

Prospective Turkish elementary science teachers' knowledge level about the greenhouse effect and their views on environmental education in university

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Abstract

The fundamental factor of environmental education is teachers who are well-informed about environmental issues. This research aimed to determine prospective Turkish elementary science teachers' knowledge level about causes, consequences and reducing of the greenhouse effect and to investigate the effect of gender, information source and membership in the environmental foundations on their knowledge. We also aimed to learn their views on environmental education given in university. Twenty-six Likert-scale items developed by Cin (2006) were used for data collection. The scale was applied to 215 prospective teachers from two universities in eastern Turkey. Results indicated that the majority of prospective teachers had misunderstandings about causes, consequences and reducing of the greenhouse effect. According to the analysis of demographic variables, there were significant differences in participants' mean scores based on gender and information sources. Additionally, prospective teachers found environmental education inadequate for different reasons.

Keywords: Environmental education, greenhouse effect, knowledge level

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Introduction

There has been an increasing awareness of environmental problems for their effect of human-life all over the world. One of the most acknowledged environmental problems is global warming, especially that aspect known as the greenhouse effect. The greenhouse effect is a natural phenomenon that makes earth habitable. Some of the short wave rays that penetrate the earth are re-radiated as long wave rays. This long-wave infrared light in the form of heat energy is absorbed by the atmospheric greenhouse gases, such as carbon dioxide, water vapour, nitrous oxide, methane and other gases, present in the earth atmosphere and this trapped heat raises the earth's temperature (Khalid, 1999). Without greenhouse effect, the temperature of the earth surface would be 16 degrees Celsius on average (US Department of Energy, 1995). This temperature is not suitable for any species to live. In fact, this warming is essential for life in the Earth (Boyes & Stanisstreet, 1993).

According to the National Academy of Sciences, the Earth's temperature has risen about approximately 0.5 degrees Celsius in the past century, with accelerated warming during the past two decades (Baird, 2005). This unnatural warming has become a potential threat to our biosphere with huge social, environmental and economic consequences (Papadimitriou, 2004). In the special report about global warming published by the Intergovernmental Panel on Climate Change, it is indicated that the key factor of global warming is human influence which is increasing the concentration of greenhouse gases in the atmosphere, primarily carbon dioxide, methane and nitrous oxide (IPCC, 1997). For this reason, there has been lately a great interest in educating pupils, the future citizens, about global warming, especially the greenhouse effect, all over the world (Koulaidis & Christidou, 1999). However, studies conducted on students' ideas about greenhouse effect revealed that students almost every level have misunderstandings about the greenhouse effect (Andersson & Wallin, 2000; Boyes & Stanisstreet, 1993; Bozkurt & Cansüngü-Koray, 2002; Darçin et al., 2006; Rye et al., 1997). Some of these misunderstandings are:

- If the greenhouse effect gets bigger, more people will get food poisoned.
- If the greenhouse effect gets bigger, more fish will be poisoned in the rivers.
- If the greenhouse effect gets bigger, more people will get skin cancer.
- If the greenhouse effect gets bigger, there will be more earthquakes.
- The greenhouse effect is made worse by acid in the rain.
- The greenhouse effect is made worse by holes in the ozone layer.

- The greenhouse effect can be made smaller by using unleaded petrol.
- The greenhouse effect can be made smaller by reducing the number of nuclear bombs in the world.

According to Loughland et al. (2003), the gender difference is one of the important factors influencing young people's conceptions of the environment and environmental problems. Therefore, findings about different environmental studies with respect to gender are one of the concerns to be tackled (Fernandez-Manzanal et al., 2007; Tuncer et al., 2005; Zelezny, 2000). In their study into the environmental attitudes of young people in Turkey, Tuncer et al. (2005) found that girls were more aware of environmental problems, individual responsibility and national environmental problems, and that they had more positive attitudes toward the solutions to the environmental problems. Thus, we have taken gender as the factor affecting the prospective teachers' knowledge level about the greenhouse effect in the present study.

