The Opinions of Teacher Candidates about Global Warming, Greenhouse Effect and Ozone Layer

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Abstract: The aim of this study is to designate the opinions and misconceptions of teacher candidates about global warming, greenhouse effect and ozone layer. The data in the study was collected via a survey form applied to 120 teacher candidates randomly chosen from Biology, Science and Primary School Teaching departments, 40 candidates from each department. In the survey, thirty statements were given to teacher candidates to determine misconceptions teacher candidates had and the results were assessed with ternary Likert scale with Right/Wrong and Don't Know options. The findings were interpreted and the opinions and misconceptions the students developed about global warming, greenhouse effect were determined. The results were compared with the findings in the literature and suggestions were made.

Key words: Global warming · Greenhouse effect · Misconceptions · Environmental education

INTRODUCTION

Industrial institutions have become more and more common since the last quarter of eighteenth century when industrial revolution began and the first time in the 1950s, harmful wastes were more likely to be seen as an environmental problem. Since the 1950s, negative elements such as climate change caused by gases having greenhouse effect, air, water and soil pollution caused by toxic materials, dangerous residues and wastes, deforestation and erosion have led to excessive destruction of environment. Environmental problems and environmental pollution were seen as a global problem in the 1970s. Thus, all people in the world started to develop environmental conscious. In the 1980s, it was explained that environmental problems could affect humans and other living beings. During this period, it was understood that environmental problems which previously had been thought to be limited to water, air and soil pollution in only industrial areas- brought about thinning of ozone layer, the destruction of biological diversity, global warming, the pollution of seas and ocean, rapid population rise and depletion of natural resources [1, 2].

The important ones among these environmental problems are increase in greenhouse effect, global warming that threatens the whole life, the damage in ozone layer and its results and acid rains that dry forests [3, 4]. Events such as climate changes, melting glaciers and drought resulting from global warming show clear enough the danger our world will have to face in the next future. The temperature of the world is about 15 °C. In fact, greenhouse gases provide this suitable temperature for the life on Earth (water vapor, CO_2, chlorofluorocarbon (CFC), nitrogen oxide and methane) [5]. When greenhouse effect increases, the world faces global warming and as a consequence, the area that glaciers cover at poles decreases in size. Therefore, it is likely that most of the lands on Earth will remain under water in the future [3, 6]. Thinning of ozone layer can also cause a very big threat in global sense. As a result of this, people will be exposed to ultraviolet rays giving out so much radiation and have different health problems [7, 4].

Using technology or enacting laws and punishing people who cause pollution are not alone sufficient to deal with the environmental problems efficiently. For that reason, environmental education programs should be revised in detail and the content of the courses should be changed and the focus should be on environmental education by starting firstly from primary schools. New educational strategies should be developed and environment education should be practical. In addition, the lessons that will develop environmental conscious

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should be put into the curriculum at high schools and universities. Environmental education, which makes it possible to create individuals who are more aware of their environment and its problems and who try to solve these problems, should be immediately implemented to deal with environmental pollution at national and international levels [8]. At this point, developing environmental conscious especially in children is closely related with knowing what kind of misconceptions that children have concerning environment and environmental problems because effective environmental education can be realized by examining the concepts that are very important to human knowledge [4]. In order to fight against these obstacles and solve them, first of all one should identify how such misconceptions are represented in children's minds. This is an essential and sufficient condition to prepare an effective teaching atmosphere [6].

The misconceptions found in several researches related with greenhouse effect, global warming and ozone layer are summarized in the following paragraphs:

