JOURNAL OF BALTIC SCIENCE EDUCATION
ISSN 1648-3898

PRE-SERVICE ELEMENTARY TEACHERS' PERCEPTIONS AND OPINIONS ABOUT GREENHOUSE EFFECT

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Abstract. *Through this research, it was aimed to determine the Pre-Service Teachers' perceptions and opinions about greenhouse effect. The research was carried out with 395 Pre-Service Elementary Teachers. The data in the research were collected through the questionnaire consisting of 36 items with likert type 5 related to greenhouse effect adapted into Turkish by Kılınç, Boyes and Stanisstreet (2008) developed by Boyes and Stanisstreet (1993) and an open-ended question. The quantitative data obtained from the questionnaire used in the research were analyzed using SPSS package program. The qualitative data obtained from an open-ended question were evaluated using the descriptive analysis technique. According to the results of the research, it has been observed that Pre-Service Teachers are not equipped with the sufficient knowledge about environmental problems. It has been concluded that Pre-Service Elementary Teachers established the false cause-effect relationship between environmental problems such as greenhouse effect, ozone layer problem, acid rain.*

Key words: *global warming, greenhouse effect, pre-service elementary teachers.*

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Introduction

Throughout history of civilization, while making use of the tecnology, human beings desired to dominate the nature with growing amount of zest. That's why, human beings are faced with rapid degradation of the environment and the corruption of the environmental values. Ecological degradation appears as a global threat which has been on the rise incessantly (Selvi and Yıldız, 2009). The most important global environmental problem that threatens the world today, is global warming caused by the greenhouse effect.

Global warming appears to be an environmental problem that has been discussed all over the world in recent years and solutions to this issue have been sought in the international arena. From the industrial revolution to present time, global warming defined as the rise in temperature in the lower layers of the atmosphere and on earth is becoming a problem that may have frigthening consequences in the future as a result of strengthening of the natural greenhouse effect with the impact of urbanization depending on the rapid rise in atmospheric concentrations of greenhouse gases emitted into the atmosphere by human activities such as the burning of fossil fuels, deforestation, agricultural activities and ındustrial processes (Türkeş, 2006).

Global Warming and the resulting climate change are gradually setting the stage for a future worldwide crisis and state of chaos at many levels, steadily bringing the globe to an environmental point of no return. The most advanced climate models predict a 1.4 to 5.8 °C increase in mean global surface temperatures during the 1990-2100 period (IPCC, 2001a). The expected consequences of global warming includes the alteration of the hydrological cycles, the melting of glaciers across the world along with reduction of their total area, the rising of the mean sea levels, and a shifting of the climatic belts. According to the IPCC Fourth Assessment Report (FAR), a 3°C increase has been observed on the surface temperature

of the Permafrost layer since the 1980s. Furthermore, it has been determined that the maximum area covered by seasonally frozen lands and the area covered by sea ice in the Northern Hemisphere has decreased every year since 1900 (IPCC, 2007). Within the context of global warming, it is likely that more floods and hurricanes will occur in certain regions due to the increase in precipitation in certain areas, while more droughts and wild fires will be observed in other areas due to the decrease in precipitation. It is expected that the increased frequency of natural disasters such as droughts and floods will lead to a decrease in agricultural productivity and freshwater sources, and also to depletion or extinction of plant and animal species that are unable to tolerate the radical climatic changes. In parallel to the exceptional increases in temperature worldwide, it is expected that global warming will cause epidemics to become more widespread; adversely affect individuals with cardiovascular, cerebrovascular and respiratory diseases triggered by excessive temperatures as well as the elderly and children (McMichael, Woodruff & Hales, 2006); and result in an overall increase in cases of death. All these predictions indicate that global warming will have direct and dire effects in socio-economical areas, on the existing ecological systems, and on human health (IPCC, 2001b; 2007).

If this world-threatening problem is not prevented, it will lead to irreversible consequences in the future. To avoid this problem, the solutions required must be sought. When the factors that cause an increase in greenhouse gas emissions causing global warming are considered, reducing the use of fossil fuels, using renewable energy sources for energy production, stopping the destruction of green spaces in the world and increasing such spaces promoting the widespread use of environmentally-friendly products, the provision of waste management and the prevention of unplanned urbanization will largely solve the problem.

To eliminate the problem on such global scale is only possible only through the conscious and responsible communities. The societies consisting of conscious individuals can be created through an effective education. If people's behaviours and attitudes are thought to be on the basis of environmental problems that are increasing with each passing day and to threaten the world, it has been seen how important it is for the world and for the living creatures to acquire positive attitudes and behaviours towards individuals to protect environment. To acquire the positive behaviours and attitudes towards the individuals to protect the environment can be provided with an effective environmental education. Through an effective environmental education, to train the individuals who are environmentally-sensitive and who know their responsibilities and who can produce solutions to the problems encountered will contribute to the solution of environmental problems.

Due to the importance of global warming and the greenhouse effect, identifying the level of knowledge and consciousness of individuals on this subject, the misconceptions they might, and their level of awareness regarding potential problems that might be encountered in time is important in terms of creating and implementing solutions for future problems. For this reason, it can be seen in the literature that a number of studies related to global warming and the greenhouse effect have been conducted in order to assess the knowledge, thoughts and misconceptions of individuals from various age groups and educational grades (Boyes, Chuckran & Stannisstreet, 1993; Boyes & Stanisstreet, 1993; Dove, 1996; Rye, Rubba & Wiesenmayer, 1997; Groves & Pugh, 1999; Summers, Kruger & Childs, 2000; Jeffries, Stanisstreet & Boyes, 2001; Summers et al., 2001; Khalid, 2003; Daniel, Stanisstreet & Boyes, 2004; Kılınç, Boyes & Stanisstreet, 2008; Boyes, Skamp & Stanisstreet; 2009; Shepardson et al., 2009; 2011).

In this study, it was aimed to determine the level of perceptions and opinions of pre-service teachers studying in the last year in Elementary Maths, Elementary Science, Primary Teaching, Pre-School and Elementary Social Sciences about greenhouse effect. In accordance with this aim, the sub-questions addressed in our study were as follows:

- Are there any significant differences in the perception levels of pre-service elementary teachers on the greenhouse effect with respect to their branches?
- Are there any significant differences in the perception level of pre-service elementary teachers on the greenhouse effect with respect to their genders?
- What are the opinions of the pre-service elementary teachers regarding the greenhouse effect?

Methodology of Research

The study was carried out at according to a general survey model. The general survey model is a survey approach conducted with the entirety population consisting of a large number of individuals, or a certain group or sample within the population, in order to reach a general conclusion regarding the population in question (Karasar, 2011).

Participants

This study was carried out with 395 volunteered pre-service teachers studying at 4th Grade (ages 21-23 years) in Elementary Maths (N=77), Science (N=96), Social Sciences (N=48), Primary Teaching (N=109), Pre-School Teaching (N=65) in Elementary Department of a Faculty of Education from a state university at the end of the spring semester of 2011 in Turkey. The present study consisted of 255 female and 140 male pre-service elementary teachers.

The study sample is the suitability sample. The suitability sample is defined as the group composed of individuals who could be reached/contacted for the study (Fraenkel & Wallen, 2003). The mentioned sample group was selected for the study based on the ease of application and accessibility. Pre-service teachers other than the Pre-service Elementary Maths Teachers had completed courses regarding environmental problems during their undergraduate education. A statistical comparison was performed between the different departments.

