



The Effect of Pre-Service Mathematic Teachers' Socio-Economic Status on Their Ideas and Behaviors about Environment

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ABSTRACT

This study was carried out to explore whether or not pre-service mathematic teachers' opinions and attitudes about environmental issues do change according to their socio-economic status. This study is descriptive in nature. An inventory comprising of both open-ended questions and a Likert-scale questionnaire to investigate students' opinions and attitudes about environment was used to collect data. They were administered to 123 students totally. Results showed that pre-service mathematics teachers were considering that the most important environmental problems were global warming, drought, climate change and the pollution of environment. Moreover, it was found that pre-service mathematic teachers had moderate attitudes about the environment, although they had upper level opinions on it.

Keywords: Pre-service Mathematics Teacher; Environmental Subjects; Attitude.

INTRODUCTION

The needs of people have increased day by day in parallel with the developments in science and technology, and the increase in the population. This increase in the needs have caused the resources of nature to be used extreme and unconsciously. Thus, this situation have resulted in the impairment of the balance in nature and regional or universal problems treating also human kind (Morgil et al., 2002; Bozkurt et al., 2004; Şahin et al., 2004; Kızılaslan & Kızılaslan, 2005; Uzun, 2006). Some of these problems can be stated as water pollution which means the dirtiness of seas and rivers by chemical and nuclear wastes, air pollution which is the dirtiness in the air that human beings breathe with the toxic gas from factory chimneys and automobiles and the carbon dioxide from the consumed fossil fuels,

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soil pollution which is the dirtiness of soil resulting from the rubbishes or rubbish piles, acid rains, fertilizing and applying disinfectant, the extinction of animals and the plants by human kind, the perforation of ozone layer, the harmful sun rays for human beings, global warming and climate change. (Erten et al., 2003; Kızılaslan & Kızılaslan, 2005).

As environmental problems have become a threat for natural life and human kind in recent years, it has become inevitable for people to find solutions to these problems with an integral and scientific approach (Yücel et al., 2006). Until the beginning of 1970s, most countries had looked for solutions to deal with the problems by themselves (Soran et al., 2000). However, it was the first time that the environment and environmental problems have been mentioned in 1972 at the conference in Stocholm held by The United Nations, so that environmental problems have been regarded as an international issue (Soran et al., 2000; Şama, 2003; Özdemir et al., 2004; Şahin et al., 2004; Uzun & Sağlam, 2005; Uzun, 2006). It is the truth that permanent solutions should be enabled for these problems treating the both living and non-living beings by means of the struggles by nongovernmental organizations and legal measures implemented by government for the continuity of a livable environment. Environmental education has a great significance in this process (Yücel & Morgil, 1999; Soran et al., 2000; Sungurtekin, 2001; Bozkurt et al., 2004; Uzun & Sağlam, 2005; Uzun & Sağlam, 2006; Uzun, 2006; Alım, 2006).

The main source of many environmental problems is irresponsible environmental behaviors of individuals. Certainly the most significant factor impacting an individual's behaviors is his/her attitudes (Bradley et al., 1999). Therefore, the goal of environmental education is to make all people on the world be more sensitive about environment and protection of environment by providing them develop positive attitudes, emotions, thoughts or behaviors on environment without considering the distinctions such as language, religion, race, age, gender, rich or poor, villager-citizen, academician or farmer, teacher or student, and so forth (Şimşekli, 2001; Erten et al., 2003; Özmen et al., 2005; Erol & Gezer, 2006). It is a unfortunate, but truth that the individuals having negative attitudes, emotions, thoughts or behaviors against environment are insensitive for environmental problems and they also continue to create problems for environment (Uzun & Sağlam, 2006). For this reason, environmental education should not only give information to the people and make them have positive feelings about environment, but also should make them reflect their positive ideas and attitudes to their behaviors about environment.

When the literature is reviewed, it is possible to find many studies carried out both in Turkey and in other countries about environment, environmental education and environmental problems. While these studies are generally on the students' attitudes towards environment and the status of environmental education at the level of pre-education, elementary education and secondary education, the studies carried out at university level have generally aimed to determine the knowledge, views, attitudes, and behaviors about environment, environmental education and environmental problems of students from the departments of biology, chemistry, social sciences, medicine and nursery. Since it is impossible to mention about the whole content of these studies, only a few of these studies considered to be related with our study have been summarized here.

Özdemir et al. (2004) investigated a total of 301 junior and senior medical faculty students' beliefs, understandings, attitudes and behaviors about environmental problems. It was found that the top three of the most important environmental problems with which the world have been faced were respectively air pollution (37.5%), wastes (36.2%), and the decline in the area of forests (30.6%). It was determined that female students were more sensitive and had more knowledge about environment.

Şama (2003) conducted a study to explore a total of 442 junior and senior prospective

teachers' attitudes towards environment. He conducted the study with the prospective teachers from different departments of Gazi Faculty of Education in Turkey. It was found out that there were statistically significant differences among students' attitudes towards environment according to their genders, settlement places in which they had lived, fathers' education levels, fathers' jobs, and families' income.

Uzun and Sağlam (2005) conducted a study to determine the effects of socio-economic levels of students on their environmental awareness and knowledge. They implemented an environmental awareness test and environmental knowledge test to the sample consisting of 258 high school students. They classified the students in the sample into *low-income, middle-income, and high-income students* and investigated whether or not their environmental awareness and knowledge were differed according their socio-economic levels. It was found that there was significant difference in the average environmental awareness between the groups in favor of the middle socio-economic group of students. There was no significant difference between the other two groups of students.