Environmental education is a life-long period not limited only official curriculum of formal education and it is influenced by informal, out of school, factors. One of the informal factors is information sources used to gain knowledge about the environmental issues like the media (Coyle, 2005). Although environmental problems have received sporadic attention in the popular media, the media is responsible for some misconceptions about environmental issues like greenhouse effect (Jeffries et al., 2001). According to Hillman et al. (1996), learning from media is unidirectional and, therefore, children might misinterpret information for not having opportunity to test their ideas against those of their peers and seniors. Another informal factor that influences the environmental education is environmental organizations that aim to improve students' environmental knowledge, attitudes and practice (Ajiboye & Silo, 2008). The results of some studies indicate that students do not participate in the environmental organizations (Çabuk & Karacaoğlu, 2003) and these organizations had no effect on students' environmental average knowledge (Uzun & Sağlam, 2007). For this reason, the formal educational system is regarded as an effective way of developing students' awareness and understandings of environmental issues (Roth, 1992).

In formal, school-based environmental education, teachers have an important role in providing students an adequate knowledge base and clear understanding of environmental problems (Khalid, 2001). Groves & Pugh (1999) stated that students' misunderstandings might arise from incorrect understandings passed along by their teachers. Recent researches in environmental education support the idea that teachers have poor understanding of the actual environmental problems, especially the greenhouse effect (Michail et al., 2007; Summers et al., 2000). Therefore, it is necessary to educate prospective teachers who incorrectly understand

causes, consequences and reducing of major environmental problems such as the greenhouse effect. But, previous studies in different countries have indicated that student teachers have many misunderstandings relating to the greenhouse effect (Groves & Pugh, 1999; Khalid, 2001, 2003; Papadimitriou, 2004). These inaccurate knowledge and misunderstandings stated in the relevant studies show that environmental education in teacher training programs is not adequate and do not properly educate prospective teachers about environmental issues. Research revealed that prospective teachers' misunderstandings about the greenhouse effect persisted even after the intervention (Groves & Pugh, 2002). According to studies, some inadequacies that cause misunderstandings about environmental issues are the lack of appropriate environmental courses, insufficient knowledge about environmental issues in the course books and notes, not using student-centred teaching methods in the classrooms (Khalid, 2001; Pekel, 2005). Khalid (2001) stated that to eliminate prospective teachers' misunderstandings about environmental issues, the inadequacies of environmental education in teacher training programs should be determined and improved.

The Significance of the Study

There are limited studies conducted on Turkish prospective teachers' knowledge level about the greenhouse effect (Bal, 2004; Cin, 2006). In these studies, some misunderstandings detected by international researchers (Groves and Pugh, 1999; Khalid, 2001; Khalid, 2003; Papadimitriou, 2004) were reported but the inadequacies of environmental education that cause these misunderstandings were not mentioned. Therefore, in the present study, we aimed to examine prevalence of misunderstandings about the greenhouse effect among the prospective science teachers in two Turkish universities and aimed to learn inadequacies of environmental education given in teacher training programs at Turkish universities according to views of prospective teachers.

Purpose

The purpose of the study is to determine prospective Turkish science teachers' misunderstandings about the causes, consequences and reducing of the greenhouse effect and to learn prevalence of these misunderstandings among the prospective elementary science teachers in two Turkish universities. It is also aimed to analyze the effect of gender, information sources and membership in environmental foundations on their knowledge about the greenhouse effect. Additionally, the third purpose of the study is to identify the inadequacies of environmental education in teacher training programs according to views of prospective teachers and to make recommendations to improve them. The following questions directed and shaped the study;

- What are the prospective Turkish science teachers' misunderstandings about the causes, consequences and reducing of the greenhouse effect?
- Are these misunderstandings similar to previous limited study conducted in other Turkish universities?
- What is the effect of gender, information sources and membership in environmental foundations on prospective science teachers' knowledge about the greenhouse effect?
- What are the inadequacies of environmental education in teacher training programs at Turkish universities according to views of prospective science teachers?

Method

Research Approach

In this study, quantitative and qualitative approaches were used together as the research methodology. In the quantitative section, the data concerning prospective teachers' knowledge level about greenhouse effect was collected by using survey research method. Surveys provide to learn about people's demographics, opinions, ideas and other types of information. It is frequently used in education studies because accurate information can be obtained for large numbers of people with a small sample (McMillan & Schumacher, 2006). Qualitative data were collected by using one open-ended question to learn prospective teachers' views about environmental education program they had taken in university.