Instruments

The data in the study were collected from the questionnaire consisting of 36 items with Likert Type 5 related to greenhouse effect developed by Boyes and Stainsstreet (1993) and adapted to Turkish by Kılınç, Boyes and Stainsstreet (2008) and the written answers given to an open-ended question. The responses of the pre-service teachers to the questionnaire items in the survey are arranged as "I am sure this is right", "I think this is right", "I have no idea", "I think this is wrong" and "I am sure this is wrong". The questionnaire items used in the study are shown in Table 1.

Table 1. Questionnaire items.

If the greenhouse effect gets bigger…	18. By gas from rotting waste
1. The Earth will get hotter	19. By radioactive waste from nuclear power stations
2. More people will get food poisoning	20. By acid in the rain
3. There will be more flooding	21. By CFC gas from spray cans
4. More fish will get poisoned in the rivers	22. By gas which comes from artificial fertilisers
5. More people will get skin cancer	23. By holes in the ozone layer
6. Some of our tap water will become unsafe to drink	24. Because the Sun's rays cannot escape from the Earth
7. There will be more 'bugs' and 'pests' on crops	**The greenhouse effect can be made smaller…**
8. There will be changes in the world's weather	25. By having more nuclear power stations instead of coal power stations
9. More people will die of heart attacks	26. By eating healthy foods
10. There will be more deserts in the world	29. By reducing the number of nuclear bombs in the world
11. Some of the ice at the North and South Poles will melt	30. By planting more trees in the world
12. There will be more earthquake	31. By making our electricity from wind, waves and tides
The greenhouse effect is made worse…	32. By using recycled paper more
13. By rubbish dumped in rivers and streams	33. By protecting rare plants and animals
14. Because too many of the Sun's rays get to the Earth	34. By not wasting electricity
15. By too much carbon dioxide in the air	35. By reducing starvation in the world
16. By too much ozone near the ground	36. By not using cars so much
17. By too much litter in the streets	

Data Analysis

In the study, the analysis of quantitative data obtained from the questionnaire used was made using the SPSS package program. The data obtained from an open-ended question in the study were assessed using descriptive analysis technique. Descriptive analysis technique enables data to organise according to the themes that the results of the research have revealed and to present considering the questions used or dimensions. In the descriptive analysis, quotation are use directly in order to represent in the viduals' opinion in a striking way (Yıldırım and Şimşek, 2010).

The data were analysed using both parametric and non-parametric tests in the study. In order to determine whether there is a significant difference between the perception levels of the pre-service elementary teachers about greenhouse effect on their departments, a parametric test for no relationship samples, one way analysis of variance, One-Way Anova was used. The pre-service teachers' departments, Tukey test was applied to determine significant difference between the levels of perception related to the greenhouse effect is in favour of which department. Whether there was a meaningful difference among the pre-service teachers' perception levels that they have about the greenhouse effect of their gender were evaluated by means of Mann Whitney U test. The data collected from the responses of the pre-service teachers to the items in the survey were analysed in percent (%) and frequency (f).

Results of Research

The Results of Quantitative Analysis

The frequency (f) and percent (%) distribution of Pre-Service Elementary Maths, Science, Primary Teaching, Pre-School and Elementary Social Sciences Teachers' responses to the 36-item questionnaire used in the study are given in the following according to departments.

The frequency (f) and percent (%) distribution of Pre-Service Elementary Maths, Pre-Service Elementary Science and Social Sciences Teachers' answers to the questionnaire related to greenhouse effect are given in Table 2.

Table 2. The Frequency (f) and Percent (%) Distribution of Pre-Service Elementary Maths, Pre-Service Elementary Science and Social Sciences Teachers' Answers To The Questionnaire Related To Greenhouse Effect.

Item	Department	I am sure this is right		I think this is right		I don't know about this		I think this is wrong		I am sure this is wrong	
		f	%	f	%	f	%	f	%	f	%
1	E.M.	23	29.9	39	50.6	13	16.9	2	2.6	0	0
	E.S.	54	56.3	36	37.5	4	4.2	1	1,0	1	1,0
	S.S.	25	52.1	21	43.8	1	2.1	1	2.1	0	0
2	E.M.	0	0	1	1.3	26	33.8	40	51.9	10	13.0
	E.S.	0	0	2	2.1	27	28.1	48	50.0	19	19.8
	S.S.	1	2.1	1	2.1	8	16.7	26	54.2	13	27.1
3	E.M.	12	15.6	29	37.7	31	40.3	5	6.5	0	0
	E.S.	27	28.1	46	47.9	18	18.8	5	5.2	0	0
	S.S.	11	22.9	22	45.8	13	27.1	1	2.1	1	2.1
4	E.M.	0	0	1	1.3	27	35.1	38	49.4	11	14.3
	E.S.	0	0	2	2.1	20	20.8	50	52.1	24	25.0
	S.S.	1	2.1	0	0	13	27.1	25	52.1	9	18.8

Item	Department	I am sure this is right		I think this is right		I don't know about this		I think this is wrong		I am sure this is wrong	
		f	%	f	%	f	%	f	%	f	%
	E.M.	0	0	2	2.6	16	20.8	39	50.6	20	26.0
5	E.S.	1	1.0	1	1.0	5	5.2	37	38.5	52	54.2
	S.S.	0	0	0	0	12	25.0	19	39.6	17	35.4
	E.M.	0	0	1	1.3	21	27.3	42	54.5	13	16.9
6	E.S.	0	0	4	4.2	10	10.4	45	46.9	37	38.5
	S.S.	0	0	1	2.1	5	10.4	24	50.0	18	37.5
	E.M.	0	0	3	3.9	31	40.3	34	44.2	9	11.7
7	E.S.	1	1.0	12	12.5	27	28.1	37	38.5	19	19.8
	S.S.	0	0	0	0	15	31.3	24	50.0	9	18.8
	E.M.	33	42.9	36	46.8	7	9.1	0	0	1	1.3
8	E.S.	59	61.5	35	36.5	2	2.0	0	0	0	0
	S.S.	18	37.5	26	54.2	4	8.3	0	0	0	0
	E.M.	16	20.8	22	28.6	35	45.5	3	3.9	1	1.3
9	E.S.	26	27.1	41	42.7	25	26.0	4	4.2	0	0
	S.S.	11	22.9	16	33.3	20	41.7	0	0	1	2.1
	E.M.	23	29.9	37	48.1	14	18.2	3	3.9	0	0
10	E.S.	54	56.3	30	31.3	8	8.3	4	4.2	0	0
	S.S.	17	35.4	26	54.2	4	8.3	1	2.1	0	0
	E.M.	29	37.7	31	40.3	16	20.8	1	1.3	0	0
11	E.S.	53	55.2	35	36.5	5	5.2	3	3.1	0	0
	S.S.	20	41.7	21	43.8	6	12.5	1	2.1	0	0
	E.M.	2	2.6	9	11.7	52	67.5	13	16.9	1	1.3
12	E.S.	7	7.3	16	16.7	53	55.2	15	15.6	5	5,2
	S.S.	3	6.3	7	14.6	24	50.0	10	20.8	4	8.3
	E.M.	2	2.6	11	14.3	36	46.8	27	35.1	1	1.3
13	E.S.	7	7.3	31	32.3	14	14.6	34	35.4	10	10.4
	S.S.	5	10.4	11	22.9	17	35.4	13	27.1	2	4.2
	E.M.	9	11.7	24	31.2	24	31.2	19	24.7	1	1.3
14	E.S.	24	25.0	38	39.6	9	9.4	20	20.8	5	5.2
	S.S.	7	14.6	14	29.2	8	16.7	14	29.2	5	10.4
	E.M.	18	23.4	39	50.6	17	22.1	3	3.9	0	0
15	E.S.	39	40.6	47	49.0	7	7.3	3	3.1	0	0
	S.S.	11	22.9	21	43.8	15	31.3	1	2.1	0	0
	E.M.	4	5.2	30	39.0	30	39.0	10	13.0	3	3.9
16	E.S.	21	21.9	36	37.5	15	15.6	17	17.7	7	7.3
	S.S.	10	20.8	19	39.6	15	31.3	3	6.3	1	2.1
	E.M.	5	6.5	31	40.3	26	33.8	12	15.6	3	3.9
17	E.S.	12	12.5	47	49.0	19	19.8	17	17.7	1	1.0
	S.S.	2	4.2	23	47.9	15	31.3	7	14.6	1	2.1