Yücel et al. (2006) conducted a study in order to determine environmental awareness of people living in Adana city of Turkey, which is the place where different environmental problems had been observed. A questionnaire form developed by researchers was implemented to 500 individuals and their views and attitudes towards environmental problems were investigated. It was determined that the level of environmental awareness of people in Adana city was at a middle level. It was also found that the environmental awareness level was significantly higher for females in comparison with males and higher for young people in comparison with older ones.

Vaizoğlu et al. (2005) conducted a study to explore students' environmental consciousness. They conducted the study with a total of 342 final year Medical Faculty students at Hacettepe University. They used a form to collect data. As a result of the evaluation of the data gathered from Environmental Consciousness Investigation Form, it was found that students' environmental consciousness level was insufficient.

Erol and Gezer (2006) conducted a study to explore prospective teachers' attitudes towards environment and environmental problems. They conducted the study with 225 prospective primary school teachers. They used Attitudes Scale for Environment and Environmental Problems to collect the relevant data. The results showed that prospective teachers' attitudes toward environment and environmental problems left much to be desired. It was found that the level of female prospective teachers' attitudes towards environment and environmental problems are significantly higher than male ones. In addition, it was found that there were statistically significant differences among prospective teachers' attitudes towards environment and environmental problems according to their mothers' job, ages, number of siblings and places of settlement. However, it was found that there were no statistically significant differences among prospective teachers' attitudes towards environment and environmental problems according to their fathers' job, parents' level of education, houses in which they had lived, families' income and courses about environment which they had taken before.

Özmen et al. (2005) implemented an environmental attitude scale to determine the attitudes of 410 students from School of Health, Vocational School of Health Service and Medical Faculty in a university towards environmental problems. They also investigated the factors influencing students' attitudes towards environmental problems. Although more than half of the students in the sample stated that they were sensitive about environmental problems, it was found that only about 15% of them had been participated in an environmental activities carried out by any environmental institution or association. In addition, twenty years and over female students from Medical Faculty and Vocational School of Health Service and the students the longest part of whose life had been in a city

centre were more sensitive about the subjects concerning environment.

As mentioned above, the main aim of environmental education is to bring up individuals, without discrimination concerning their area of interest and study, who are sensitive about environment and have positive attitudes (emotion, thought, and behavior) towards protection of environment. However, when the literature is examined it has been found that there is no study which carried out to determine views of pre-service mathematics teacher concerning environment and environmental problems. Regarding this reason, the aims of the study are to determine pre-service mathematics teachers' ideas and behaviors about environment and environmental problems, and to investigate whether or not socio-economic features of pre-service mathematics teachers affect on their ideas and behaviors. In other words, this study was carried out to find solutions to two main problems. These are;

- 1- What are the ideas and behaviors of pre-service mathematics teachers about environment and environmental problems?
- 2- Do socio-economic features have impact on pre-service mathematics teachers' ideas and behaviors about environment and environmental problems?

METHODOLOGY

Survey method was used in this descriptive study to collect data about prospective mathematics teacher' ideas and behaviors about environment and environmental problems. The data related to the first problem of the study was obtained from the students' written responses to the open-ended questions which were developed in accordance with the literature (Özmen et al., 2005). Environmental attitudes scale, which was developed by Uzun and Sağlam (2006) and the validity and the reliability of which were ensured by the authors, were used to collect data about their ideas and behaviors about environment, and their personal information which was used to find solutions for the second research problem. The questionnaire consisted of two parts one of which investigated environmental behaviors and the other investigated environmental ideas of prospective mathematics teachers. The Cronbach α - reliability coefficient of the questionnaire was 0.80 ($\alpha=0.80$) and the correlation between two split half coefficient was 0.76. The questionnaire was composed five-point Likert scale questions. 5 points are given to positive answers such as always or strongly agree to the sentences, and 1 point is given to negative answers such as no, never or strongly disagree to the sentences. The questionnaire consisted of a total of 27 items/sentences, 13 of which are related to environmental behavior (environmental behaviors sub-scale), and 14 of which are related to environmental ideas (environmental ideas sub-scale). Therefore, a student can take score between 13 and 65 from the environmental behavior items/sentences (environmental behaviors sub-scale) and he/she can take score between 14 and 70 from the environmental ideas items/sentences (environmental ideas sub-scale). Students whose mean scores are ranged from 1 to 13 on the environmental behavior items/sentences were classified in the category of *very low*. Students whose mean scores are ranged from 14 to 26 on the environmental behavior items/sentences were classified in the category of *low*. Students whose mean scores are ranged from 27 to 39 on the environmental behavior items/sentences were classified in the category of *medium*. Students whose mean scores are ranged from 40 to 52 on the environmental behavior items/sentences were classified in the category of *high*. Students whose mean scores are ranged from 53 to 65 on the environmental behavior items/sentences were classified in the category of *very high*. Students whose mean scores are ranged from 1 to 14 on the environmental ideas items/sentences were classified in the category of *very low*. Students whose mean scores are ranged from 15 to 28 on the environmental ideas items/sentences were classified in the category of *low*. Students whose

mean scores are ranged from 29 to 42 on the environmental ideas items/sentences were classified in the category of *medium*. Students whose mean scores are ranged from 43 to 56 on the environmental ideas items/sentences were classified in the category of *high*. Students whose mean scores are ranged from 57 to 70 on the environmental behavior items/sentences were classified in the category of *very high*.

The questionnaire was implemented to a total of 123 senior prospective mathematics teachers at Fatih Faculty of Education of Karadeniz Technical University in the spring term of 2006-2007 academic year and the data were collected. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software in terms of frequency (f)-percentage (%) distribution, mean, t-test and variance analysis (ANOVA).

FINDINGS AND DISCUSSION

The findings of the study are presented and discussed under two headings by considering the research problems of the study.