In a research study by Groves and Pugh [9] which was carried out on 330 students studying at the departments of education, science, art, pharmacy and health, the species of plants and animals in danger of extinction was correlated with greenhouse effect by mistake with regard to the statement that 'protecting the diminishing species of plants and animals will reduce greenhouse effect'. 80% of the students who participated in the research and who studied in the faculty of education agreed that protecting species of plants and animals helped reducing the greenhouse effect [6]. Boyes *et al.* [10] conducted a questionnaire related to ozone layer with 435 university students. According to the result of the research, though many of the students knew that ozone layer was a gas layer formed naturally and protected the world from harmful ultraviolet rays, most of them thought that environmental polluters were the main reason for the thinning of ozone layer, supposed that thinning of ozone layer raised greenhouse effect and they couldn't know that volcanoes were harmful to ozone layer. In a study conducted by Dove [11] to investigate how students understood thinning of ozone layer and greenhouse effect, the similar results as in the previous study were found [12]. In the researches conducted at both high school and university level [13, 14], it was found that students had misconceptions (e.g., the hole in ozone layer contributes global warming and the raise in greenhouse effect causes skin cancer, etc.) as well as true conceptions (e.g., increase in greenhouse effect warms up the world, it can cause

glaciers to melt, the main reason of the warming is the release of more CO_2 ve CFC gas, etc.). In another research carried out on 267 high school and university students [15], it was discovered that while 92% of the students thought that the use of spray destroyed ozone layer, only 55% of the students were aware of that it increased UV radiation. Besides, while 47% of the students thought that deforestation and firing were the reason for the increase in carbon dioxide, only 13% of the students knew that the greenhouse effect could have an impact on this situation [16]. In a research carried out by Boyes *et al.* [17] on 861 students between the ages of 11-16 in the UK, it was found out that one fourth of the students in the age group of 11 and 12 agreed that global warming occurred due to greenhouse effect and could cause food poisoning more frequently and a half of them thought that global warming as a result of greenhouse effect will lead to much more floods because of the statement that "when greenhouse effect increases, more floods will be seen". In this study, three-fourth of the students also agreed that global warming caused melting glaciers at the Poles and as a result, they explained that floods could happen [6]. Many pupils of all ages believe that holes in the ozone layer will cause an enhanced greenhouse effect. This has also been observed by others, e.g. Andersson and Wallin [18], Dove [11], Mason and Santi [19]. Boyes and Stanisstreet [20] suggest that the problems of distinguishing between the greenhouse effect and ozone depletion may be due to problems in distinguishing IR radiation from UV radiation or even radiation from thermal energy. Many pupils believe that the energy release (not the carbon dioxide) from cars' engines is the reason for global warming [21, 22].

For an effective, accurate and efficient learning to be realized, misconceptions teacher candidates forge in their minds are to be revealed. With this aim in mind, in this study opinions and misconceptions of teacher candidates about global warming, greenhouse effect and ozone layer-all of which threaten human health today- are researched. The results were compared with the findings in the literature and suggestions were made.

MATERIALS AND METHODS

This study is a case study which was carried out with the survey method.

Sampling: The sampling was done by randomly choosing 4th grade 120 Biology, Science and Class Teacher Candidates studying at Selcuk University, Faculty of Education, in 2007-2008 education year.

Data Collection and Analysis: The data in this study was collected via a survey form which was applied to a total of 120 teacher candidates, 40 teacher candidates being chosen randomly from each of the three departments. In the survey, thirty statements were given to teacher candidates to determine misconceptions teacher candidates had and the results were assessed with ternary Likert scale with Right/Wrong and Don't Know options. The questions in the survey were taken from previous survey studies by Groves and Pugh [9], Boyes *et al.* [10], Rye *et al.* [23], Boyes and Stanısstreet [17,24], Bozkurt and Cansüngü [6], Pekel *et al.*[12] and partially modified. This survey is the main tool in the study and applied to the teacher candidates in March in 2007-2008 education year. The teacher candidates filled in the survey form under supervision and before the application the prominence of the issue was told to the students to prevent them from filling in the forms without reading the questions. Besides, they were told that it is not an exam and they were given enough time to fill in the form. This survey was also checked by 3 lecturers who are specialized in environmental education. The choices the teacher candidates made in ternary Likert Scale was assessed in percentages with SPSS statistical program.

RESULTS

The findings of the answers the teacher candidates gave to the statements that were prepared to find out the misconceptions they had about global warming, greenhouse effect and ozone layer are shown in Table 1 and Table 2.