Item	Department	I am sure this is right		I think this is right		I don't know about this		I think this is wrong		I am sure this is wrong	
		f	%	f	%	f	%	f	%	f	%
	E.M.	10	13.0	34	44.2	25	32.5	6	7.8	2	2.6
18	E.S.	15	15.6	50	52.1	19	19.8	11	11.5	1	1.0
	S.S.	4	8.3	20	41.7	18	37.5	5	10.4	1	2.1
	E.M.	4	5.2	7	9.1	25	32.5	34	44.2	7	9.1
19	E.S.	0	0	19	19.8	20	20.8	38	39.6	19	19.8
	S.S.	1	2.1	5	10.4	14	29.2	24	50.0	4	8.3
	E.M.	4	5,2	9	11.7	26	33.8	28	36.4	10	13.0
20	E.S.	5	5.2	25	26.0	17	17.7	37	38.5	12	12.5
	S.S.	2	4.2	10	20.8	15	31.3	17	35.4	4	8.3
	E.M.	21	27.3	42	54.5	12	15.6	1	1.3	1	1.3
21	E.S.	42	43.8	49	51.0	3	3.1	2	2.1	0	0
	S.S.	7	14.6	23	47.9	15	31.3	1	2.1	2	4.2
	E.M.	4	5.2	30	39.0	40	51.9	3	3.9	0	0
22	E.S.	26	27.1	44	45.8	24	25.0	2	2.1	0	0
	S.S.	6	12.5	24	50.0	12	25.0	4	8.3	2	4.2
	E.M.	17	22.1	28	36.4	21	27.3	8	10.4	3	3.9
23	E.S.	18	18.8	39	40.6	16	16.7	19	19.8	4	4.2
	S.S.	10	20.8	20	41.7	10	20.8	7	14.6	1	2.1
	E.M.	12	15.6	27	35.1	31	40.3	6	7.8	1	1.3
24	E.S.	48	50.0	24	25.0	13	13.5	8	8.3	3	3.1
	S.S.	13	27.1	14	29.2	16	33.3	5	10.4	0	0
	E.M.	7	9.1	18	23.4	27	35.1	17	22.1	8	10.4
25	E.S.	6	6.3	29	30.2	13	13.5	32	33.3	16	16.7
	S.S.	5	10.4	12	25.0	16	33.3	13	27.1	2	4.2
	E.M.	3	3.9	16	20.8	23	29.9	22	28.6	13	16.9
26	E.S.	5	5.2	22	22.9	32	33.3	24	25.0	13	13.5
	S.S.	3	6.4	3	6.4	12	25.5	22	46.8	7	14.9
	E.M.	2	2.6	8	10.4	21	27.3	33	42.9	13	16.9
27	E.S.	1	1.0	14	14.6	13	13.5	50	52.1	18	18.8
	S.S.	3	6.3	8	16.7	9	18.8	24	50.0	4	8.3
	E.M.	2	2.6	2	2.6	29	37.7	28	36.4	16	20.8
28	E.S.	0	0	4	4.2	17	17.7	50	52.1	25	26.0
	S.S.	0	0	6	12.5	10	20.8	26	54.2	6	12.5
	E.M.	4	5.2	2	2.6	15	19.5	32	41.6	24	31.2
29	E.S.	1	1.0	5	5.2	19	19.8	30	31.3	41	42.7
	S.S.	0	0	5	10.4	7	14.6	27	56.3	9	18.8
	E.M.	38	49.4	33	42.9	5	6.5	1	1.3	0	0
30	E.S.	62	64.6	29	30.2	3	3.1	2	2.1	0	0
	S.S.	17	35.4	26	54.2	3	6.3	2	4.2	0	0

Item	Department	I am sure this is right		I think this is right		I don't know about this		I think this is wrong		I am sure this is wrong	
		f	%	f	%	f	%	f	%	f	%
31	E.M.	24	31.2	26	33.8	23	29.9	3	3.9	1	1.3
	E.S.	55	57.3	30	31.3	9	9.4	2	2.1	0	0
	S.S.	15	31.3	20	41.7	8	16.7	4	8.3	1	2.1
32	E.M.	33	42.9	33	42.9	9	11.7	1	1.3	1	1.3
	E.S.	51	53.1	28	29.2	11	11.5	6	6.3	0	0
	S.S.	16	33.3	20	41.7	10	20.8	2	4.2	0	0
33	E.M.	5	6.5	4	5.2	27	35.1	21	27.3	20	26.0
	E.S.	2	2.1	11	11.5	24	25.0	34	35.4	25	26.0
	S.S.	1	2.1	5	10.4	11	22.9	17	35.4	14	29.2
34	E.M.	9	11.7	8	10.4	32	41.6	19	24.7	9	11.7
	E.S.	6	6.3	10	10.4	27	28.1	40	41.7	13	13.5
	S.S.	6	12.5	9	18.8	17	35.4	12	25.0	4	8.3
35	E.M.	9	11.7	17	22.1	33	42.9	12	15.6	6	7.8
	E.S.	7	7.3	25	26.0	35	36.5	18	18.8	11	11.5
	S.S.	3	6.3	15	31.3	13	27.1	12	25.0	5	10.4
36	E.M.	24	31.2	33	42.9	15	19.5	4	5.2	1	1.3
	E.S.	48	50.0	34	35.4	8	8.3	4	4.2	2	2.1
	S.S.	13	27.1	18	37.5	11	22.9	4	8.3	2	4.2

When Table 2 is examined, the Pre-Service Elementary Maths Teachers have expressed that as a result of the greenhouse effect, the world will get hotter (80.5%), the world's air will begin to change (89.7%), the rate of desertification will increase (78.0%), a portion of the polar glaciers melt (78.0%), many more people will lose their lives as a result of heart attack (49.4%). They have expressed the items which reported that most people will live the problem of food poisoning as a result of the greenhouse effect (64.9%), the majority of fish will get poisoned (63.7%), more and more people will die from skin cancer (76.6%), drinking water will get dirty (71.4%) and pesticides on crops will increase (55.9%) are incorrect. The Pre-Service Elementary Maths Teachers have expressed that they have no idea about the items that reported as a result of greenhouse effect there will be more floodings (40.3%) and more and more earthquakes (67.5%). The Pre-Service Elementary Maths Teachers have expressed that the sources of the greenhouse effect are excess CO_2 gas in the air (74.0%), rubbish in cities (46.8%), gases from rotting waste (57.2%), CFC gases from spray cans (81.8%), the holes in the ozone layer (36.4%), the accumulation of excess ozone on the earth's surface (44.2%), sun rays reaching the earth (42.9%), rays reflected from the earth's surface but not spreading into space (50.7%). The Pre-Service Elementary Maths Teachers have expressed that they have no idea about whether waste dumped in rivers and streams (46.8%) and gases which come from artificial fertilizers (51.9%) are the sources of the greenhouse effect or not. They have expressed that radioactive waste produced by nuclear power stations and acid rain are not the source of the greenhouse effect. The Pre-Service Elementary Maths Teachers think that increasing the proportion of green space in the world (92.3%), providing electrical energy by natural ways such as tides, currents and wind (65.0%) , using recycled papers (85.8%) and using cars for reduction in transport rate (74.1%) are true to prevent or reduce the impact of the greenhouse effect. The Pre-Service Teachers have expressed that they have no idea about whether establishing nuclear power stations instead of coal power stations (35.1%), not using electrical energy (41.6%) and reducing hunger in the world (42.9%) prevent greenhouse effect or not. Also, the Pre-Service Teachers have stated the items which reported that keeping beaches clean (59.8%), protecting rare plants and animals (53.3%), eating healthy foods

(45.5%), using unleaded petrol (57.2%), reducing the number of nuclear bombs in the world (72.8%) to reduce the greenhouse effect are incorrect.