1-Findings and discussion about pre-service mathematics teachers' ideas about environment and environmental problems

The distributions of pre-service mathematics teacher' ideas on environment and environmental problems are given in Table 1. 71,5% of the students had taken any course about environment during their primary or secondary school education. More than half of the students (53,4%), who had taken courses on environment before their university educations, stated that they had taken *Health and Traffic* course (f=47).

While 79,6% of pre-service mathematics teacher responded that "yes, environmental issues attract my attention" and 9,9% of them responded that "sometimes, it changes according to topic", 10,9% of them responded that "no, environmental issues don't attract my attention" to the question whether or not the environmental issues attract their attention. It was determined that the top three of the environmental problems attracting the attention of the pre-service mathematics teacher were *global warming, climate change and drought* (f=50), *environmental pollution such as air, water, soil and noise pollution* (f=29) and *plants, forests and forestation* (f=11), while the least attracting ones were *the extinction of living species* (f=3), *the perforation of ozone layer* (f=3), and *the extreme and unconscious usage of natural resources* (one person).

It was found that 97, 5% of pre-service mathematics teacher in the sample had no memberships for any non-governmental organization and they hadn't participated in an environmental activities carried out by these organizations. It was determined that only 2,5% of them had memberships for environmental associations such as *Environment and Culture Association* (f=1), *Foundation for Combating Erosion, Reforestation and the Protection of Natural Habitats* (f=1), and *Environment Club and Nature Association* (f=1) and they also participated in an environmental activities carried out by these organizations. This finding is parallel with Yücel et al. (2006)'s study in which they found that the number of individuals who were the member of non-governmental organizations on environment and were quite low.

As seen in Table 1, 61,7% of pre-service mathematics teachers stated that environmental problems had always been discussed in their family and 26,1% of them stated that environmental problems had sometimes been discussed in their family, while 12,2% of them stated that they had never talked about environmental problems within their family. It was determined that the most frequently discussed environmental problems within the families of pre-service mathematics teachers in the sample were *environmental*

pollution such as air, water, soil and noise pollution (f=46), global warming, climate change, and drought (f=31), and solid wastes and garbage (f=16), while the least mentioned environmental problems were the extinction of living species (f=3), the perforation of ozone layer (f=2), and the waste batteries (f=2).

Table 1. *The pre-service mathematics teacher's ideas about environment and environmental problems*

Questions or evaluated situations	Answer	F	%	Explanations
Have you taken any course or studies about environmental issues?	Yes	88	71,5	1- Health and Traffic (f=47) 2- Environmental Issues (f = 22) 3- Human and Environment (f=13) 4- Units or subjects on environment in different courses such as Science, Biology, and Geography (f=6)
	No	35	27,5	
Do environmental issues attract your attention?	Yes	98	79,6	The environmental issues which attracted students' attention: 1- Global warming, climate change, and drought (f=50) 2- Environmental pollution such as air, water, soil, and noise pollution (f=29) 3- Plants, forests and forestation (f=11) 4- Natural disasters such as erosion, earthquake, flood, and volcanic eruption (f=6) 5- Ecological balance (f=6) 6- Waste batteries (f=5) 7- Nuclear weapons, power plants, and radiation (f=4) 8- Recycling of waste garbage (f=4) 9- The extinction of living species (f=3) 10-The perforation of ozone layer (f=3) 11-The extreme and unconscious usage of natural resources (f=1)
	Sometimes, it changes according to topics	12	9,9	
	No	13	10,5	
Do you have a membership for any non-governmental organization? Have you participated in an environmental activities carried out by these organizations?	Yes	3	2,5	Non-governmental organizations of which students were a member: 1. Environment and Culture Association (f=1) 2. Foundation for Combating Erosion, Reforestation and the Protection of Natural Habitats (f=1) 3. Environment Club and Nature Association (f=1)
	No	120	97,5	
How often are environmental problems discussed among your family members?	Always	76	61,7	The environmental issues discussed between students' family members: 1- Environmental pollution such as air, water, soil, and noise pollution (f=46) 2- Global warming, climate change, and drought (f=31) 3- Solid wastes and garbage (f=16) 4- Destruction of green fields and forests/Forestation (f=10) 5- The extreme usage of natural resources and being consumed of natural resources (f=6) 6- Natural disasters such as erosion, earthquake, flood, and volcanic eruption (f=4) 7- The extinction of living species (f=3) 8- The perforation of ozone layer (f=2) 9- Waste batteries (f=2)
	Sometimes	32	26,1	
	Never	15	12,2	

Table 1. Continued..

Do you think environmental education should be in place in your university education program? Why?	Yes	68	55,3	Reasons which students listed: <ul style="list-style-type: none"> • Because all teachers or educators should be more conscious and sensitive about environment and environmental education, they should be well educated about environment and environmental problems (a=40) • Because all people living on earth are to be interested in environment and environmental problems, everyone should be educated and informed about the environment and environmental problems (f=45) • Environmental education is not related to mathematics. Therefore, environmental education should be taken place in primary or secondary school program rather than university programmes (f=21)
	Elective	9	7,3	
	No	46	37,4	
In which education level students should be in place environmental education?	Pre-school	10	8,1	
	Primary	95	77,2	
	Secondary	7	5,7	
	University	0	0	
	Every level	9	7,3	
	No answer	2	1,7	
Do you think yourself to be sensitive about environment and environmental problems?	Yes	68	52,2	
	Sometimes, it changes according to topic	46	37,4	
	No	9	7,4	

As seen in Table 1, 55, 3% of the pre-service mathematics teachers agreed that a course focusing on environmental education should be taken place in teacher education programmes at universities by presenting some reasons such as “*all teachers or educators should be more conscious and sensitive about environment and environmental education (f=40)*” and “*all people living on earth are to be interested in environment and environmental problems (f=45)*”. Only 7,3% of the students have answered that it should be taught at every level of education to the question “*In which education level students should be taken environmental education?*”. Similar findings were also revealed in the study by Özmen et al. (2005).