In Table 1, 25% of the class teacher candidates, 15% of the biology teacher candidates and 20.8% of the science teacher candidates, which makes up a total of 60.8% of all teacher candidates, had misconception about the first statement saying that "When greenhouse effect increases, people will be poisoned by foods". 20% of the class teacher candidates, 15% of the biology teacher candidates, 20% of the science teacher candidates, which makes up a total of 55% of all teacher candidates, had the misconception about the second statement saying that "Greenhouse effect means producing any plant by developing suitable conditions even though it's not its season". In addition, it was determined that 8.2% of the teacher candidates didn't have enough knowledge about greenhouse effect. 21.6% of the class teacher candidates, 18.3% of the biology teacher candidates, 15.8% of the science teacher candidates, which makes up a total of 55.7% of all teacher candidates had the misconception

Table 1: The answers given by the teacher candidates to the statements about greenhouse effect

Statement	Department	Correct n	Correct %	Wrong n	Wrong %	I don't know n	I don't know %
1. When greenhouse effect rises, people will be poisoned from foods.	C.T.	30	25.0	3	2.5 *	7	5.8
	B.T.	18	15.0	17	14.1 *	5	4.1
	S.T.	25	20.8	7	5.8 *	8	6.6
	Total	73	60.8	27	22.4 *	20	16.5
2. Greenhouse effect means producing any plant by developing	C.T.	24	20.0	11	9.1 *	5	4.1
suitable conditions even though it's not its season.	B.T.	18	15.0	22	18.3 *	-	-
	S.T.	24	20.0	11	9.1 *	5	4.1
	Total	66	55.0	44	36.5 *	10	8.2
3. Using hormone causes greenhouse effect.	C.T.	26	21.6	8	6.6 *	6	5.0
	B.T.	22	18.3	12	10.0 *	6	5.0
	S.T.	19	15.8	15	12.5 *	6	5.0
	Total	67	55.7	35	29.1 *	18	15.0
4. Protecting the diminishing species of plants	C.T.	18	15.0	13	10.8 *	9	7.5
and animals will reduce greenhouse effect.	B.T.	24	20.0	8	6.6 *	8	6.6
	S.T.	30	25.0	6	5.0 *	4	3.3
	Total	72	60.0	27	22.4 *	21	17.4
5. The increase in the amount of garbage that people	C.T.	20	16.6 *	10	8.3	10	8.3
produce increases greenhouse effect much more.	B.T.	17	14.1 *	15	12.5	8	6.6
	S.T.	14	11.6 *	17	14.1	9	7.5
	Total	51	42.3 *	42	34.9	27	22.4
6. The increase in the amount of CO_2 increases greenhouse effect much more.	C.T.	34	28.3 *	3	2.5	3	2.5
	B.T.	31	25.8 *	5	4.1	4	3.3
	S.T.	23	19.1 *	12	10.0	5	4.1
	Total	88	73.2 *	20	16.6	12	9.9
7. As greenhouse effect increases, the glaciers in the poles will melt.	C.T.	31	25.8 *	3	2.5	6	5.0
	B.T.	30	25.0 *	3	2.5	7	5.8
	S.T.	26	21.6 *	10	8.3	4	3.3
	Total	87	72.4 *	16	13.3	17	14.1