When the Table 2 is examined, the Pre-Service Science Teachers have stated that as a result of the greenhouse effect, the earth will get hotter (93.8%), the world's air will begin to change (98.0%), the rate of desertification will increase (87.6%), a portion of the polar glaciers in the Poles will melt (91.7%), there will be more floodings (76.0%), too many people will die of a heart attack (69.8%), most of the people will suffer from skin cancer (92.7%) and food poisoning (69.8%), most of the fish will get poisoned (77.1%), drinking water will get dirty (85.4%) and pesticides on crops will increase (58.3%). Also, Pre-Service Teachers expressed that they have no idea about the item is that there will be more earthquakes because of the greenhouse effect. The Pre-Service Science teachers have stated that they see sun rays reaching the earth (64.6%), excess CO_2 gas in the air (89.6%), the accumulation of excess ozone on the earth's surface (59.4%), rubbish in cities (61.5%), gases from rotting waste (67.7%), CFC gases from spray cans (94.8%), gases produced by artificial fertilizers (72.9%), holes in the ozone layer (59.4%) and the rays reflected from the earth's surface but not spreading into space (75.0%) as a source of greenhouse effect. The Pre-Service Teachers think that greenhouse effect is not the source of radioactive waste produced by nuclear power stations (59.4%), waste dumped in rivers and streams (45.8%) and acid rain (51.0%). The Pre-Service Science Teachers think that increasing the proportion of green space in the world (94.8%), providing electrical energy by natural ways such as tides, currents and wind (88.6%), using recycled papers (82.3%) and using cars for reduction in transport rate (74.1%) will prevent the greenhouse effect. Also, they have stated that establishing nuclear power stations instead of coal power stations (46.8%), protecting rare plants and animals (61.4%), not using electrical energy (55.2%), keeping beaches clean (70.9%), using unleaded petrol (78.0%), eating healthy foods (38.5%), reducing the number of nuclear bombs in the world (74.0%) won't prevent the greenhouse effect. The Pre-Service Teachers have stated that they have no idea about if the greenhouse effect reduce hunger in the world (36.5%) or not.

When Table 2 is examined, the Pre-School Social Sciences Teachers have stated that the earth will get hotter (95.9%), the world's air will begin to change (91.7%), the rate of desertification will increase (89.6%), there will be more floodings (68.7%), a portion of the polar glaciers in the Poles will melt (85.5%) and many people will die of heart attacks (56.2%) as a result of the greenhouse effect. They did not express any idea about that there will be more earthquakes due to the increasing the greenhouse effect. Furthermore, the Pre-Service Teachers think that the items reported that most of the people will live food poisoning problem (81.3%), most of the fish will get poisoned (70.9%), drinking water will get dirty (87.5%), more people will suffer from skin cancer (75.0%) and pesticides on crops will increase (68.8%) as a result of the greenhouse effect are incorrect. The Pre-Service Social Sciences Teachers have expressed that excess CO_2 gas in the air (66.7%), the accumulation of excess ozone on the earth's surface (60.4%), rubbish in cities (52.1%), gases from rotting waste (50.0%), CFC gases from spray cans (62.5%), gases from artificial fertilizers (62.5%), sun rays reaching the earth (43.8%), rays reflecting from earth's surface but not spreading into space (56.3%) and holes in the ozone layer (62.5%) cause the greenhouse effect. They have stated that they have no idea about whether waste dumped in rivers and streams (35.4%) is the source of the greenhouse effect or not. They have thought that radioactive waste produced by nuclear power stations (58.3%) and acid rain (43.7%) are not the source of the greenhouse effect. The Pre-Service Social Sciences Teachers have stated that to prevent or reduce the impact of the greenhouse effect, increasing the proportion of green space in the world (89.6%), providing electrical energy from natural ways such as tide, currents and wind (73.0%), establishing nuclear power stations instead of coal power stations (35.4%), using recycled papers (75.0%), reducing hunger in the world (37.6%) and reducing the rate of transportation using cars (64.6%) is correct. The Pre-Service Teachers have expressed that they have no idea about if the use of electrical energy (35.4%) can reduce the greenhouse effect or not. In addition, they stated that the items reported that eating healthy foods (61.7%), keeping beaches clean (58.3%), the use of unleaded petrol (66.7%), reducing the number of nuclear bombs in the world (75.1%), and the protection of rare plants and animals (64.6%) are incorrect.

The frequency (f) and percent (%) distribution of the Primary Teaching and Pre-Service Pre-School Teachers' answers to the questionnaire related to greenhouse effect are given in Table 3.

Table 3. The Frequency (f) and Percent (%) Distribution of Primary Teaching and Pre-Service Pre-School Teachers' Answers To The Questionnaire Related To Greenhouse Effect.

Item	Department	I am sure this is right		I think this is right		I don't know about this		I think this is wrong		I am sure this is wrong	
		f	%	f	%	f	%	f	%	f	%
1	P.T.	35	32.1	51	46.8	23	21.1	0	0	0	0
	P.S.	23	35.4	21	32.3	17	26.2	3	4.6	1	1.5
2	P.T.	0	0	4	3.7	46	42.2	41	37.6	18	16.5
	P.S.	1	1.5	4	6.2	27	41.5	23	35.4	10	15.4
3	P.T.	14	12.8	43	39.4	44	40.4	6	5.5	2	1.8
	P.S.	11	16.9	24	36.9	26	40.0	3	4.6	1	1.5
4	P.T.	0	0	2	1.8	38	34.9	52	47.7	17	15.6
	P.S.	1	1.5	1	1.5	30	46.2	22	33.8	11	16.9
5	P.T.	0	0	2	1.8	26	23.9	52	47.7	29	26.6
	P.S.	1	1,5	1	1.5	21	32.3	26	40.0	16	24.6
6	P.T.	3	2.8	1	.9	25	22.9	57	52.3	23	21.1
	P.S.	1	1.5	2	3.1	21	32.3	26	40.0	15	23.1
7	P.T.	0	0	3	2.8	42	38.5	50	45.9	14	12.8
	P.S.	0	0	3	4.6	26	40.0	32	49.2	4	6.2
8	P.T.	44	40.4	52	47.7	11	10.1	1	0.9	1	0.9
	P.S.	23	35.4	32	49.2	9	13.8	1	1.5	0	0
9	P.T.	19	17.4	39	35.8	47	43.1	4	3.7	0	0
	P.S.	5	7.7	12	18.5	46	70.8	1	1.5	1	1.5
10	P.T.	29	26.6	61	56.0	17	15.6	1	0.9	1	0.9
	P.S.	25	38.5	26	40.0	13	20.0	1	1.5	0	0
11	P.T.	36	33.0	55	50.5	16	14.7	1	0.9	1	0.9
	P.S.	26	40.0	24	36.9	14	21,5	1	1.5	0	0
12	P.T.	2	1.8	23	21.1	65	59.6	17	15.6	2	1.8
	P.S.	3	4.6	7	10.8	36	55.4	14	21.5	5	7.7
13	P.T.	5	4.6	15	13.8	56	51.4	28	25.7	5	4.6
	P.S.	2	3.1	11	16.9	34	52.3	16	24.6	2	3.1
14	P.T.	14	12.8	33	30.3	40	36.7	17	15.6	5	4.6
	P.S.	8	12.3	23	35.4	25	38.5	8	12.3	1	1.5
15	P.T.	19	17.4	43	39.4	39	35.8	6	5.5	2	1.8
	P.S.	9	13.8	22	33.8	29	44.6	5	7.7	0	0
16	P.T.	13	11.9	46	42.2	42	38.5	4	3.7	4	3.7
	P.S.	6	9.2	22	33.8	30	46.2	7	10.8	0	0
17	P.T.	6	5.5	26	23.9	60	55.0	14	12.8	3	2.8
	P.S.	6	9.2	14	21.5	32	49.2	12	18.5	1	1.5
18	P.T.	10	9.2	37	33.9	53	48.6	7	6.4	2	1.8
	P.S.	8	12.3	11	16.9	34	52.3	10	15.4	2	3.1

