EVALUATING EIGHTH GRADE STUDENTS' ENVIRONMENTAL LITERACY:
THE ROLE OF SOCIO-DEMOGRAPHIC VARIABLES

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Approval of the Graduate School of Social Sciences

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ABSTRACT

EVALUATING EIGHTH GRADE STUDENTS' ENVIRONMENTAL LITERACY:
THE ROLE OF SOCIO-DEMOGRAPHIC VARIABLES

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The purpose of this study is to evaluate eighth grade students' environmental literacy (knowledge, attitude, sensitivity and concern) level and to assess effects of socio-demographic variables (gender, parents' educational level, parents' work status and source of information about environmental knowledge) on their environmental literacy level. A total of 437 (212 girls and 225 boys) eight grade public school students are administered Environmental Literacy Test which includes four parts; knowledge (20 items), attitude (10 items), sensitivity (19 items), concern (12 items). Descriptive analysis showed that students have positive attitude and high degrees of concern and sensitivity toward environment; however they have low to moderate levels of environmental knowledge. In order to evaluate the role of socio-demographic variables on students' environmental literacy level, six separate one-way MANOVAs were conducted. The results revealed that; a) there is significant effect of gender on students' environmental literacy regarding to concern, in favor of girls, b) there is a significant effect of parents' educational level on students' environmental literacy; c) there is a significant effect of mothers' work status on students' environmental literacy and d) there is not a significant effect of source of information about environment on students' environmental literacy.

Keywords: Environmental Education, Environmental Literacy, Socio-demographic Variables, Elementary Students

ÖZ

SEKİZİNCİ SINIF ÖĞRENCİLERİNİN ÇEVRE OKURYAZARLIĞININ
DEĞERLENDİRİLMESİNDE SOSYODEMOGRAFİK DEĞİŞKENLERİN ROLÜ

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Bu çalışmanın amacı sekizinci sınıf öğrencilerinin çevre okuryazarlığının (bilgi, tutum, duyarlılık ve endişe) değerlendirilmesinde sosyodemografik değişkenlerin (cinsiyet, anne-babanın eğitim durumu ve mesleği ve çevre ile ilgili bilgileri edindikleri kaynaklar) etkisini incelemektir. Çalışmada 437 (212 kız ve 225 erkek) sekizinci sınıf devlet okulu öğrencisine Çevre Okuryazarlığı Anketi uygulanmıştır. Ankette, bilgiyle ilgili 20, tutumla ilgili 19, duyarlılıkla ilgili 10 ve endişeyle ilgili 12 adet soru bulunmaktadır. Betimsel istatistik sonuçları öğrencilerin çevre bilgilerinin az ya da orta düzeyde olduğu, çevreye karşı tutumlarının olumlu olduğu, çevre ile ilgili konularda duyarlı olduğu ve çevre sorunları ile ilgili endişelerinin olduğu belirlenmiştir. Bununla birlikte, öğrencilerin sosyodemografik değişkenlerin öğrencilerin çevre okuryazarlıklarını nasıl etkilediğini anlamak için çıkarımsal istatistik yöntemleri kullanılmıştır. MANOVA analizlerinin sonuçları, a) cinsiyetin kız öğrenciler lehine endişe düzeyi üzerinde etkisi olduğunu; b) anne ve babanın eğitim seviyelerinin öğrencilerin çevre ile ilgili bilgi düzeyini etkilediğini; c) annenin meslek sahibi olmasının öğrencilerin çevre ile ilgili bilgi düzeyini etkilediğini; d) çevre ile ilgili bilgileri edindikleri kaynakların öğrencilerin çevre okuryazarlığını etkilemediğini göstermiştir.

Anahtar Kelimeler: Çevre Eğitimi, Çevre Okuryazarlığı, Sosyodemografik Değişkenler, İlköğretim Öğrencileri