Sample

The sample of the study was 215 third and fourth years' prospective science teachers from science education departments of two large universities in eastern Turkey. There were two reasons for choosing this population for data collection. First, they have taken at least one course continued a semester long about environment. Second, they would begin their professional career as elementary science teachers in about one to one and a half years. There were 96 (44.7%) female and 119 (55.3%) male participants in the study.

Data Collection

The study was conducted by means of a questionnaire (see Appendix). The questionnaire consisted of two parts. The first part included demographic questions dealing with gender, information sources about the greenhouse effect and membership in any environmental organizations. The students were also asked whether or not they found the environmental education program they took were adequate. If students' answer to this question was "No", then, we wanted them to explain why they thought so. For this purpose, prospective teachers were given an open-ended question (Why do you think the environmental education program you take is not adequate?)

and they were asked to answer it. In the second part of questionnaire, a survey instrument developed by Cin (2006) was used to learn prospective teachers' knowledge level about the greenhouse effect. The instrument consisted of 26 statements, 11 were regarding the causes of the greenhouse effect, 9 were about consequences of the greenhouse effect and 6 statements were about the reducing of the greenhouse effect. The students had three choices to respond to each survey statements: "I agree", "I do not agree" and "I am not sure". The pilot data were collected with 41 students and reviewed to determine the reliability coefficient of the questionnaire. Cronbach's alpha (α) of the instrument was calculated as 0.83. For construct validity, experienced faculty members from biology, environmental science and science education critically reviewed the instrument. As a result of the review, the instrument was administered without any changes.

Data Analysis

The results were evaluated by using SPSS package program. Prospective teachers' percentages and frequencies of answers were calculated and the misunderstandings that prospective science teachers had were presented. Independent samples t test analysis was used for gender and membership effect on prospective teachers' misunderstandings. To analyze the effect of information source on prospective teachers' knowledge about the greenhouse effect, LSD-ANOVA analysis was used. Qualitative data were analyzed by open coding technique and the conceptions were interpreted in terms of determined categories and conceptual constructions. Open coding refers to naming and categorizing phenomena through close examination of the data (Strauss & Corbin, 1990). Open coding fractures data into concepts and categories. Then data were compared and similar incidents were grouped together and given the same conceptual label (Smit, 2002). In the analysis process, prospective teachers' views about inadequacy of environmental education program they took were reviewed by two faculty members and phenomenon were determined, named and categorized. After the review process, five categories were identified according to prospective teachers' views.

Results

Analysis of the prospective science teachers' answers to statements in the questionnaire revealed some of the misunderstandings stated as follows about the causes, consequences and reducing of the greenhouse effect.

Misunderstandings about causes of the greenhouse effect

Prospective science teachers' misunderstandings about the causes of the greenhouse effect are presented in Table 1. About 66.5% of prospective teachers affirmed the description of the mechanism of the greenhouse effect that extreme Sun's rays get to the Earth's surface (#1). Only 20 % correctly responded to the statement. Boyes & Stanisstreet (1993) suggested that students appreciated that solar radiation plays a part in global warming, but did not fully understand the idea of energy entrapment by atmospheric

conditions. Additionally, response to #4 indicates that prospective teachers confuse the greenhouse effect with ozone layer depletion. About 74% of prospective teachers think that holes in the ozone layer cause the greenhouse effect whereas only 12% know ozone layer is not related to the greenhouse effect. This result parallels the problem found by Khalid (2001) that students teacher tend to lump greenhouse effect and ozone depletion together.

Most of the prospective teachers believe that there is a connection between solid waste and the greenhouse effect. About 61.4% agreed on the statement that “solid waste (unspoilt waste) increases the greenhouse effect” (#5). Only 7.4% know that unspoilt waste do not produce the greenhouse gases. In the study of Cin (2006), 94 prospective teachers, incorrectly, affirmed this statement.

One of the prospective teachers' problems is nuclear stocks and the greenhouse effect. Only 7.4% of prospective teachers appreciated that nuclear stocks do not increase the greenhouse effect (#6). About 59.1% had confusion between an increase in the greenhouse effect and nuclear stocks. Groves & Pugh (1999) and Bal (2004) reported that many of prospective teachers incorrectly connected radioactive waste with the greenhouse effect.