19	P.T.	1	0.9	6	5.5	44	40.4	38	34.9	20	18.3
	P.S.	1	1.5	3	4.6	34	52.3	18	27.7	9	13.8
20	P.T.	4	3.7	15	13.8	44	40.4	37	33.9	9	8.3
	P.S.	1	1.5	9	13.8	33	50.8	15	23.1	7	10.8
21	P.T.	18	16.5	52	47.7	33	30.3	5	4.6	1	0.9
	P.S.	14	21.5	23	35.4	26	40.0	2	3.1	0	0
22	P.T.	16	14.7	46	42.2	42	38.5	5	4.6	0	0
	P.S.	10	15.4	24	36.9	25	38.5	4	6.2	2	3.1
23	P.T.	15	13.8	46	42.2	36	33.0	6	5.5	6	5.5
	P.S.	14	21.5	24	36.9	19	29.2	8	12.3	0	0
24	P.T.	13	11.9	36	33.0	49	45.0	6	5.5	5	4.6
	P.S.	6	9.2	23	35.4	33	50.8	3	4.6	0	0
25	P.T.	12	11.0	22	20.2	36	33.0	22	20.2	17	15.6
	P.S.	4	6.2	10	15.4	38	58.5	9	13.8	4	6.2
26	P.T.	4	3.7	18	16.5	35	32.1	38	34.9	14	12.8
	P.S.	1	1.5	11	16.9	22	33.8	17	26.2	14	21.5
27	P.T.	2	1.8	8	7.3	34	31.2	47	43.1	18	16.5
	P.S.	0	0	3	4.6	23	35.4	23	35.4	16	24.6
28	P.T.	1	0.9	7	6.4	39	35.8	42	38.5	20	18.3
	P.S.	0	0	0	0	27	41.5	24	36.9	14	21.5
29	P.T.	1	0.9	5	4.6	33	30.3	37	33.9	33	30.3
	P.S.	1	1.5	2	3.1	24	36.9	18	27.7	20	30.8
30	P.T.	44	40.4	46	42.2	18	16.5	0	0	1	0.9
	P.S.	26	40.0	25	38.5	14	21.5	0	0	0	0
31	P.T.	32	29.4	35	32.1	37	33.9	5	4.6	0	0
	P.S.	25	38.5	18	27.7	21	32.3	1	1.5	0	0
32	P.T.	34	31.2	42	38.5	29	26.6	3	2.8	1	0.9
	P.S.	25	38.5	20	30.8	20	30.8	0	0	0	0
33	P.T.	2	1.8	8	7.3	35	32.1	40	36.7	24	22.0
	P.S.	0	0	1	1.5	23	35.4	21	32.3	20	30.8
34	P.T.	7	6.4	18	16.5	51	46.8	25	22.9	8	7.3
	P.S.	3	4.6	4	6.2	42	64.6	13	20.0	3	4.6
35	P.T.	7	6.4	25	22.9	52	47.7	19	17.4	6	5.5
	P.S.	2	3.1	11	16.9	39	60.0	9	13.8	4	6.2
36	P.T.	29	26.6	49	45.0	25	22.9	5	4.6	1	0.9
	P.S.	14	21.5	24	36.9	25	38.5	2	3.1	0	0

When Table 3 is examined, the Pre-Service Primary Teaching Teachers have stated the items which reported that the earth will get hotter (78.9%), a portion of the polar glaciers in the Poles will melt (83.5%), the world's air will begin to change (88.1%), there will be more floodings (52.2%), the rate of desertification will increase (82.6%) are true as a result of greenhouse effect. Moreover, the Pre-Service Primary Teaching Teachers have stated they have no idea the items reported that too many people will lose their lives because of heart attack (53.2%) and there will be more earthquakes (59.6%). The Pre-Service Primary Teaching Teachers think that the items reported that most of the people will live food poisoning problem (54.1%), more and more people will suffer from skin cancer

(74.3%), most of the fish will get poisoned (63.3%), drinking water will get dirty (73.4%) and pesticides on crops will increase (58.7%) are incorrect. The Pre-Service Primary Teaching Teachers think that the items reported that excess CO_2 gas in the air (56.8%), the accumulation of excess ozone on the earth's surface (54.1%), CFC gases from spray cans (64.2%), gases from artificial fertilizers (56.9%) and holes in the ozone layer (56.0%) cause greenhouse effect are correct. Besides, they have stated that they have no idea about whether waste dumped in rivers and streams (51.4%), sun rays reaching the earth (43.1%), rubbish in cities (55.0%), gases from rotting waste (48.6%) and rays reflecting from the earth but not spreading into space (45.0%) are the sources of the greenhouse effect or not. The Pre-Service Teachers have stated that radioactive waste produced by nuclear power stations (53.2%) and acid rain (42.2%) are not the sources of the greenhouse effect. The Pre-Service Primary Teaching Teachers have expressed that increasing the proportion of green space in the world (82.6%), using recyled paper (69.7%), providing electrical energy by natural ways such as tides, currents and wind (61.5%) and using cars for reduction in transport rate (71.6%) are true to prevent the greenhouse effect or reduce its impact. The Pre-Service Teachers have expressed that they have no idea about if reducing hunger in the world (47.7%) and not using electrical energy (69.7%) reduce the greenhouse effect or not. They think that the items reported that eating healthy food (47.7%), establishing nuclear power stations instead of coal power stations (35.8%), protecting rare plants and animals (58.7%), keeping beaches clean (59.6%), using unleaded petrol (56.8%), reducing the number of nuclear bombs in the world (64.2%) will prevent greenhouse effect are wrong.