To My Family

Thanks God for giving you to me

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LIST OF ABBREVIATIONS

df: Degree of Freedom

ELT: Environmental Literacy Test

FEL: Father Educational Level

FWS: Father Work Status

M: Mean

MEL: Mother Educational Level

MONE: Ministry of National Education

MWS: Mother Work Status

N: Sample Size

NEP: New Ecological Paradigm

NGOs: Non-Governmental Oganizations

p: Significance Level

SD: Standard Deviation

STSE: Science-Technology-Society-Environment

CHAPTER 1

INTRODUCTION

The history of environmental education began with a novel, called *Emilie,* published by a well-known philosopher Jean-Jacques Rousseau in 1762 (McCrea, 2006). Jean-Jacques Rousseau thought that education should be environment oriented, which can be seen as the early influences of environmental education. A few decades later, John Dewey presented a student-centered approach to environmental education which included learning by doing, integrated efforts, lifelong learning, in the early 1930's, which can be seen as the starting point of conservation education era (McCrea, 2006). In 1960's, concerning about environmental degradation and decreasing quality of life carried with environmental education as a formal education movement. In 1970's environmental education changed to emphasize action components. The United Nations Conference on the Human Environment met at Stockholm from 5 to 16 June 1972. The imperative goal of this conference was to defend and improve human environment for present and future generations, which would demand the acceptance of responsibility by individuals, local and national governments. After Stockholm Conference, the Belgrade Charter was written in Belgrade, Yugoslavia by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1975. Belgrade Charter stated new development approaches, which were explained in the Stockholm Conference and could improve the world's conditions but all of them were short-term solutions, unless the youth of the world received a new kind of education. Environmental education goal of the Belgrade Charter (1975, p.3) was:

> *To develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.*

The environmental education objectives of the Belgrade Charter (1975, p.3) were stated as:

> *1. Awareness: to help individuals and social groups acquire an awareness of and sensitivity to the total environment and its allied problems.*
> *2. Knowledge: to help individuals and social groups acquire basic understanding of the total environment, its associated problems and humanity's critically responsible presence and role in it.*
> *3. Attitude: to help individuals and social groups acquire social values, strong feelings of concern for the environment and the motivation for actively participating in its protection and improvement.*
> *4. Skills: to help individuals and social groups acquire the skills for solving environmental problems.*
> *5. Evaluation ability: to help individuals and social groups evaluate environmental measures and education programmes in terms of ecological, political, economic, social, esthetic and educational factors.*
> *6. Participation: to help individuals and social groups develop a sense of responsibility and urgency regarding environmental problems to ensure appropriate action to solve those problems.*

Two years after the Belgrade Charter, UNESCO and the United Nations Environment Programme held the Intergovernmental Conference on Environmental Education in Tbilisi, Republic of Georgia. The goals, objectives and principles of environmental education which were declared in this conference are still used by many environmental educators. The goals and objectives of environmental education of the Tbilisi Declarations (1977, p.26) were:

> *Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.*
> *Knowledge: to help social groups and individuals gain a variety of experiences in and acquire a basic understanding of the environment and its associated problems.*
> *Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection.*
> *Skills: to help social groups and individuals acquire the skills for identifying and solving environmental problems.*
> *Action: to help provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.*

These five items were known as "AKASA model", which is still being used by many educators today (Tbilisi Declaration, 1977). After Tbilisi Declaration, The World Commission on Environment and Development published The Brundtland Report (Our Common Future) and "sustainable development" was introduced by this report in 1987. In the same year UNESCO and the United Nations Environment Programme (UNEP) held International Congress on Environmental Education and Training in Moscow. The objectives of this congress (1987, p.7-20) were:

> 1. *Strengthening of the international system for information and exchange of experience of the International Environmental Education Programme (IEEP);*
> 2. *Strengthening of research and experimentation on educational content and methods and strategies for the organization and transmission of messages concerning environmental education and training;*
> 3. *Promotion of EE through the development of curricular and teaching materials for general education;*
> 4. *Promotion of pre- and in-service training for qualified formal and non-formal environmental education personnel;*
> 5. *Incorporation of an environmental dimension into technical and vocational education;*
> 6. *More effectively educating and informing the public about the environment through the use of the media and the new communication and information technologies;*
> 7. *More effective incorporation of the environmental dimension into general university education through the development of study programmes, teaching materials and training, and through the establishment of appropriate institutional machinery;*
> 8. *Promoting specialized scientific and technical environmental training;*
> 9. *Development of environmental education through coordinated international and regional cooperation.*

The objectives of the International Congress on Environmental Education and Training focused on particular types of environmental education; gathering information about environment or teaching materials or educating public and training such as specialist training. In 1992, the United Nations Conference on Environment and Development was held in Rio (1992, p.1) with a goal of:

> *To establish a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people.*

The international community adopted Agenda 21 as a comprehensive plan of action for sustainable development at the 1992 Earth Summit in Rio. Five years later, UNESCO and the Government of Greece adopted Thessaloniki Declaration, which not only emphasized equal opportunity in education for all women and men in the world but also stated that environmental education dealt with education for environment and sustainability. The United Nations Commission on Sustainable Development held the Johannesburg Summit in Johannesburg, South Africa, in 2002. The summit focused on turning plans into action and evaluated the obstacles to progress and the results achieved since the 1992 Earth Summit. Moreover it presented an opportunity to build on the knowledge gained over the past decade and provided a new impetus for commitments of resources and specific action towards global sustainability. Five years after the Earth Summit, the 4th International Conference on Environmental Education was held in Ahmedabad, India in 2007. This conference concentrated on changes in thinking about education and learning accompanied by changes in pedagogy and methods, since Tbilisi Declaration. According to the Ahmedabad Conference, experimentation and broader social and cultural situated learning processes should be taken into consideration.