It was found that more than half of the pre-service mathematics teachers in the sample (52, 2%) stated they felt themselves sensitive for environment and environmental issues. Moreover, 37, 4% of them stated that their sensitiveness changed up to the problem. Both the frequencies and the percentages of the pre-service mathematics teachers’ responses to another question “*What are the top five of the most important environmental problems with which the world has been faced?*” were given in Table 2.

Table 2. *The most important environmental problems with which the world has been faced according to the pre-service mathematics teacher*

Importance	Environmental Problems	F	%
1	Global warming, drought, and climate change	93	75,6
2	Environmental pollution such as air, water, soil and noise pollution	89	72,4
3	Solid or liquid chemical wastes and garbage	41	33,3
4	Destruction of green fields and forests	40	32,5
5	The decline in the amount of clean water sources	23	18,7
6	The perforation of ozone layer	22	17,9
7	Natural disasters such as erosion, earthquake, flood, and volcanic eruption	19	15,4
8	Non-planned urbanization and concretion	19	15,4
9	Polluting seas	16	13
10	The extinction of living species	15	12,2
11	The unconsciousness and insensitiveness of humans about environment	14	11,4
12	Nuclear Pollution (nuclear weapons, power plants, and radiation)	9	7,3
13	The extreme and unconscious usage of natural resources	9	7,3
14	The damage of ecological balance	7	5,7
15	The usage of non-recyclable materials	3	2,4
16	Agricultural pollution (applying disinfectant, fertilizing, and unsteady watering)	2	1,6
17	Acid rains	2	1,6
18	Biological weapons	1	0,8
19	Excessive population growth	1	0,8
20	Waste batteries	1	0,8
	Total	426	

Note: The total of the percentages may not be 100%, or the total of the frequencies may not equal to the number of students in the sample, because each pre-service mathematics teacher wrote down five (or more than one) environmental problems.

As seen in Table 2, the top five of the most important environmental problems with which the world has been faced were respectively *global warming, drought, and change of climate* (75,6%), *environmental pollution such as air, water, soil and noise pollution* (72,4%), *solid or liquid chemical wastes and garbage* (33,3%), *destruction of green fields and forests* (32,5%), and *the decline in the amount of clean water sources* (18,7%) according to the prospective teachers in the sample. On the other hand, the least important ones were listed as *agricultural pollution (applying disinfectant, fertilizing, and unsteady watering)* (1,63%), *acid rains* (1,63%), *biological weapons* (0,8%), *excessive population growth* (0,8%) and *waste batteries* (0,8%). While *global warming, drought, and change of climate* was determined as the most significant environmental problem with which the world has been faced in this study, Vaizoğlu et al. (2005) found that the most important environmental problem was *the decline in the area of forests* according to Medical Faculty students in the sample of their study. Besides, *air pollution* was determined as the most significant environmental problem by the students in the sample of Özdemir et al. (2004)'s study. This discrepancy between the results of our study and the other studies mentioned above may stem from the differences in times which these studies have carried out. Because *global warming, drought, and change of climate* have been frequently seen on both visual and written media in recent years and kept up-to-date, this result is different the result of earlier studies which were conducted four or five years ago.

2-Findings and discussion about the change on pre-service mathematics teachers' ideas and behaviors about environment and environmental problems according to their socio-economic features

Socio-economic features of students and students' average points on environmental behaviors and environmental ideas sub-scales have been presented in Table 3 and Table 4. In addition, the results of the statistical analyses on whether or not there is a meaningful correlation between the scores on the sub-scales and the socio-economic features of students are presented.

Table 3. The relationship between socio-economic features of students and their average points on environmental ideas and environmental behaviors sub-scales.

Features		F	%	Environmental Attitude Scale			
				Environmental behavior Sub-scale		Environmental Ideas Sub-scale	
				X_{ort}	p^*	X_{ort}	p^*
Gender	Female	69	56,1	38,05	$t_{(121)}=2,10$ $p=0,03^{**}$	65,33	$t_{(121)}=3,27$ $p=0,001^{**}$
	Male	54	43,9	35,09		62,22	
	Total	123	100	36,57		63,77	
Age	21 years and below	27	22,0	37,00	$t_{(121)}=0,18$ $p=0,85$	63,77	$t_{(121)}=0,20$ $p=0,83$
	22 years and over	96	78,0	36,68		64,02	
	Total	123	100	36,84		63,89	
Monthly Average Expense	Under 250 TL	39	31,7	37,15	$t_{(121)}=0,38$ $p=0,70$	64,10	$t_{(121)}=0,18$ $p=0,85$
	250 TL and above	84	68,3	36,57		63,90	
	Total	123	100	36,86		64,00	
Settlement place being lived the longest	City center	67	54,5	37,01	$F_{(2-120)}=0,838$ $p=0,435$	64,13	$F_{(2-120)}=0,159$ $p=0,853$
	District center	38	30,9	35,60		63,55	
	Village/Town	18	14,6	38,33		64,22	
	Total	123	100	36,98		63,97	
Smoking Habit	Smoker	25	20,3	33,00	$F_{(2-120)}=3,812$ $p=0,025^{**}$	64,64	$F_{(2-120)}=0,647$ $p=0,526$
	Given up	7	5,7	38,86		62,00	
	Never smoked	91	74,0	37,63		63,93	
	Total	123	100	36,49		63,52	

* Independent t-test was used for the comparison of two groups, while One-way Variance Analysis (ANOVA) was used for the comparison of more than two groups.