Table 1. *Students' misunderstandings about the causes of the greenhouse effect*

#	Statement	Agree (%)	Do not agree (%)	Not sure (%)
1	The greenhouse effect is to get much more sun's rays to the earth's surface.	66.5	20	13.5
4	Hole in the ozone layer causes the greenhouse effect.	74	14	12
5	Solid waste (unspoilt waste) increases the greenhouse effect.	61.4	7.4	31.2
6	Nuclear stocks increase the greenhouse effect.	59.1	7.4	33.5

Misunderstandings about consequences of the greenhouse effect

Prospective teachers have two misunderstandings about the consequences of the greenhouse effect (Table 2). Statements dealing with consequences revealed considerable confusion over the relationship of the greenhouse effect to skin cancer. A rather high percentage (73.5%) of prospective teachers believed that the greenhouse effect will increase chances of getting skin cancer (#14). Only 4.7% knew skin cancer deals with ozone depletion. Groves & Pugh (1999) and Khalid (2001) stated in their studies that majority of the prospective teachers believed the skin cancer was a result of the greenhouse effect.

Most of the prospective teachers (42.3%) accepted the statement that “Negative results of the greenhouse effect will be felt in equator at most.”

(#15). Only a small group of prospective teachers (12.6%) disagreed with the statement. Greenhouse warming will be felt more in countries located on the equator than at each of the poles. The most important reason for this fact is that lives in poles cannot accommodate to this warming (Cin, 2006).

Table 2. *Students' misunderstandings about the consequences of the greenhouse effect*

#	Statement	Agree (%)	Do not agree (%)	Not sure (%)
14	The greenhouse effect will cause more people to get skin cancer.	73.5	4.7	21.8
15	Negative results of the greenhouse effect will be felt in equator at most.	42.3	12.6	45.1

Misunderstandings about ways to reduce the greenhouse effect

Responses of prospective teachers indicated that many students did not understand the practical actions which could be taken to reduce the greenhouse effect (Table 3). Prospective teachers did not realize that there was no causal link between the greenhouse effect and feeding (#25). Most of the prospective teachers (46.5%) had no idea about reducing starvation would reduce the greenhouse effect whereas 42.8% knew they were not related to each other. Only 10% mistakenly thought that reducing starvation would reduce the greenhouse effect. This result is similar to findings of Jeffries et al. (2001) showing that there is little confusion between an increase in the greenhouse effect and reduction of global starvation among college students.

A high proportion of prospective teachers (57.2%) thought that the use of unleaded petrol would help to reduce the greenhouse effect (#26). Only 5.6% responded correctly to this statement. Groves & Pugh (1999) reported in their research that 13% of prospective teachers appreciated that the unleaded petrol did not help to reduce the greenhouse effect.

Table 3. *Students' misunderstandings about the ways to reduce the greenhouse effect*

#	Statement	Agree (%)	Do not agree (%)	Not sure (%)
25	Reducing starvation reduces the greenhouse effect.	10.7	42.8	46.5
26	Using unleaded petrol reduces the greenhouse effect.	57.2	5.6	37.2

Effect of gender, information sources and membership in environmental organizations

As determined by independent samples *t* test, there were statistically significant differences between students' gender in mean scores of the questionnaire (Table 4). Female prospective teachers' mean scores were significantly higher than males in total of the questionnaire.

Table 4. *Prospective teachers' gender differences in mean scores of the questionnaire*

Gender	<i>N</i>	<i>M</i>	<i>SD</i>	Difference	<i>t</i>
Female	96	2.62	0.22	0.11	3.459**
Male	119	2.52	0.23		

$p < .001^{**}$

Analysis of information source for greenhouse effect showed that participants were mostly used visual and written media (T.V.-radio, newspaper-magazines) and internet. Formal based information sources such as course book and lecturers were not frequently used by the prospective teachers (Table 5).