To summarize, environmental education has changed over time depending on changing environmental problems. Thus, it can be concluded that, environmental education is a life-long learning process aimed at developing environmentally literate individuals who are able to handle changing environmental problems (Roth, 1992).

In fact, the history of environmental literacy began with an article which was written by Charles Roth in Massachusetts Aubundon in 1968. The study was related to environmental education, environmental literacy, which means the ability to read and write about environment, and developing environmentally literate citizens who can make decisions and choices to sustain their environment.

In his study, Roth stated that, effective environmental education was a necessity in order to develop environmentally literate citizens who have not only environmental knowledge, attitude and sensitivity, but also problem solving, planning and collaborative skills and action strategies to enhance the environment. According to Hungerford and Tomara (1977), raising environmentally literate individuals, who are able to take action on critical environmental issues and ready to take that action, is an important goal of environmental education. In 1984, Roth expanded his perception of environmental literacy and he stated that an environmentally literate person should;

> *Understand the self-regulating systems of our life-sustaining planet.*
> *Operate their lifestyles in congruence with those self-regulating systems.*
> *Work cooperatively to eliminate cultural activities that significantly disrupt the life-sustaining systems.*

In 1989, Rockcastle defined environmental literacy as understanding of interaction between humans and their natural environment and also short- and long-term effects of these interactions. In other words, according to Rockcastle, environmental literacy was the relationship in the interaction between humans and their natural environment. Disinger and Roth (1992) gave a generally accepted definition of environmental literacy:

> *Environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore or improve the health of those systems (p. 2).*

Disinger and Roth (1992) also explained environmental literacy components as environmental sensitivity, knowledge, skills, attitudes and values, personal investment and responsibility, and active involvement. In 2003, they stated that environmental literacy should increase individual's sensitivity, knowledge, skills, attitudes and values towards the environment (Disinger and Roth, 2003).

While the studies related to environmental literacy and its components have been going on, the effects of socio-demographic variables on environmental literacy have also been investigated.

Several studies showed that there were significant effects of socio-demographic variables such as culture, gender, educational level, work status on environmental literacy. In his review about the relationship between knowledge, affect and environmental education during 15 years (1979-1993), Zimmerman (1996) reported the effects of gender, ethnicity and socio-economic factors on knowledge and affect. The research had shown differences in levels of environmental knowledge on the basis of ethnicity and gender. According to the results, Blacks and women are generally less knowledgeable about ecological concepts than Whites and men.

Studying with participants from Japan, Germany, Sweden, and the United States, Eisler, Eisler and Yoshida (2003) reported the effect of culture and gender on knowledge, attitudes, beliefs, opinions, and perceived risk factors in human ecology. The Japanese rated the sea, the mountain, and the river as less pleasant than did the German, Swedish and Americans. Similarly, the Japanese had the highest scores on environmental knowledge; the Americans had the lowest score. The German had the lowest score in sea affairs, and both the German and the Swedish identified and assessed their behavior as most protective; however, the Japanese as least protective of the environment. Gender differences were also revealed such as compared with male, female perceived the risk factors as more serious as regards ecological and environmental problems, the global instability caused by economic nationalism, and the increasing gap between rich and poor nations. Also, male were more knowledgeable about environmental issues than female; however they showed lower motivation for ecological thinking and behavior than female.

In a study with adults living in Shanghai, Shen and Saijo (2007) found that high household income and high education level had positive effect on environmental concern. Also, they concluded that older generations were more concerned about environment than younger generations, and men were more concerned about environment than women. However, they stated that employment status and household size were found not to be relevant to environmental concern.

In line with the available literature, current study examines the level of environmental knowledge, attitudes, sensitivity and concern of eighth grade students in Turkey in order to understand their level of environmental literacy. In addition, the current study investigates the effects of socio-demographic variables (gender, parents' educational level, parents' work status and source of information about environment) on students' environmental literacy.