Table 1: Continued

Statement	Dept	n	%	n	%	n	%
8. The increase in the amount of acid in rains increases	C.T.	28	23.3	4	3.3 *	8	6.6
greenhouse effect much more.	B.T.	26	21.6	4	3.3 *	10	8.3
	S.T.	32	26.6	2	1.6 *	6	5.0
	Total	86	71.5	10	8.2 *	24	19.9
9. Preventing the usage of nuclear bombs will reduce greenhouse effect.	C.T.	40	33.3	-	- *	-	-
	B.T.	35	29.1	3	2.5 *	2	1.6
	S.T.	35	29.1	2	1.6 *	3	2.5
	Total	110	91.5	5	4.1 *	5	4.1
10. CFC gases given out from spray products increases	C.T.	36	30.0 *	4	3.3	-	-
greenhouse effect much more.	B.T.	35	29.1 *	5	4.1	-	-
	S.T.	32	26.6 *	8	6.6	-	-
	Total	103	85.7 *	17	14.0	-	-
11. When greenhouse effect increases, the world will have much more deserts.	C.T.	31	25.8 *	2	1.6	7	5.8
	B.T.	32	26.6 *	8	6.6	-	-
	S.T.	34	28.3 *	5	4.1	1	0.8
	Total	97	80.7 *	15	12.3	8	6.6
12. When greenhouse effect increases, much more floods will happen.	C.T.	26	21.6 *	14	11.6	-	-
	B.T.	22	18.3*	18	15.0	-	-
	S.T.	20	16.6 *	20	16.6	-	-
	Total	68	56.5 *	52	43.2	-	-
13. The wastes thrown away from nuclear power stations increases	C.T.	34	28.3	4	3.3 *	2	1.6
greenhouse effect much more.	B.T.	36	30.0	3	2.5 *	1	0.8
	S.T.	39	32.5	1	0.8 *	-	-
	Total	109	90.8	8	6.6 *	3	2.4
14. Greenhouse effect is that the temperature, is the same	C.T.	8	6.6	32	26.6 *	-	-
everywhere in the world.	B.T.	15	12.5	25	20.8 *	-	-
	S.T.	18	15.0	20	16.6 *	2	1.6
	Total	41	34.1	77	64.0 *	2	1.6
15. The wastes drained to rivers increases greenhouse effect much more.	C.T.	20	16.6 *	18	15.0	2	1.6
	B.T.	15	12.5 *	24	20.0	1	0.8
	S.T.	25	20.8 *	11	9.1	4	3.3
	Total	60	49.9 *	53	44.1	7	5.7

'C.T.': Class Teacher candidates, 'B.T.': Biology Teacher candidates, 'S.T.': Science Teacher candidates.

'*' means that it is correct the answer for the statement.

Table 2: The answers that the teacher candidates gave to the statements about global warming and ozone layer

Statement	Department	Correct		Wrong		I don't know	
		n	%	n	%	n	%
16. Ozone layer is a gas layer which was created naturally and it	C.T.	40	33.3 *	-	0	-	-
protects the world from harmful ultraviolet rays	B.T.	38	31.6 *	2	1.6	-	-
	S.T.	39	32.5 *	1	0.8	-	-
	Total	117	97.4 *	3	2.4	-	-
17. If the thinning of ozone layer ncreases, more ultraviolet	C.T.	39	32.5 *	1	0.8	-	-
rays will reach the world.	B.T.	34	28.3 *	6	5.0	-	-
	S.T.	39	32.5 *	1	0.8	-	-
	Total	112	93.3 *	8	6.6	-	-
18. If the thinning of ozone layer ncreases, more people will get skin cancer.	C.T.	40	33.3 *	-	-	-	-
	B.T.	37	30.8 *	3	2.5	-	-
	S.T.	36	30.0 *	4	3.3	-	-
	Total	113	94.1 *	7	5.8	-	-
19. The thinning of ozone layer is defined as non-transmission of the	C.T.	22	18.3	18	15.0 *	-	-
lights to the atmosphere which are reflected from crust of the earth.	B.T.	19	15.8	21	17.5 *	-	-
	S.T.	26	21.6	14	11.6 *	-	-
	Total	67	55.7	53	44.1 *	-	-
20 The thinning of ozone layer increases greenhouse effect.	C.T.	16	13.3	20	16.6 *	4	3.3
	B.T.	28	23.3	4	3.3 *	8	6.6
	S.T.	30	25.0	3	2.5 *	7	5.8
	Total	74	61.6	27	22.4 *	19	15.7
21. Ozone layer protects the world from high temperatures.	C.T.	34	28.3	6	5.0 *	-	-
	B.T.	37	30.8	3	2.5 *	-	-
	S.T.	38	31.6	2	1.6 *	-	-
	Total	109	90.7	11	9.1 *	-	-
22. If ozone layer continues thinning, it will affect the temperature	C.T.	37	30.8	3	2.5 *	-	-
of the weather and so the weather of our world will change.	B.T.	38	31.6	2	1.6 *	-	-
	S.T.	39	32.5	1	0.8 *	-	-
	Total	114	94.9	6	4.9	-	-