Table 5. *Prospective teachers' information sources for the greenhouse effect*

Information Source	<i>N</i>	<i>M</i>	<i>SD</i>
Magazine-Newspaper	49	2.62	0.19
T.V.-Radio	64	2.51	0.19
Internet	43	2.58	0.27
Course Book	19	2.46	0.30
Friends	19	2.54	0.25
Lecturer	21	2.62	0.17

ANOVA analysis indicated that there was a statistically significant difference between the mean scores of participants using different information sources ($p < .05$) (Table 6).

Table 6. *Results of ANOVA analysis for information sources*

	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
Between Groups	.630	5	.126	2.293	.039
Within Groups	11.011	209	.053		
Total	11.642	214			

$p < .05$

According to the LSD-ANOVA analysis, there was a statistically significant difference among the mean scores of prospective teachers using course book, magazine-newspaper and lecturer as information source ($p < .05$). Statistical LSD test results indicated that using magazine-newspaper ($M = 2.62$) and lecturer ($M = 2.62$) were more successful than using course book ($M = 2.46$). Also, a significant difference was detected between prospective teachers using magazine-newspaper and TV-radio as information source ($p < .05$). Mean of using magazine-newspaper ($M = 2.62$) was higher than mean of using TV-radio ($M = 2.51$).

According to findings about the membership, 19 prospective teachers (8.8%) were members in environmental organizations. But, 196 prospective teachers (91.2%) were stated that they did not have membership in any environmental organizations. In the study of Özmen et al. (2005), most of the university students stated they had no membership in any environmental organizations. According to Independent samples t-test result considering the membership in any environmental organizations, no significant difference is found between students in mean scores ($t(213) = .421, p > .05$). This finding is similar to result found by Uzun & Sağlam (2007) that there were no significant differences between students' environmental knowledge average based on active participation in the voluntary environment organizations.

Inadequacies of environmental education according to prospective teachers

Prospective teachers' views about the environmental education program they took indicated that while 96 participants (44.7%) found environmental education adequate, 119 participants (55.3%) stated they found environmental education program inadequate. Prospective teachers' answers about inadequacies of environmental education program were evaluated in five categories.

- Gaining insufficient information about environment.
- Environmental insensitivity of lecturers.
- Scarcity of courses about environment.
- Using traditional teaching method in courses.
- Lacking outdoor activities.

Most of the prospective teachers ($N = 44, 36.9\%$) expressed that environmental education they took was not adequate for the courses about the environment. For 24 (20.1%) prospective teachers, the reason for the inadequacy of environmental education is to gain insufficient information from books, notes etc. about the environment. Additionally, 22 (18.4%) prospective teachers think that lecturers were insensitive towards the environment. Furthermore, 20 (16.8%) prospective teachers' reason for inadequacy is to be used traditional teaching method in the lesson. According to a small group of prospective teachers ($N = 9, 7.5\%$), environmental education is not adequate for lack of outdoor activities (Table 7).

Table 7. *Prospective teachers' views about inadequacy of environmental education program they took*

Inadequacies of environmental education program	<i>N</i>
gaining insufficient information about environment	24
environmental insensitivity of lecturers	22
scarcity of courses about environment	44
using traditional teaching method in courses	20
lacking of outdoor activities	9
Total	119

Some quotes of prospective teachers' answers were given below.

"...there are not enough courses about environment in our training program. We took only two courses about environment and it is not enough for constructing positive attitudes toward environment."

"...information about environmental problems in our books is very superficial. Also, we cannot gain detailed information from our notes. So, we have to gain information about environment and environmental problems from out of school source like internet, magazine etc."

"...it is aimed to construct high environmental attitudes toward environment but as far as I am concerned, our lecturers' attitudes toward environment are low. Because they advise us something to protect the environment like using public transportation, however; they do not do what they advise."

"...lecturers only give information about environmental problems and we memorize them. A few months later, we forget this knowledge. I think, it will be better if we become active in environmental courses and investigate into the environmental problems."

"...as far as I am concerned, the environmental education should be given in nature. For example, we can take environmental course in a forest or near a lake. I think, it will be more effective."

Discussion

The results indicate that prospective teachers graduate from the university having many misunderstandings concerning the greenhouse effect which can be summarized as follows:

- The greenhouse effect is to get much more sun's rays to the earth's surface.