1.1 Significance of the Study

In recent years, academic research and bureaucracy have taken a strong interest in environmental education, as local and global environmental problems such as population growth, depletion of resources, pollution, global warming, extinction of animals and plants sound a note of alarm for future generations, in other words, today's children tomorrow's adults. At the present day, not only local but also global environmental problems make all living creatures' lives difficult. Therefore, in order to handle environmental problems it is crucial to raise environmentally literate children who know about environment and are aware of the environmental problems. In addition, children should notice the things that they are able to do themselves for their environment; they should take precautions to conserve their environment and provide solutions for environmental problems.

As Hungerford (2003) stated, environmental citizenship is a complicated issue because individuals' sensitivity to the environment, knowledge and use of citizenship action skills and individuals' accountability for the environment affect environmental citizenship. In order to accomplish this task, instruction for environmental literacy has to be not only reasonably enhanced and sequenced but also focus on all components of environmental literacy such as knowledge, attitudes and action (Hungerford, 2003). In line with this idea, Turkish Science and Technology curriculum has been revised recently (Ministry of National Education, [MONE] (2005). The main objective of this curriculum is to raise students who are scientifically literate.

According to the new curriculum, science literate person should understand nature of science and technology, fundamental science concepts, relationship between science-technology-society-environment (STSE) and also should have science process skills. Apart from that, revised curriculum emphasizes environment, consequently environmental education, by including many concepts such as basic ecological concepts, local and global environmental problems. While sixth grade curriculum includes STSE objectives, seventh and eighth grade curriculums include STSE objectives and also subjects related to environmental issues and basic ecological concepts. Seven graders cover a unit called 'Human and Environment', which includes ecosystems, biological diversity and local and global environmental problems. The main objectives of these topics are to learn ecosystems and biological diversity, to be aware of species which become extinct, to notice local and global environmental problems and also to have a step in mind to solve these problems. Similarly, eight graders cover a unit called 'Living Creatures and Energy Relations', which is related to energy flow in food chain, matter cycles, recycle and renewable and non-renewable energy resources. The main objectives of this chapter are to not only learn, but also establish a relation among all these concepts. Moreover, students are encouraged to make a connection between these ecological concepts and their life experiences, in this chapter. Thus, it can be said that revised curriculum tries to enhance students' knowledge about environment, attitudes, sensitivity and concern towards environment. In other words, the new curriculum aims to raise environmentally literate students, because policy makers, educators, curriculum developers, authors and also teachers realize that, knowledge is not enough to conserve their environment (MONE, 2005). The purpose of this study therefore is to evaluate students' environmental literacy level and to assess effects of socio-demographic variables on their environmental literacy level. In this study, gender, parents' educational level, parents' work status and source of information about environmental knowledge are identified as socio-demographic variables. Eighth grade students are selected as a sample, because they are the first students who are educated with the revised curriculum, in other words, they cover environmental issues, basic ecological concepts and all STSE objectives.

Since private school students have much more opportunities than public school students and these opportunities might affect the results of the study, public school students are selected. In addition, so far, public schools have never attended this kind of a study related to environmental literacy. Therefore, the results of this study may provide valuable feedback to curriculum developer, science teacher, and textbook author about how revised curriculum achieves to accomplish environmental issues, and ecological concepts, and also how environmental education can be improved in terms of socio-demographic variables, which affect students' environmental literacy.

1.2 Definition of Important Terms

Environmental Education:

> *Environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones. (UNESCO, 1977)*

Environmental Literacy:

> *Environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore or improve the health of those systems (Disinger and Roth, 1992).*

Environmental Knowledge:

> *Environmental knowledge includes all the cognitive understandings of the environment and its associated problems (Roth, 1992).*

Environmental Attitudes:

> *Attitude refers to set of values and feelings of concern for the environment and motivation for actively participating in environment improvement and protection (UNESCO, 1978).*

Environmental Sensitivity:

> *Environmental sensitivity refers to a set of affective attributes which result in an individual viewing the environmental from an empathic perspective (Petersen, 1982).*

Environmental Concern:

> *Environmental concern refers to a sympathetic perspective toward the environment (Hungerford and Volk, 1990).*

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter includes review of literature related to environmental education and environmental literacy in two sections: research on environmental education and research on environmental literacy.

2.1 Research on Environmental Education

In his review about the state of environmental education, Smyth (2005) stated that environmental education should be a part of fundamental educational reform. He thought that environmental education had improved through the developing educational approaches and the growing attention given to human aspects of the system. However, according to the author many more studies were needed in order to bring environmental and social systems together into a single structure, and to destroy the misconceptions about environmental issues.