**If $p < 0, 05$, there is a statistically significant difference between groups.

As seen in Table 3, there is statistically significant difference between the pre-service mathematics teachers' scores on environmental behavior sub-scale in terms of the gender variable [$t_{(121)} = 2,10$, $p=0,03 < 0,05$]. The environmental behavior sub-scale scores of female pre-service mathematics teachers ($X_{female}=38, 05$) were higher than males ($X_{male}=35, 09$). Similarly, there is statistically significant difference between the pre-service

mathematics teachers' scores on environmental ideas sub-scale in terms of the gender variable [$t_{(121)} = 3,27, p = 0,001 < 0,05$]. The environmental ideas sub-scale scores of female pre-service mathematics teachers ($X_{\text{female}} = 65,33$) were higher than males ($X_{\text{male}} = 62,22$). It can be concluded that female pre-service mathematics teachers are more sensitive about environment and environmental issues than males, depending on these findings. Similar results have also been revealed from earlier studies by Riechard and Peterson (1998), Worsley and Skrzypiec (1998), Tikka et al. (2000), Şama (2003), Özdemir et al. (2004), Özmen et al. (2005), Erol and Gezer (2006), Yücel et al. (2006), Vaizoğlu et al. (2005), and Alp et al. (2008).

As seen in Table 3 and 4, there is no statistically significant difference between the pre-service mathematics teachers' scores on environmental behaviours sub-scale in terms of many variables such as *age* [$t_{(121)} = 0,18, p = 0,85 > 0,05, X_{\text{ort}} = 36,84$], *monthly average expense* [$t_{(121)} = 0,38, p = 0,70 > 0,05, X_{\text{ort}} = 36,57$], *the settlement place being lived the longest* [$F_{(2-120)} = 0,838, p = 0,435 > 0,05, X_{\text{ort}} = 36,98$], *the number of siblings* [$F_{(2-120)} = 0,964, p = 0,384 > 0,05, X_{\text{ort}} = 36,76$], *the education level of parents* [$t_{(121)} = 1,17, p = 0,24 > 0,05, X_{\text{mother}} = 35,55; t_{(121)} = 0,72, p = 0,47 > 0,05, X_{\text{father}} = 36,43$] and *the family income* [$F_{(2-120)} = 0,198, p = 0,821, X_{\text{ort}} = 36,76$]. With similar to environmental behaviors sub-scale scores, it is also seen that there is also no statistically significant difference between the pre-service mathematics teachers' scores on environmental ideas sub-scale in terms of the mentioned variables.

It was determined that pre-service mathematics teachers at the age of 21 and below had higher scores than those at the age of 22 and over on environmental behavior sub-scale, while the former ones had lower scores than and latter ones on environmental ideas sub-scale. However, there is no statistically significant difference between the pre-service mathematics teachers' scores on both environmental behaviors and environmental ideas sub-scales in terms of age variable even if there is little difference between two groups of students' mean scores on sub-scales. This finding is parallel with Özdemir et al. (2004)'s study proving that there is no significant difference between students' attitudes towards environment according to age variable. On the other hand, this finding is not harmonious with Özmen et al. (2005)'s study in which it was reported that students at the age of 20 and over had more positive attitudes towards environment than those under 20 years old. Erol and Gezer (2006) also found that older students had more positive attitudes towards environment than younger ones.

It was determined that pre-service mathematics teachers whose monthly expense were under 250 Turkish Liras (TL) had higher scores than those whose monthly expense were 250 TL and over on both environmental behaviors and environmental ideas sub-scales. This finding shows that the individuals with higher monthly expenditure do not have more positive attitudes towards environment and environmental problems than those with lower monthly expenditure.

It was found that pre-service mathematics teachers who had lived the longest in village or towns had higher scores than those who had lived the longest in city or district center on both environmental behaviors and environmental ideas sub-scales. This special result is not harmonious with the results of other studies conducted by Özmen et al. (2005), Altın et al. (2002), Şama (2003), and Erol and Gezer (2006) in which it was reported that students who spent most of his/her life in big cities had more positive attitudes towards environment than those who spent most of his/her life in small villages or towns. These particular results could be interpreted that individuals living in small villages or towns could also have positive attitudes towards environment.

It was determined that there is statistically significant difference between the pre-service mathematics teachers' scores on environmental behavior sub-scale in terms of the

smoking habits variable [$F_{(2-120)}=3,812, p=0,025 < 0,05, X_{ort}=36,49$]. The pre-service mathematics teachers who had given up their smoking habits got higher scores ($X_{ort}=38,86$) than those who were smokers ($X_{ort}=33,00$) and those who had never smoked ($X_{ort}=37,63$) on environmental behaviors sub-scale. On the contrary, as seen in Table 3, there is no statistically significant difference between the pre-service mathematics teachers' scores on environmental ideas sub-scale in terms of the smoking habits variable [$F_{(2-120)}=0,647, p=0,526 > 0,05, X_{ort}=63,52$]. Surprisingly, it was found that the mean score of pre-service mathematics teachers who were smokers ($X_{ort}=64,64$) on environmental ideas sub-scale was slightly higher than those who had given up smoking ($X_{ort}=62,00$) and those who had never smoked ($X_{ort}=63,93$).