- Holes in the ozone layer cause the greenhouse effect.
- Solid waste (unspoilt waste) increases the greenhouse effect.
- Nuclear stocks increase the greenhouse effect.
- The greenhouse effect will cause more people to get skin cancer.
- Negative results of the greenhouse effect will be felt in equator at most.
- Reducing starvation will reduce the greenhouse effect.
- Using unleaded petrol will reduce the greenhouse effect.

These misunderstandings are similar to previous limited studies conducted on prospective teachers' views about the greenhouse effect in other Turkish universities (Bal, 2004; Cin, 2006). This result shows that the majority of prospective teachers in Turkey have the same misunderstandings about the greenhouse effect and graduate from universities with these misunderstandings.

One remarkable misunderstanding of the study is that prospective teachers confuse greenhouse effect with ozone layer depletion. According to Cin (2006), the reason for this confusion is that two environmental problems have common features; both deal with sunlight and the result of atmospheric pollutions. This can cause prospective teachers to conflate cause and affect relationship of these two environmental issues. These similarities of two environmental problems cause teachers and students to adopt simplistic mental models for these issues. Groves & Pugh (2002) described simplistic models as cognitive illusions which hinder the development of correct understanding of complex issues in science.

According to our study, several reasons for presence of these misunderstandings among the prospective teachers can be suggested. One reason focuses on the role of the information sources about the greenhouse effect. Prospective teachers in our study stated that they mostly used printed and visual media, magazine-newspaper, television-radio and internet, to gain knowledge about the greenhouse effect instead of formal sources such as course book and lecturer and it can contribute to the development of misconceptions (Adler, 1992). For example, most of prospective teachers think that using unleaded petrol will reduce the greenhouse effect (#26). Unleaded petrol takes part in the media with its green image and associated environmentally friendly propaganda. Thus, students think unleaded petrol is for the environment compared to the leaded petrol (Boyes & Stanisstreet, 1993). Similarly, Khalid (2001) stated that the reason why everyone knew carbon dioxide as the only greenhouse gas was that other gases (e.g. Methane, nitrous oxide) were not discussed in the media. Surprisingly, the prospective teachers who use magazine-newspaper and their lecturer as information source for the greenhouse effect have the highest mean score. Coyle (2005) stated that there is the more superficial coverage of environmental issues in the media which produces

familiarity, rather than deep understanding. This familiarity can raise the prospective teachers' mean scores.

Another reason for these misunderstandings held by prospective teachers can be inadequate environmental education program which is implemented in teacher training program. According to participants, the environmental education program they took was not adequate. The most frequently cited reason why their environmental education program was inadequate was the scarcity of courses about the environment. Indeed, participants of this study take only two courses which are two-hour classes (Environmental chemistry and environmental health) during their teacher education. Khalid (2001) stated that prospective teachers, who take one or two courses, do not get the whole content and have misunderstandings about the environmental issues.

Furthermore, prospective teachers find environmental education inadequate for being used traditional teaching methods. According to Lord (1999), one reason for the misconceptions held by students is science classroom instruction. He suggested that teacher-centred teaching method cause students not to retain the information they learn. Meadows and Wiesenmayer (1999) suggested using innovative teaching methods such as constructivism in environmental class for eliminating students' misconceptions about environmental issues.

Besides, participants of the study indicated that they did not gain sufficient information from their books. According to Pekel (2005), little information about environmental issues in course books and notes causes the confounding of one environmental problem with others. This also explains that prospective teachers erroneously tend to relate ozone layer depletion to the greenhouse effect. Furthermore, it can be the reason why course books are the least using information source by prospective teachers (Table 5).

The t-test result showed that females reported higher mean scores on the items in the survey than the males in the study. This result coincides with the findings obtained by Tuncer et al. (2005) and Fernandez-Manzanal et al. (2007). According to Fernandez-Manzanal et al. (2007), one interpretation of this phenomenon is based on the fact that in social aspects and collective actions women tend to display a higher level of commitment and responsibility than men. Therefore, the females are more informed and sensitive about the environment and environmental problems.