Table 2: Continued

23. The glaciers in the poles will be affected by	C.T.	36	30.0	4	3.3 *	-	-
the increase in the problem of ozone layer.	B.T.	38	31.6	2	1.6 *	-	-
	S.T.	39	32.5	1	0.8 *	-	-
	Total	113	94.1	7	5.7 *	-	-
24. Much more lights will get into the world with the increase in CO_2 and	C.T.	35	29.1	5	4.1 *	-	-
so the increase in the amount of lights can't return to the space and	B.T.	32	26.6	8	6.6 *	-	-
this situation will increase the thinning of ozone layer	S.T.	36	30.0	4	3.3 *	-	-
	Total	103	85.7	17	14.0 *	-	-
25. The most effective material leading to the	C.T.	20	16.6 *	18	15.0	2	1.6
thinning of ozone layer is CFC gases.	B.T.	25	20.8 *	14	11.6	1	0.8
	S.T.	25	20.8 *	13	10.8	2	1.6
	Total	70	58.2 *	45	37.4	5	4.0
26. Reducing nuclear weapons stocks also reduces global warming.	C.T.	38	31.6	2	1.6 *	-	-
	B.T.	36	30.0	4	3.3 *	-	-
	S.T.	33	27.5	7	5.8 *	-	-
	Total	107	89.1	13	10.7	-	-
27. The hole in ozone layer is the main reason of global warming.	C.T.	20	16.6	17	14.1 *	3	2.5
	B.T.	30	25.0	5	4.1 *	5	4.1
	S.T.	34	28.3	2	1.6 *	4	3.3
	Total	84	69.9	24	19.8 *	12	9.9
28. Increase in ultraviolet rays will also increase the thinning of ozone layer.	C.T.	31	25.8	9	7.5 *	-	-
	B.T.	24	20.0	16	13.3 *	-	-
	S.T.	27	22.5	13	10.8 *	-	-
	Total	82	68.3	38	31.6 *	-	-
29. The wastes thrown away from nuclear stations damage ozone layer.	C.T.	40	33.3	-	- *	-	-
	B.T.	38	31.6	2	1.6 *	-	-
	S.T.	39	32.5	1	0.8 *	-	-
	Total	117	97.4	3	2.4 *	-	-
30. Using nuclear stations instead of coal stations will	C.T.	28	23.3	11	9.1 *	1	
be better for ozone layer.	0.8						
	B.T.	31	25.8	9	7.5 *	-	-
	S.T.	34	28.3	6	5.0 *	-	-
	Total	93	77.4	26	21.6 *	1	0.8

'C.T.': Class Teacher candidates, 'B.T.': Biology Teacher candidates, 'S.T.': Science Teacher candidates.
'*' means that it is the correct answer for the statement

about the third statement which says using hormones causes greenhouse effect. When the answers that the teacher candidates gave to the first, second and third statements were analyzed, it was understood that the teacher candidates mistake the concepts of greenhouse effect for the concepts of green housing, so they fell into error by correlating the concept of greenhouse effect with agriculture.

34.1% of the teacher candidates thought that the 14th statement saying 'Greenhouse effect means that the temperature is the same everywhere in the world' was correct and 60% of them thought that the 4th statement saying 'Protecting the diminishing species of plants and animals will reduce greenhouse effect' was correct. As understood from the answers that the teacher candidates gave to the 14th statement and the 4th statement, the teacher candidates were perplexed about certain terms.