When Table 3 is examined, the Pre-Service Pre-School Teachers have stated the items reported that the earth will get hotter (67.7%), a portion of the polar glaciers in the Poles will melt (76.9%), the world's air will begin to change (84.6%), there will be more floodings (52.2%) ,the rate of desertification will increase (82.6%) are true as a result of the greenhouse effect. They think that the items reported that most of the people will live food poisoning problem (50.8%), most of the fish will get poisoned (50.7%), more and more people will suffer from skin cancer (64.6%), drinking water will get dirty (63.1%) and pesticides on crops will increase (55.4%) are wrong. The Pre-Service Teachers have stated that they have no idea about the items reported that more and more people will die of heart attacks (70.8%) and there will be too many earthquakes (55.4%). The Pre-Service Pre-School Teachers think that holes in the ozone layer (58.4%), CFC gases from spray cans (56.9%), gases from artificial fertilizers (52.3%), excess CO_2 gas in the air (47.6%) and sun rays reaching the earth (47.7%) cause greenhouse effect. They have stated that they have no idea about whether waste dumped in rivers and streams (52.3%), the accumulation of excess ozone on the earth's surface (46.2%) rubbish in cities (49.2%), gases from rotting waste (52.3%), acid rain (50.8%) and rays reflecting from earth's surface but not spreading into space (50.8%) are the sources of greenhouse effect or not. They have explained that radioactive waste produced by nuclear power stations (52.3%) is not the source of the greenhouse effect. The Pre-Service Pre-School Teachers think that increasing the proportion of green space in the world (78.5%), providing electrical energy by natural ways such as tides, currents and wind (66.2%), using recycled papers (69.3%) and using cars for reduction in transport rate (58.4%) are true statements in preventing the greenhouse effect and reducing its impact. The Pre-Service Teachers have stated they do not have any idea about if establishing nuclear power stations instead of coal power stations (58.5%), using unleaded petrol (58.4%), reducing the number of nuclear bombs in the world (58.5%), protecting rare plants and animals (63.1%), not using electrical energy (64.6%) reduce greenhouse effect or not. Also, they think that the items reported that eating healthy food (47.7%), keeping beaches clean (60.0%) and reducing hunger in the world (60.0%) are incorrect.

According to the results of the Kolmogorov-Smirnov and Shapiro-Wilk, as the pre-service teachers' questionnaire results related to the greenhouse effect show a normal distribution, according to departments, to determine whether there is a significant difference between the pre-service elementary teachers' levels of perceptions about the greenhouse effect, the single-factor variance analysis was used for unrelated samples (One-Way Anova) which is a parametric test was used and the results are given in Table 4.

Table 4. One-Way Anova Results of The Pre-Service Teachers' Questionnaire Points Related to The Greenhouse Effect According to Departments.

Variance Source	Squares Total	Sd	Squares Avarage	F	p
Among groups	1444.106	4	361.027	8.355	0.000
In groups	16851.524	390	43.209		
Total	18295.630	394			

When Table 4 is examined, a significant difference between the pre-service teachers' levels of perception about the greenhouse effect has been observed ($F_{(4.390)} = 8.355$; $p < 0.05$). According to the departments of pre-service teachers, Tukey test was applied to determine significant difference between the levels of perception related to the greenhouse effect is in favour of which depatment and the results are given in Table 5.

Table 5. The Tukey Test Results of the Pre-Service Teachers' Perception Level Related to Greenhouse Effect According to Their Departments.

Departments	E.M.	E.S.	P.T.	P.S.	S.S.
E.M.	-				
E.S.	0.010*	-			
P.T.	0.689	0.000*	-		
P.S.	0.452	0.000*	0.981	-	
S.S.	0.999	0.018*	0.911	0.725	-

**p< 0.05*

When Table 5 is examined, a significant difference between the pre-service elementary teachers' perception levels related to the greenhouse effect was found in favour of Science Education ($p < 0.05$). According to the results of the Kolmogorov-Smirnov, as the results of the questionnaire scores related to the greenhouse effect that the pre-service teachers got do not show a normal distribution, in order to determine whether the pre-service teachers' perception levels that they have about the greenhouse effect in terms of gender have a significant difference, Mann-Whitney U testing was performed for non-parametric unrelated samples and the results are given in Table 6. Table 6 the Mann-Whitney U Test Results of the pre-service teachers' qestionnaire scores related to the greenhouse effect according to gender.

Table 6. Mann Whitney U Test Results of the Pre-Service Teachers' Qestionnaire Scores Related to Greenhouse Effect According to Gender.

Gender	N	Mean Rank	Sum of Ranks	U	p
Female	255	192.69	49136.00	16496.000	0.212
Male	140	207.67	29074.00		

When Table 6 is examined, the pre-service elementary teachers' perception levels related to greenhouse effect according to gender do not show a significant difference ($U= 16496.000$; $p= 0.212 > 0.05$).

The Results of Qualitative Analysis

In the research, "*Please write your comments about the greenhouse effect*" the pre-service teachers were asked. The analysis results of the responses of the pre-service elementary teachers who answered the question according to departments are given below.

When the Pre-Service Elementary Maths Teachers' opinions about the greenhouse effect are examined, 33 pre-service teachers reported that the greenhouse effect is formed by greenhouse gases, especially CO_2. As 20 pre-service teachers were mentioning about the temperature increase in the world, they described the greenhouse effect as the warming of the world. 2 pre-service teachers defined the greenhouse effect as climate change. 15 pre-service teachers explained the greenhouse effect as a situation which is caused by ozone layer problem and acid rain. 1 pre-service teacher expressed greenhouse effect as a situation which occurs as a result of the global warming. Examples related to the Pre-Service Elementary Maths Teachers' views about the greenhouse effect are given below:

"It is a station that affects the natural life in a negative way as a result the form of precipitation called acid rain."
"The rate of CO_2 in the world above the standards and the sun's rays don't return back, the atmosphere get warm."
"The warmig of the ozone layer. The disappearance of the seasons's characteristic."
"Due to the ozone layer depletion, harmful sun's rays reach the earth and give harm."
"It is an effect caused by global warming."

When the Pre-Service Science Teachers' views on the greenhouse effect are examined, 41 pre-service teachers explained the greenhouse effect as the warming of the world. 53 pre-service teachers explained this situaiton caused by the impact of greenhouse gases, 34 pre-service teachers explained the greenhouse effect as the fact that the sun's rays reflected from the earth do not leave from the atmosphere. 5 pre-service teachers defined the greenhouse effect as a situation that increases with global warming. 4 pre-service teachers expressed the greenhouse effect establishing relations with ozone layer problem, 3 pre-service teachers explained it with acid rain. Some examples related to the Pre-Service Science Teachers' views about the greenhouse effect are given below:

"As the greenhouse gasses increase in the atmosphere, they act as layer in the atmosphere and they don't send the sun's rays coming to earth back and keep them in the world, so they cause the world to get warmer."
"The greenhouse effect is an effect formed by some gasses accumulatede in the atmosphere defined as greenhouse gasses. So, these gasses send the sun's rays toearth, the they don't send the rays reflecting from the earth back and it causes temperature rise."
"The weather will be warmer than usual."
"Harmful gasses such as CO_2 and CFC give harm to the ozone layer and so the sun's rays reach the earth more than usual."
"It is accumulation of some gasses in the nature. It gets fast due to global warming."
"The greenhouse effect means acid rain. It is colled acid rain consisting of some gasses combination in the atmosphere as a result of global warming."