Most of the prospective teachers have no membership in any environmental organizations and there is no significant difference between prospective teachers' mean scores based on membership in environmental organizations. Environmental organizations aimed to educate people and to increase the environmental awareness about environmental problems among the community (Ajiboye & Silo, 2008). But, most of the environmental organizations in Turkey study on general environmental

pollution. The number of environmental organizations which study special problems, such as global warming, ozone depletion, is not enough (Duru, 1995). Therefore, the number of environmental organizations which study special environmental problems such as greenhouse effect, ozone layer depletion should be increased and made a part of environmental education program in teacher education.

On the other hand, it appears that Turkish prospective teachers, in our sample, have a good understanding of some aspects of the greenhouse effect. For example, they seem aware that burning fossil fuels, increasing in deforestation and releasing too much carbon dioxide increase the greenhouse effect. It also well known that increase in the greenhouse effect can result in weather patterns, more flooding and disappearing in some species. Most of prospective teachers understood the roles of saving electricity, using of recycled paper and renewable sources of energy to alleviate the greenhouse effect.

Suggestions

The misunderstandings regarding the environmental issues held by prospective teachers raise some concerns because they will begin their professional career very soon (Pekel, 2005) and they can reflect their misunderstandings to their students. To improve the knowledge level of pre-service teachers and eliminate their misunderstandings, some changes which are summarized as follows should be made in teacher education programs:

- Number of the courses about the environment should be increased in teacher education programs.
- Student-centred methodologies (such as classroom discussions) should be used in the environmental education (Littledyke, 1996).
- The difference in the causes and consequences of different global problems in environmental class should be emphasized.
- Information about environmental issues in books and notes used in environmental education programs in teacher training should be given in more detailed.
- Outdoor activities such as visiting places where water is purified should be made in environmental education of prospective teachers (Papadimitriou, 1996).
- Environmental organizations should be introduced to students and be made students participate in these foundations (Uzun & Sağlam, 2007).

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Appendix

INSTRUMENT

PERSONAL INFORMATION

1- Gender

- female
- male

2- Information source about the Greenhouse Effect

- newspaper-magazine
- T.V.-radio
- internet
- lesson book
- friend
- lecturer

3- Do you think the environmental education program you take in university is adequate?

- yes
- no

If your answer is no, please explain why do you think the environmental education program you take is not adequate?

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4- Do you have membership in any environmental organizations (foundation, association, student club e.t.c.)?

- yes
- no

QUESTIONNAIRE
[Developed by Cin (2006)]

No	Statements	Agree	Not sure	Do not agree
Causes of the Greenhouse Effect				
1	The greenhouse effect is to get much more sun's rays to the earth's surface.			
2	Unconscious using of the environment by the people increases the greenhouse effect.			
3	Destroying the forest increases the greenhouse effect.			
4	Hole in the ozone layer cause the greenhouse effect.			
5	Solid waste (unspoilt waste) increases the greenhouse effect.			
6	Nuclear stocks increase the greenhouse effect.			
7	A rapid rising in population growth increases the greenhouse effect.			
8	Using fosil fuels increases the greenhouse effect.			
9	Diffusion of too much carbon dioxide in the atmosphere increases the greenhouse effect.			
10	Extensive volcanic eruptions increase the greenhouse effect.			
11	Solar explosions increase the greenhouse effect.			
Consequences of the Greenhouse Effect				
12	Average temperature of the world will increase about 2 degrees Celcius a hundred years later because of the greenhouse effect.			
13	If the greenhouse effect gets bigger, the risk of the epidemic diseases will increase.			
14	The greenhouse effect will cause more people to get skin cancer.			
15	Negative results of the greenhouse effect will be felt in equator at most.			
16	If the greenhouse effect gets bigger, there will be more flooding in the world.			
17	Some animals and plants will disappear as a result of the greenhouse effect.			
18	If the greenhouse effect gets bigger, submergence risk of the digs in shoreline will increase.			
19	Clarities among the seasons will decrease as a result of the greenhouse effect.			
20	The greenhouse effect will cause both animals and plants to migrate.			
Ways to reduce the Greenhouse Effect				
21	Saving electricity reduces the greenhouse effect.			
22	Using recycled papers more reduces the greenhouse effect.			
23	Using renewable energy resources reduces the greenhouse effect.			
24	Using public transport reduces the greenhouse effect.			
25	Reducing starvation reduces the greenhouse effect.			
26	Using unleaded petrol reduces the greenhouse effect.			