It was found that pre-service mathematics teachers having five or more siblings had higher scores than those having one or two siblings or those having three or four siblings on both environmental behaviors and environmental ideas sub-scales. However, there is no statistically significant difference between the pre-service mathematics teachers' scores on both environmental behaviors and environmental ideas sub-scales in terms of the variable of the number of siblings. The effects of the number of siblings on students' attitudes toward environment have been searched in different studies. Özmen et al. (2005) found that students who had one or two siblings took higher scores than those who had three or more siblings from environmental attitude scale. Erol and Gezer (2006) also found that students having a family consisting of four or more members had more positive attitudes towards environment than those having a family consisting of less than four members and there was statistically significant difference between the scores of students in terms of the variable of the number of family members. The results of these studies are not harmonious with the findings of our study. This particular finding related to effects of the number of siblings on students' attitudes towards environment indicates that students' attitudes towards environment is not always affected negatively that when the number of their siblings is increased.

Table 4. The relationship between the characteristics of students' families and their scores on environmental behavior and ideas sub-scales

Family Characteristics	Sub-Characteristics	f	%	Environmental Attitude Scale				
				Environmental Behaviors Sub-scale		Environmental Ideas		
				X_{ort}	p^*	X_{ort}	p^*	
Number of Siblings	1 or 2 siblings	37	30,1	37,27	$F_{(2-120)}=0,964$ $p=0,384$	64,05	$F_{(2-120)}=0,083$ $p=0,92$	
	3 or 4 siblings	66	53,7	35,92		63,80		
	5 and more siblings	23	16,3	38,55		64,35		
	Total	123	100	36,76	63,97			
Education level of parents	M	Primary Education or lower levels	112	91,1	37,01	$t_{(121)}=1,17$ $p=0,24$	63,67	$t_{(121)}=1,89$ $p=0,06$
		Secondary Education and	11	8,9	34,09		66,90	
	Total		123	100	35,55		65,28	
	F	Primary Education or lower levels	94	76,4	37,04	$t_{(121)}=0,72$ $p=0,47$	63,71	$t_{(121)}=0,93$ $p=0,35$
		Secondary Education and	29	23,6	35,82		64,79	
	Total		123	100	36,43		64,25	

Table 4. Continued..

Jobs of parents	M	Housewife	103	83,7	36,86	$t_{(121)}=0,344$ $p=0,73$	63,49	$t_{(121)}=2,220$ $p=0,028$ $**$
		Still working / Worked	20	16,3	36,20		66,40	
	Total		123	100	36,53		64,94	
	F	Unemployed	11	8,9	35,36	$t_{(121)}=0,613$ $p=0,54$	61,00	$t_{(121)}=1,916$ $p=0,058$
		Still working / Worked	112	91,1	36,89		64,25	
	Total		123	100	36,12		62,62	
Family Income	Income higher than expenses		28	22,8	37,50	$F_{(2-120)}=0,198$ $p=0,821$	64,00	$F_{(2-120)}=1,109$ $p=0,333$
	Income equal to expenses		75	60,0	36,65		64,39	
	Income lower than expenses		20	16,3	36,10		62,35	
	Total		123	100	36,76		63,97	

* Independent t-test was used for the comparison of two groups, while One-way Variance Analysis (ANOVA) was used for the comparison of more than two groups.

**If $p < 0,05$, there is a statistically significant difference between groups.

It was found that pre-service mathematics teachers whose parents were less educated (being graduated from primary school, left schools at any grades of primary school, or took no education) had higher scores than those whose parents were more educated (being graduated from secondary school, college, university, or more) on environmental behaviors sub-scale. On the contrary, pre-service mathematics teachers whose parents were less educated had lower scores than those whose parents were more educated on environmental ideas sub-scale. Similar results have also been revealed from earlier studies by Özmen et al. (2005) and Altın et al. (2002). Erol and Gezer (2006) and Vaizoğlu et al. (2005) determined that there was no statistically significant difference between the environmental attitude scores of students in terms of the education level of parents even if there is little difference between the mean score of students whose parents were graduated from universities and those whose parents were less educated in favor of the former ones. Şama (2003) reported that there was statistically significant difference between the scores of students in terms of the variable of the fathers' education level in favor of the students whose father had been graduated from university. He found that students whose father had been graduated from university had significantly more positive attitudes towards environment than the others. Alp et al. (2008) conducted a study in which they investigated the factors effecting students' knowledge and attitudes about environment found that the education level of mother did not affect students' knowledge and attitudes about environment, while increasing education level of father affected positively to the students' knowledge about environment. However, they also found that students' attitudes towards environment did not change in spite of increasing education level of their fathers. Similar data with regard to the effects of the education level of parents on students' ideas about environment in both our study and other mentioned studies shows that students ideas or knowledge about environment are generally improving in a positive way when the education level of their parents increases. However, this positive change has not been observed on students' environmental behaviors. Although the students have been aware of the environmental problems and they have both knowledge and ideas about what should be done for overcoming these problems, it is quite thought-provoking that they couldn't reflect their ideas to their behaviors. Teaching environment or environmental issues

theoretically and in a traditional manner like the other natural or social sciences can be the reason of this situation. The most important obstacles that make it difficult for students to reflect their ideas about environment to their behaviors is current environmental education courses (1) which are teacher centered and not require students actively participate in real life projects, (2) in which students are not informed about the purposes, the functions, and the projects of non-governmental organizations related to environment, and (3) which does not encourage students to become a member of these organizations and not support them to participate actively in the activities carried out by them.