When the Pre-Service Primary Teaching Teachers' views on the greenhouse effect are examined, 19 pre-service teachers stated that the greenhouse effect is a situation that occurs due to greenhouse gases. 22 pre-service teachers mentioned about temperature increase in the world and they defined this situation as the warming of the world. 7 pre-service teachers associated the greenhouse effect with climate change. 19 pre-service teachers identified the greenhouse effect as the fact that the earth will get hotter with more sunlight coming to earth as a result of ozone layer problem. 1 pre-service teacher announced the greenhouse effect as a condition caused by environmental pollution. 5 pre-service teachers associated the greenhouse effect with global warming. Some examples related to the Pre-Service Primary Teaching Teachers' views about the greenhouse effect are given below:

"Due to the greenhouse effect, glacier in the world melt and gasses accumulated in the atmosphere cause the overheating of the world."
"The gasses acumulated in the atmosphere cause the overheating of the world. The greenhouse gasses accumulate in the lower layer of the atmosphere. Greenhouse gas is a kind of gas layer consisting of gasses by the fossil fuels, the use of chemicals or factory waste such as SO_2."
"As a result of the emission of CO_2, weather condidations will change in a negative way and will be climate changes."
"Due to the emission of CO_2, global warming will increase."
"As a result of ozone layer depletion, the world will get hotter. The sun's rays reach the earth directly."
"Gasses caused by the burning of the fossil fuels emitted into the atmosphere won't let the sun's rays reflecting from the earth escape."

When the Pre-Service Pre-School Teachers' opinions about the greenhouse effect are examined, 8 pre-service teachers explained the greenhouse effect as the warming of the world, 9 pre-service teachers explained this situation caused by the effect of greenhouse gases while 3 pre-service teachers associated with climate change, 3 pre-service teachers associated with global warming while 1 pre-service teacher defined the greenhouse effect as a harmful gas for ozone layer, 1 pre-service teacher explained it as a situation formed by acid rain. While 1 pre-service teacher stated the greenhouse effect as a harmful thing that affects sun's rays,1 pre-service teacher explained only as a harmful event. In addition, 1 pre-service teacher stated that the greenhouse effect as greenhouses used in agriculture. Some examples of the Pre-Service Pre-school Teachers' views about the greenhouse effect are given below:

"Formation of acid rain caused by harmful gasses."
"The greenhouse effect is a harmful gas for the ozone layer and I know this gas is in factory waste, cosmetic products and etc. Due to this gas that has a negative impact, to prevent the sun ray's harmful effects of the ozone layer becomes difficult."
"To see the effects of that season in the region out of season, the changing of the seasons. The ripening of crops early."
"It causes accumulation of harmful gases in the atmosphere and overheating of the world."
"Because of the global warming, the warming of the world, the melting of glacier, the increasing the rate of CO2 in the air."
"I think it has a harmful effect to the sun rays."
"It is an event that the sun rays coming to the earth are kept by CO accumulated in the atmosphere. So, the world will get hotter."
"The greenhouse effect is to make a lot of food and vegetables grow in artificial places. It is to consum unhealty food."
"I know the greenhouse is harmful I remember so."

When the Pre-Service Social Sciences Teachers' views on the greenhouse effect are examined, 22 pre-service teachers stated the greenhouse effect as a situation formed by the effect of this gas, especially CO_2. By mentioning about temperature increase in the world,16 pre-service teachers described this situation as the warming of the world. 10 pre-service teachers explained the greenhouse effect as the fact that the sun's rays reflected from the earth do not leave from the atmosphere. 7 pre-service teachers described the greenhouse effect as a situation that happens as a result of the ozone layer problem. 1 pre-service teacher explained the greenhouse effect by establishing a relationship with climate change. Some examples of the Pre-Service Social Science Teachers' views about the greenhouse effect are given below:

"The greenhouse effect is called as the warming of the world due to the sun's rays that warm the earth passing through the atmosphere after hitting the earth and then returning back into the space as a result of blocking the output of various gasses from the atmosphere."
"Because of the emission of the gasses caused by fossil fuels, the accumulation of gasses such as methane,

the world will get hatter."
"Harmful sun rays will such the earth as a result of ozone layer depletion and the temperature in the world will increase."
"Due to the greenhouse effect, the world will get hotter and get cold less. This situtation will cause climate changes."

Discussion

As a result of this study, it has been concluded that the pre-service elementary teachers have the perception to be able to establish relationship between natural disasters and the greenhouse effect and distinguish between the results of water and soil pollution and the results of the ozone layer issue from the consequences of the greenhouse effect. According to the results of the study, the Pre-Service Elementary Social Sciences Teachers have expressed that they have no idea about the fact that fish will get poisioned because of the increase in the greenhouse effect and both the Pre-Service Social Sciences and the Primary Teaching Teachers do not have any idea about the fact that people will suffer from food poisining. This may be caused by the fact that either they do not have enough perception on this issue or they are not sure about the correctness of the answers they will give.

In addition, the fact that teachers do not specify any idea about the increase in death rate from heart attacks because of the increase in the greenhouse effect has shown that the Pre-Service Elementary Maths and Pre-School Teachers do not have any perception to be able to establish relationship between some health problems and the greenhouse effect. In this study, it has been seen that the majority of the Pre-Service Elementary Teachers established correct relationship between increase in temperature as a result of the greenhouse effect and possible weather events and some natural disasters depending on climate change. The Pre-Service Teachers' perceptions about the fact that there will be both desertification and floods because of the greenhouse effect have shown that they are able to do the separation that some regions will receive more precipitation and some will receive less precipitation according to today's rainfall patterns. In the study carried out by Boyes and Stanisstreet (1992), the fact that almost all of the undergraduate students think there will be increase in flooding because of the increase in the greenhouse effect supports the results of our study.

One of the most striking results of the study was that a large majority of the pre-service teachers in all departments did not express any idea about the item and they stated that there would be more earthquakes because of the increase in the greenhouse effect. This case has shown that the Pre-School Elementary Teachers do not have any perception about whether there is a relationship between earthquakes and the greenhouse effect. In the study conducted by Çelikler and Kara (2011) with the Pre-Service Chemistry and Biology Teachers, the similar results obtained supports the results of the research.

In the study, it has been seen that the pre-service elementary teachers are aware of CFC gases in greenhouse gases which cause the greenhouse effect and have the correct perception about the fact that they are used in aerosols. One of the remarkable results of the study is that the vast majority of the pre-service elementary teachers have stated that radioactive waste produced by nuclear power stations is not the source of the greenhouse effect and can do the separation of elements that cause global warming and radioactive pollution. In addition, the vast majority of the pre-service elementary teachers think that the sun's rays that reach the earth and ozone layer holes cause the greenhouse effect. With the study they made, Summers et al. (2001) expressed that the majority of the pre-service teachers and teachers have a dominant idea that the depletion of the ozone layer will cause global warming. In the study Selvi (2007) made with the Pre-Service Biology Teachers, she has expressed that almost all the teachers have a common idea that holes in the ozone layer cause much more heat reaching the earth from the sun. In the study by Boyes and Stanisstreet (1997) made with their students aged around 13-14 years, reaching similar conclusions supports the results of our study.