In the 5th statement, 34.9% of the teacher candidates had the misconception that the increase in the amount of garbage that people produce does not increase the greenhouse effect. In the 6th statement, it can be said that 16.6% of the teacher candidates do not think that the increase in the amount of CO_2 increases greenhouse

effect much more. In the 7th statement, it was determined that 13.3% of the teacher candidates had the misconception that melting glaciers in the poles was not one of the results of greenhouse effect. In the 8th statement, it was found out that 71.5% of the teacher candidates had the thought that increase in the amount of acid rains increases greenhouse effect much more and it was determined that these teacher candidates fell into misconception by setting a relationship between greenhouse effect and acid rains, which is another environmental problem. The fact that 91.5% of the teacher candidates have the thought that preventing the usage of nuclear bombs will reduce greenhouse effect according to the statement 9 and that 90.8% of them have the thought that the wastes thrown away from nuclear power stations increase greenhouse effect much more as tested with the statement 13 show their misconception about the proportional increase in greenhouse effect with nuclear pollution. 14% of the teacher candidates didn't agree with the 10th statement saying CFC gases given out from spray products increase greenhouse effect much more, so it is understood that they had the misconception that CFC gases might have the impact on only thinning of ozone layer.

It was determined that 12.3% of the teacher candidates were of the opinion that 'when greenhouse effect increases, the world will not have more deserts' related with the statement 11 and that 43.2% of them thought 'when greenhouse effect increases, far more floods will not happen' related with the statement 12. 44.1% of them also believed that the wastes drained to rivers will increase greenhouse effect much more. As understood from these statements, it was found that the teacher candidates had a lot of misconceptions about events which can probably happen when greenhouse effect increases. It was determined that the science teacher candidates gave more wrong answers to the statements -as can be seen in Table 1 than the class and biology teacher candidates did. It was also determined that the class teacher candidates gave more wrong answers than the biology teacher candidates.

The findings belonging to the answers that the teacher candidates gave to the statements prepared in order to find out the misconceptions they had about global warming and ozone layer can be seen in Table 2.

According to the statement 16, shown in Table 2, 97.4% of the teacher candidates knew that 'ozone layer is a gas layer which existed naturally and it protects the world from harmful UV rays. When it comes to the statement 17, 93.3% of them knew that if the thinning in ozone layer continues, more Ultraviolet rays will reach the world. 94.1% of them also knew that if the thinning in ozone layer continues, more people will get skin cancer as shown in the statement 18. However, as tested in the statement 19, 55.7% of the teacher candidates had the misconception that 'the thinning of ozone layer means non-transmission of the lights to the atmosphere which are reflected from the crust of the earth' and as tested in the statement 20, 61.6% of them had the misconception that 'the thinning of ozone layer increases greenhouse effect'. Also as understood from the answers given to the statement 21, 90.7% of them had the misconception that 'ozone layer protects the world from being very hot' and 68.3% of them had the misconception that 'increase in ultraviolet rays will increase the hole in ozone layer' in the statement 28. In addition, many of them (94.9%) had the misconception that 'the increase in the thinning of ozone layer will affect the temperature of the weather' and 94.1% had the misconception that the glaciers in the poles will be affected by the increase in the problem of ozone layer. In the statement 24, it was determined that the percentage of the teacher candidates who had the misconception that much more lights will get into the world with the increase in CO_2 and so the growing amount of lights can't return to

the space and this situation will increase the thinning of ozone layer is 85.7%. It was also found that 69.9% of them had the misconception that 'the hole in ozone layer is the main reason of global warming'. In the statement 25, 37.4% of the teacher candidates had the misconception that 'the most effective material leading to the thinning of ozone layer is not CFC gases'.

It was determined that 97.4% of the teacher candidates had the misconception that the wastes thrown out of nuclear stations damage ozone layer and 77.4% of them had the misconception that the use of nuclear stations instead of coal stations will be better for ozone layer and also 89.1% of the participants of the research had the misconception that reducing nuclear weapons stocks also reduces global warming. According to the statements shown in Table 2, it was determined that the science teacher candidates gave far more wrong answers than the biology and class teacher candidates did. It was also seen that the biology teacher candidates gave more wrong answers than the class teacher candidates did.