It was determined that there is no statistically significant difference between the pre-service mathematics teachers' scores on environmental behaviors sub-scale in terms of the variable of the jobs of parents (for mother; [$t_{(121)}=0,344$, $p=0,73 > 0,05$, $X_{mother}=36,53$], for father; [$t_{(121)}=0,613$, $p=0,54 > 0,05$, $X_{father}=36,12$]). However, there is statistically significant difference between the pre-service mathematics teachers' scores on environmental ideas sub-scale in terms of mothers' jobs [$t_{(121)}=2,220$, $p=0,028 < 0,05$, $X_{mother}=64,94$]. The pre-service mathematics teachers whose mothers are still working/or worked ($X_{ort}=66, 40$) had higher scores than those whose mothers are housewives ($X_{ort}=63, 49$) on environmental ideas sub-scale. As seen in Table 4, there is no statistically significant difference between the pre-service mathematics teachers' scores on environmental ideas sub-scale in terms of fathers' jobs [$t_{(121)}=1,916$, $p=0,058 > 0,05$, $X_{father}=62,62$]. Nevertheless, the mean scores of the pre-service mathematics teachers whose fathers are still working/or worked are higher than those of the pre-service mathematics teachers whose fathers are not working on both environmental behavior and environmental ideas sub-scales. This finding is parallel with Erol and Gezer (2006)'s study reporting that there is no significant difference between students' attitudes towards environment according to their fathers' jobs, while there is significant difference between students' attitudes towards environment according to their mothers' jobs. Moreover, they found that students whose mothers are still working and whose fathers are farmers had more positive attitudes towards environment than those whose mothers are housewives and whose fathers have the other jobs. On the other hand, our finding is not harmonious with Şama (2003)'s study in which it was reported that there were statistically significant differences between students' attitudes towards environment in terms of their fathers' job. They found that students whose fathers are self-employed such as lawyer, doctor, tradesman, and industrialist had more positive attitudes towards environment than the others. When the findings with regard to the effects of the jobs of parents on students' attitudes and behaviors about environment in both our study and other mentioned studies are considered together, we are unable to do generalization about which occupational groups have more positive attitudes and behaviors about environment. However, it can be said that students whose fathers and mothers are working or worked have more positive ideas about environment than those whose mothers are housewives and whose fathers are unemployed.

It was found that pre-service mathematics teachers whose families' income were high had higher scores than those whose families' income were low on both environmental behaviors and environmental ideas sub-scales. This finding related to effects of the families' income on students' ideas and behaviors about environment is parallel with Özmen et al. (2005) and Altın et al. (2002)' studies reporting that students having high-income families had more positive attitudes towards environment than those having low-income families. On the other hand, our finding is not harmonious with Erol and Gezer (2006)'s study in which it was reported that there were no statistically significant differences between students' attitudes towards environment in terms of their families' income. In contrary to our finding, they even found that students whose families had low-

income had higher scores on environmental attitudes questionnaire than those whose families had high-income. When the findings with regard to the effects of the family income on students' attitudes and behaviors about environment in both our study and other mentioned studies are considered together, it can be deduced that students whose family incomes are high does not always have more positive environmental attitudes or behaviors than those whose family incomes are low.

Dependent t-test was applied to the pre-service mathematics teachers' scores on both sub-scales in order to evaluate all data obtained from the study and to define whether or not statistically significant difference between their scores on the environmental ideas sub-scale and the environmental behaviors sub-scale. The results of the *dependent t-test* are given in Table 5.

Table 5. The results of the dependent t-test applied to the pre-service mathematics teachers' scores on both sub-scales

Environmental Attitude Questionnaire	N	X	S	sd	t	p*	Correlation(r)
Environmental Behaviours	123	36,75	7,87	122	35,48	0,000**	0,226
Environmental Ideas	123	63,96	5,44				

* *Dependent t-test*

** If $p < 0,05$, there is a statistically significant difference between groups.

Dependent t-test results indicate that there is statistically significant difference between the scores of pre-service mathematics teachers on environmental behaviors and environmental ideas sub-scales [$t_{(122)}=35,48$, $p < 0,05$]. As seen in Table 5, the mean score of pre-service mathematics teachers on environmental behavior sub-scale is 36, 75, while the mean score of them on environmental ideas sub-scale is 63, 96. When the mean scores of pre-service mathematics teachers on both scales are examined, it can be induced that their environmental behaviors are at *medium level*, while their environmental ideas are at *high level*. This situation shows that there is a notable discrepancy between the pre-service mathematics teachers' environmental behavior and their environmental ideas. In other words, the pre-service mathematics teachers could not reflect their ideas to their behaviors although they are aware of the environmental problems and they have both information and ideas about what precautions should be taken for these environmental problems. This result is in harmonious with Yücel et al. (2006)' study having determined there is significant difference between people's level of consciousness of environment and their attitudes towards environment. These situations revealed from both our study and the other studies are also parallel with Alp et al. (2006, 2008)'s studies have reported that students did not have enough knowledge about environment and environmental issues, while their attitudes towards environment were at the highest level. The final results which the findings of both our study and the other studies has been implying is that students have positive attitudes and ideas about environment although they don't have enough knowledge about environment and environmental issues and they don't exhibit necessary behaviors related to environment. Similar results have been reported in some of the earlier studies on students' attitudes, ideas, behaviors or knowledge about environment (Dimopoulos and Pantis, 2003; Makki et al., 2003).