In the research, it was seen that only the Pre-Service Elementary Science Teachers among the pre-service teachers established a relationship between the greenhouse effect and waste dumped in the river and the sea. It has showed that the Pre-Service Elementary Maths, Science, Primary Teaching and Social Sciences Teachers' perceptions that CO_2 gas in the air and the increase in the accumulation of

ozone will cause the greenhouse effect and they are aware that CO_2 and ozone is a greenhouse gas and the increase in atmospheric concentrations increase the greenhouse effect. In addition, the Pre-Service Elementary Maths, Science, Primary Teaching and Social Sciences Teachers' perceptions that acid rain will not cause the greenhouse effect shows that they can separate environmental problems and their causes and consequences from each other. The striking result here is that the Pre-Service Pre-School Teachers do not have any idea about whether increase in ozone accumulation, CO_2 in the atmosphere and acid rain cause the greenhouse effect. This result shows that the Pre-Service Pre-School Teachers do not have adequate perception about greenhouse gases and some environmental problems. It is understood that all the Pre-Service Elementary Teachers, except the Pre-Service Maths Teachers are aware that gases caused by artificial fertilizers (nitrogen oxides) are a greenhouse gas and the Pre-Service Elementary Maths, Science, and Social Sciences Teachers are aware that gases caused by decayed waste are also a a greenhouse gas. In this study, it has been seen that the Pre-Service Elementary Teachers have different perceptions about the fact that urban waste is the source of the greenhouse effect. While the Pre-Service Elementary Science and Social Sciences Teachers did not see urban waste as a source of greenhouse effect, the Pre-Service Elementary Maths Teachers reported the opposite. The Pre-Service Primary Teaching and Pre-School Teachers' refraining from mentioning about some greenhouse gases, their sources and the mechanism of the greenhouse effect can be caused by the fact that they do not have enough perception or they are not sure of the ideas they have. These results show that although the Pre-Service Elementary Maths, Science and Social Sciences Teachers have some lack of perception, they are aware of the factors behind the greenhouse effect.

It has been seen that a large part of the pre-service elementary teachers are aware of the importance of reducing the greenhouse effect due to the use of renewable energy sources, the use of recycled products, green areas and greenhouse emission caused by transportation. It has been understood that only the Pre-Service Science Teachers among the pre-service elementary teachers have a perception that reducing the use of electrical energy will diminish the greenhouse effect. This shows that the pre-service teachers in other departments have an incomplete perception about the relationship between the use of electrical energy and the greenhouse effect as they do not express an opinion on this issue. In the study made by Boyes and Stanisstreet (1992), and in the study made by Kılınç, Boyes and Stanisstreet (2008), to reach the conclusion that the majority of students think that tree planting, the use of recycled paper, less use of the vehicles and the use of renewable energy sources will reduce global warming is in line with our research results. Selvi and Yıldız (2009) reached similar conclusions in studies conducted with the Pre-Service Biology Teachers. It has been seen that the majority of the Pre-Service Elementary Teachers stated an opinion that measures against local environmental pollutions, the protection of species, a healthy diet and the effect of nuclear bombs do not have an anti-greenhouse effect. This situation shows that the pre-service elementary teachers have been able to distinguish some environmental problems from each other. It has been observed that the Pre-Service Pre-School Teachers and Social Sciences Teachers have a view that reducing hunger in the world will eliminate the greenhouse effect, whereas the Pre-Service Elementary Maths, Science, and Primary Teaching Teachers do not have any views. Another remarkable result obtained in this study is that the Pre-Service Science, Primary Teaching and Pre-School Teachers have stated an opinion that establishing nuclear power stations instead of coal power stations will prevent the greenhouse effect. This view shows they are aware that nuclear power stations do not contribute to the greenhouse effect.

It was seen that the majority of the pre-service teachers identified the greenhouse effect as warming of the world when the answers that the pre-service elementary teachers gave to the open-ended question are evaluated to get their opinions on the greenhouse effect. The answers given have revealed that the pre-service teachers are trying to explain the greenhouse effect with its causes and consequences using the concept of greenhouse gases, climate change, global warming. In this study, data obtained from the open-ended question show that some pre-service teachers have the view that global warming causes the greenhouse effect. This situation shows that the pre-service teachers are unable to establish correct cause-effect relationship between global warming and the greenhouse effect. It has been seen that some of the pre-service teachers associated the greenhouse effect with the greenhouses used in agriculture. The data obtained from the open-ended question related to the greenhouse effect have

showed that the pre-service teachers associated the greenhouse effect with ozone layer problem and acid rain in a wrong way. Groves and Pugh (1999), in their study, have found that the pre-service elementary teachers have a misconception about the fact that one of the reason for the greenhouse effect is acid rain. Kılınç, Boyes and Stanisstreet (2008), in their study, have reached the conclusion that students confused the causes and consequences of global warming and depletion of the ozone layer. In the study he investigated Pre-Service Primary Teaching Teachers' perceptions related to global warming, Bozdoğan (2009) has determined that pre-service teachers have a misunderstanding about global warming and the ozone layer. Çelikler and Kara (2011) in their study, reached the conclusion that Pre-Service Chemistry and Biology Teachers have the wrong perceptions such as ozone depletion will increase even more the greenhouse effect. Coşkun and Aydin (2011) in their study determined that pre-service teachers have a misuderstanding about the ozone layer problem, the greenhouse effect, acid rain and nuclear energy. Çelikler and Aksan (2011) in their study determined that the Pre-Service Elementary Science Teachers confused the consequences of global warming with the results of thinning of the ozone layer and also they confused the causes of the ozone layer problem and the measures taken against this problem with the causes of the greenhouse effect and possible measures to mitigate the greenhouse effect. All the results of this study seem to support the results obtained from the open-ended question. Similar results were obtained in many studies conducted on primary, secondary and tertiary students (Dove, 1996; Boyes & Stanisstreet, 1998; Boyes Stanisstreet & Papantoniou, 1999; Jeffries, Stanisstreet & Boyes 2001; Khalid, 2003; Daniel, Stanisstreet & Boyes, 2004).

Conclusions and Suggestions

As a result of this study, it has been seen that the majority of the pre-service elementary teachers have enough perceptions about the events caused by the increase in the greenhouse effect.

According to the departments, it was observed that there was a significant difference between the pre-service elementary teachers' levels of perception about greenhouse effect in favor of the Pre-Service Science Teachers. According to other departments, the fact that they have a higher level of perception is caused by the nature of the issue which is related to their fields, increasing the level of interest and perception providing an efficient education related to these issues at university, the media publications which draw their attention to the subject with their growing interests. The conclusion is that the pre-service elementary teachers' perception levels about the greenhouse effect, according to gender do not show a significant difference.

At the end of the study, it was observed that the Pre-Service Pre-School Teachers have a lower level of perception than the pre-service elementary teachers and the Pre-Service Elementary Science Teachers have the highest level of perception among the pre-service elementary teachers. It was observed that according to the results obtained from the open-ended question, the Pre-Service Elementary Science Teachers among the pre-service elementary teachers are more successful in explaining the mechanism of the greenhouse effect and the cause of the warming. It has been thought that the Pre-Service Elementary Science Teachers have higher perception as the issue is related to their fields and courses taken during their university education increase their interest and perceptions.

If it is thought that human being is the main culprit behind environmental problems, the greatest precaution that may be taken against environmental problems is to make people conscious and sensitive to the environment. This is possible with effective environmental education. When it is taken into consideration that teachers influence students' knowledge and attitudes over the years and they are very important for students, the pre-service elementary teachers' having sufficient knowledge and equipment is important to prevent future generations' possible misconceptions related to environmental problems and to grow more conscious and sensitive individuals to environment. Therefore, by putting the courses involving these subjects in curriculum throughout university education in all departments, teachers should be informed and made conscious with a variety of educational activities. In this sense, scientific activities can be organized such as conferences, symposia, panel discussions about the greenhouse effect and global warming at universities. The greenhouse effect is the subject of the study and accordingly, in terms of the potential importance of global warming within the scope of the courses in

primary, secondary, and undergraduate programs, students should be motivated and their attention should be drawn to environmental problems by organizing various social and educational activities and an environmental awareness should be raised among the students.

Acknowledgements

This study is a part of the first author's thesis supported by Ondokuz Mayıs University Project Management Office with the number PYO.EGF.1904.10.014 project.

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Received: *February 27, 2012* Accepted: *February 18, 2013*

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