Sutcliffe, 1999; Shevelson, 1974), it can be said that the pre-service teachers have a stronger cognitive structure about the causes of environmental problems in comparison to other themes. This theme was followed by the types of environmental problems. Air pollution, land pollution, water or sea pollution, noise pollution, unconscious urbanization, and global warming are the most frequently indicated problems. A lot of studies in the literature report that students have more awareness of those problems which they frequently see in the daily lives and in various media organs (Yardımcı & Bağcı Kılıç, 2010; Alerby, 2000; Gulum, 2011; Oztas & Kalıpcı, 2009).

Expressions such as environmental consciousness, awareness, and love included in the sentences of the pre-service teachers, show that they think education is important in terms of measures that can be taken against environmental problems and the solution to these problems. In Gulum (2011), students suggested environmental education as a solution to environmental problems. However, the findings of the present study demonstrate that the pre-service teachers have a low perception of the individual measures that can be taken with regard to environmental problems as well as the responsibilities that need to be taken. Various studies also report similar results (Gulum, 2011; Seckin, Yalvac & Cetin, 2010). However, environmental education aims to enable individuals to be able to solve problems and take an active part in the solution of problems, besides providing them with knowledge, awareness, and positive attitudes (UNESCO-UNEP, 1977). These results imply that there are some problems associated with the environmental education provided in schools. Related to environmental courses, students should adopt an affective role in dealing with environmental issues, and also should be encouraged to participate and take part in voluntary agencies, besides using energy saving bulbs and public transportation.

Some pre-service teachers, though few in number, are worried and pessimistic about environmental problems and their possible outcomes, which is clear from the sentences they made. This feeling of pessimism may prevent them from taking any action to prevent or solve environmental problems. As a matter of fact, Gulum (2011) reports that some university students do nothing to solve environmental problems. According to Seckin, Yalvac & Cetin (2010), 8th grade students are pessimistic about environmental problems and have difficulty in producing solutions to them. In this

regard, it seems important that the perception that there is nothing that can be done to maintain and improve the natural balance should be eliminated through environmental education.

Similar to what various studies in the literature report (Yardımcı & Bağcı Kılıç, 2010; Abdullahi & Tuna, 2014; Oztaş & Kalıpcı, 2009; Seckin, Yalvac & Cetin, 2010), the present study shows that the pre-service teachers regard garbage, industrialization, human beings, various gases, motor vehicles, traffic, and natural disasters as the main causes of environmental problems. Some pre-service teachers, though few in number, consider unawareness, neglect, disrespect, and so on as the causes of environmental problems.

Many responses on the part of the pre-service teachers under the theme of types of environmental problems relate to environmental pollution. It is clear that a many pre-service teachers have difficulty in understanding and explaining the concepts of environmental problems and pollution, and they even regard environmental problems as environmental pollution. It is important for preservice teachers not only to focus on having new information about the environment in the courses but also to reduce their misconceptions and overcome such misconceptions.

The variety and the number of the pre-service teachers' responses about the effects of environmental problems, and the sentences constructed by them, indicate that they have low perceptions of the effects of environmental problems. While most of the pre-service teachers focused on the effects of environmental problems on human beings, very few participants emphasized the harmful effects of these problems on other living beings. That implies that a great majority of the pre-service teachers participating in the study have a people-oriented environmental approach. It is clear in various studies in the literature that many pre-service teachers regard the human being as the main focus of the environment rather than as just one element of the environment (Ozata Yucel & Ozkan, 2014; Moseley, Desjean-Perrotta & Utley, 2010; Desjean-Perrotta, Moseley & Cantu, 2008). Mistakes in daily life may have a big share in this perception which is held by th participants, even though the environment is focused on as a topic and concept in science courses in middle schools and in biology courses in high schools. It is also covered in both ecology courses and in elective courses in higher education institutions.

Some pre-service teachers have the following misconception: marshy grounds lead to an environmental problem for all living beings or animals. Rough roads and difficulty in transportation, which were also indicated as environmental problems, are two other examples of a people-oriented perspective.

The research results reveal that the perception with regard to environmental problems is not adequate among pre-service science teachers. This lack of perception among individuals who are to play an important part in raising environmental awareness, can be eliminated only through effective environmental education. The levels of this perception may be raised, and realistic suggestions may be made meaningful through the teaching of the education and educational problems in a holistic and real-life based way.

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