RESULTS

The results of the study are; as follow:

- ~ The vast majority of the pre-service mathematics teachers in the sample have taken different school courses such as *Health and Traffic, Environmental Issues, and Human and Environment* or have studied on the subjects about environment in different courses such as *Science, Biology, and Geography* through their primary and secondary education.
- ~ The pre-service mathematics teachers in the sample have hardly become a member of an environmental association and participated in environmental activities through his life, although more than half of them have stated that environmental issues are always discussed in their family and a large majority of them have stated they are interested in environment and environmental problems and feel themselves sensitive about environment and environmental issues.
- ~ More than half of pre-service mathematics teachers in the sample have agreed that a course focusing on environmental education should be taken place in teacher education program, because all people living on earth are to be interested in environment and environmental problems and especially teachers or other educators are to be more conscious and sensitive about environment and environmental education.
- ~ The top five of the most important environmental problems with which the world has been faced are respectively *global warming, drought, change of climate, environmental pollution such as air, water, soil and noise pollution, solid or liquid chemical wastes and garbage, destruction of green fields and forests, and the decline in the amount of clean water sources* according to the pre-service mathematics teachers in the sample.
- ~ Female pre-service mathematics teachers are more sensitive about environment and environmental issues than males because there is statistically significant difference between the pre-service mathematics teachers' scores on both environmental behaviors and environmental ideas sub-scales in favor of females. In addition, female pre-service mathematics teachers in the sample have higher scores on both environmental behaviors and environmental ideas sub-scales than males.
- ~ There is statistically significant difference between the pre-service mathematics teachers' scores on environmental behavior sub-scale in terms of the smoking habits variable. The pre-service mathematics teachers giving up their smoking habits have got higher scores than those being smokers and those who have never smoked on environmental behaviors sub-scale.
- ~ There is statistically significant difference between the pre-service mathematics teachers' scores on environmental ideas sub-scale in terms of mothers' jobs. The pre-service mathematics teachers whose mothers are still working/or worked have higher scores than those whose mothers are housewives on environmental ideas sub-scale. However, there is no statistically significant difference between the pre-service mathematics teachers' scores on both environmental ideas and environmental behaviors sub-scales in terms of other variables related to the characteristics of both pre-service mathematics teachers and their families.

There is a notable discrepancy between the pre-service mathematics teachers' environmental behaviors and their environmental ideas, because there is statistically significant difference between the scores of prospective teachers on environmental ideas sub-scale and those on environmental behaviors sub-scale. Their environmental behaviors are at *medium level*, while their environmental ideas are at *high level*. Therefore, it can be

concluded that the pre-service mathematics teachers could not reflect their ideas to their behaviors although they are aware of the environmental problems and they have both information and ideas about what precautions should be taken for these environmental problems.

IMPLICATIONS FOR TEACHING

Although the vast majority of pre-service mathematics teachers are aware of the environmental problems and they have both information and ideas about what should be done for overcoming these environmental problems, they could not reflect their ideas to their behaviors. This situation is true for not only pre-service mathematics teachers in the sample, but also other individuals in society (Yücel et al., 2006). People are informed about the environmental problems and the points to take into consideration for overcoming these environmental problems during their formal education as well as during their daily life in which they are also informed by means of written and visual media informally. However, the results of the study showed that current both formal and informal guidance and education on education have failed in informing people about the environment and environmental issues. To improve environmental education in both schools and daily life, namely to eliminate this failure, following suggestions may be offered:

1. Students are generally taught by traditional methods and also given theoretical knowledge in environmental education courses as both the natural science courses and the social science courses. As a result, students have most of the ideas and knowledge about environment and environmental issues, even though they could not reflect their ideas or knowledge to their behaviors. Therefore, teaching approaches and strategies based on the applications of knowledge in different real life situations should be adopted in environmental education. Students must be restrained from memorizing and only having information, instead, they must be trained as individuals who are able to think solutions for environmental problems, and criticize not only the events or situations but also themselves (Şahin et al., 2004). From this perspective, it is believed that the environmental education courses will make more major contributions to the students, if the project based learning approach in which students actively participate in real life projects is used for the teaching of environment and environmental issues.
2. Reaching all individuals in society is very important for achieving the purposes of environmental education and for struggling with environmental problems. Therefore, environmental education should be taken place not only within formal education, but also within informal education in a more systematic and extensive way. From this perspective, the major task falls to the media (Morgil et al., 2002; Alım, 2006). Government should encourage media organizations to broadcast programs and to publish articles or magazines about environmental education and environmental problems by cooperating with them. The environmental awareness, positive attitudes towards environment and the positive environmental behaviors which an individual firstly gains within his/her family will be improved through his/her life by means of formal education institutions (schools), informal education institutions, written and visual media.
3. Non-governmental organizations and universities should take responsibility in extending environmental education for reaching all segment of society. Activities with broad participation such as in-service courses, symposiums, congresses, or panels in which both academicians from universities and non-governmental organizations works cooperatively should be organized to make people more conscious and sensitive about environmental problems and what to be done for overcoming these problems.

4. One of the ways to make students reflect their positive ideas about environmental problems and what to be done for overcoming these problems to their behaviors is encouraging them to become a member of non-governmental organizations or the other organizations related to environment. They should be informed about the purposes, the functions, and the projects of non-governmental organizations or the other organizations related to environment in detail. Encouraging students to become a member of non-governmental organizations or the other organizations related to environment and supporting them to participate actively in the activities carried out by these organizations by giving them extra points or awards will contribute to improve their behaviors about environment and to change positively their viewpoints to the environmental problems.
5. Environmental education should be seen as a part of formal education because all people in the world are to be interested in environmental issues and environmental education is to be an ongoing life-long process. Although this study has investigated only the pre-service mathematics teachers' ideas and behaviors about environment and environmental problems, data obtained from the sample of our study and the results emerged from our study are parallel with other studies conducted with most of the other university students (Şama, 2003; Özdemir et al., 2004; Şahin et al., 2004; Erten, 2005; Özmen et al., 2005). In environmental education, the teachers who will teach about environment and inform their students about environmental issues should be well educated on environment, environmental problems and what to be done for overcoming these problems as a first step. All prospective teachers should be taken the course of environmental education so that they will be equipped with both sufficient knowledge and skills about environmental education to be able to educate their students. It is believed that only prospective teachers who have taken the course of environmental education during their university education feel themselves adequate to teach about environment effectively.

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