DISCUSSION AND CONCLUSION

When all of these statements were evaluated, it is seen that the teacher candidates set a wrong relationship between global warming and ozone layer and greenhouse effect-ozone layer interaction without any reason. Moreover, they mixed up these three different concepts with each other. They had misconception that the results of thinning of ozone layer will increase greenhouse effect and the function of ozone layer is to protect the earth against excessive heat. They fell into a misconception that ozone layer prevents global warming, the hole in ozone layer is the main reason of global warming and the increase in the problem in ozone layer will cause glaciers in the poles to melt. Global warming resulting from greenhouse effect is perceived as if it were the result of the thinning of ozone layer since it is taken in the wrong sense. These results show similarities with the research made by Pekel et al. [12] and the statement that 'Students naturally set a relationship between global warming and the thinning of ozone layer' which was expressed in the research made by Meadows and Wiesenmayer [25]. In the research carried out with 6th, 7th and 8th grade students by Darcın et al.[26], it was found out that many of the students had misconceptions like if greenhouse effect rises gradually, more people will be in danger of having skin cancer (46%) and that the thinning of ozone layer will increase greenhouse effect much more (37%).

It has been found out in our study that the teacher candidate students at university have a lot of misconceptions about greenhouse effect, global warming and ozone layer that were found out in some studies such as "identifying primary school students' misconceptions about greenhouse effect [6], identifying 6th, 7th and 8th grade primary school students' misconceptions about ozone layer [4] and identifying high school students' misconceptions about ozone layer [12]. Therefore, it can be said that the students beginning from nursery school to university should be given a proper environmental education in our country. It is clear that these teacher candidates will teach these misconceptions to their students when they become a teacher and that this confusion in certain terms will continue in next generations. Khalid [27] showed that also among American pre-service high school teachers many misconceptions concerning the greenhouse effect, the depletion of the ozone layer and acidification are present [22]. A study by Jefferies, Stanisstreet and Boyes [28] investigated university students' understanding of the greenhouse effect 10 years after the previous studies in order to see if the situation has improved. However, if there was any change, more students held misconceptions in the later study than in the first one [22].

The number of studies about environmental education during university years and earlier is not enough. When the environmental education in the primary school in international models is compared with our studies, it is seen that there isn't a proper environmental education in our country [29-31]. Environmental education in Turkey has started to be given in formal education since 1991. These courses are given by the teachers of other branches but not by the teachers of the related subject [32]. It was found out that 94.9% of the teacher candidates have never participated in the meetings or conferences about environment and that 60% of them didn't take environment protection course at university. In addition, it was found that 96.6% of them aren't a member of any environmental institution and that 77.5% of them aren't informed about environmental pollution by their parents. These results show that neither parents nor schools can make individuals conscious of the concepts about environment, environmental risks and their impacts. The fact that the misconceptions Dikmenli and Cardak found out in their study were similar to the misconceptions observed in high school students supports the opinion that misconceptions can also stem from course books [33].

In an Msc study by Kavruk [34] named "The Role and The Importance of Environmental Education in Enhancing Environmental Awareness in Turkey", the following conclusions were made: Environmental education in Turkey could not fulfill its function properly, environmental education was conducted by traditional teaching, the concept of rote learning came to the forefront in formal education, the applied education could not be put into practice. In another study by Simsekli [35] tittled as "The Consciousness of Primary Schools about Activities on Environmental Education Intended for Improving Environmental Awareness", it was concluded that the environmental education awareness was below the desired level in 25 primary schools in the center of Bursa [36].

Suggestions: In Turkey, it is essential that a policy of environmental education be prepared and essential funds to be used in giving education be created to enable student to understand properly both the concepts like greenhouse effect, ozone layer and global warming and concepts about other environmental pollutions. The concepts and events about environment should be explained with tangible examples and active teaching atmosphere should be created to prevent teacher candidates from falling into misconception. Therefore, it will be very useful to set ecology camps for students and to arrange technical trips to explore the nature. Moreover, it is essential to use computer assisted visual materials (simulations, modeling, films, graphic animations, etc.) and to prepare curriculums to protect the environment beginning from primary schools. On the other hand, students who graduated from a university as a teacher should be provided with in-service training to dispel these misconceptions in their minds.

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