For many years, researchers have been interested in environmental issues; such as air pollution, ozone layer, global warming, acid rain and natural sources. For instance, Boyes and Stanisstreet (1997) investigated children's ideas and reasoning on the environmental impact of cars on global environmental problems. For this study authors developed a questionnaire which was completed by 1637 (14-15 years old) students. The majority of the students thought that cars exacerbate global warming and half of these could accept that carbon dioxide was responsible. However, they thought that heat from exhausts caused the greenhouse effect. Half of the students were aware that cars contribute to acid rain. Few of them thought that oxides of nitrogen were responsible; instead, carbon dioxide was seen as causing acid rain. Also most of the students believed that vehicle emissions were harmful to the ozone layer. Some students thought that heat damaged stratospheric ozone. Many students believed specific gases as 'pollutants' in general to be contributing to a variety of environmental problems.

One way to avoid confusion might be not to use the genetic term 'pollution' and to link the idea of a 'pollutant' to the environmental problems it causes.

In a separate study, Boyes and Stanisstreet (1998) investigated high school students' perceptions about the possible links between the increase in skin cancer and global environmental effects. Although, they concentrated on skin cancer which was a highly publicized consequence of ozone layer, the results showed that majority of the students did not understand why precautions need to be taken, or why the problem arises. Students also thought that greenhouse effect and ozone layer depletion was the same thing and they could cause skin cancer. They suggested that, students should perform experiments related to those issues in order to make a connection between their knowledge and their daily life experiences, which were helpful to eliminate their misconceptions.

In another study, Fisher (1998) assessed Australian students' explanations of the greenhouse effect and the ozone hole. Students participated in the study lived in urban or rural areas, and they went to the private or public schools. They answered four open-ended questions for each concept. The result of the study showed that majority of the students conflated these two concepts; the greenhouse effect and the ozone hole. The researcher suggested that, teachers should be aware of this conflation and they should compare those concepts through discussion to promote better understanding.

In a study with fifth grade students attending public elementary school in rural area of Padova, Italy, Mason and Santi (1998) investigated changes of conceptions about the greenhouse effect and global warming. The authors hypothesized that verbal explanations, comparing and critically evaluating different aspects of the global warming would improve students' understanding and their conceptual changes about this issue. The results show that classroom discussions enhance integration of new scientific knowledge into students' conceptual ecology, based on the personal revision of pre-instructional conceptions.

According to the results, students had alternative conceptions about global warming so they had to change their conceptions. Small group discussions and whole class discussion led the students to build new scientific knowledge based on their alternative conceptions. Also, the results showed that there was a high positive correlation between conceptual change and metaconceptual awareness of the changes in pre-existing knowledge. This study indicated that, students should discuss their knowledge and their feelings about ecological concepts such as global warming in their class in order to evaluate their knowledge and to be aware of their alternative concepts, and finally to change their alternative concepts with the new scientific knowledge.

Gambro and Switzky (1996), however, conducted a national survey of American high school students' environmental knowledge. A sample was composed of 2900 high school students from 52 middle school and 51 high schools. In the study, environmental knowledge was defined as a student's ability to understand and evaluate the impact of society on the ecosystem, and it was revealed by understanding environmental problems as well as recognizing the origins, implications and consequences of those problems. Students answered a knowledge scale instrument including items related to environmental issues such as acid rain, the greenhouse effect, and future energy sources. The results showed that, students had low level of knowledge. Majority of students were able to understand basic facts regarding environmental problems; however, most students were not able to apply their knowledge to comprehend the consequences or possible solutions related to the problems. Students had little improvement in environmental knowledge from 10th grade to 12th grade. According to the results, the authors suggested that educators should give more importance to increase the level of environmental knowledge of the students. It was not enough to identify the problems for students to comprehend the consequences of and possible solutions for the problems. Teachers should use their students' concerns as a source of motivation, and their students' knowledge to develop isolated pieces of information into concepts for critical thinking.

Devine-Wright, Devine-Wright and Fleming (2004), investigated children's beliefs about global warming, energy conservation and renewable energy from a situational perspective based on existing theories of the psychological components like awareness, responsibility, concern and self-efficacy, which enhanced pro-environmental view. The data were collected from 198 UK children and adults to evaluate the effects of a cooperative learning on students' beliefs about global warming and energy. Children who were members of the Woodcraft Folk educational organization formed one group and children who were non-members and adult members of the same organization formed another group in order to conduct a comparative study. Woodcraft Folk program covered games, drama, dancing, singing and craftwork as well as following an educational program. The data were analyzed by using Chi-squared method and the result showed that cooperative learning had a positive effect on students' beliefs about environmental problems. Woodcraft Folk children had higher levels of awareness and self-efficacy about global warming than their peers; however, they had lower levels of self-efficacy about global warming than Woodcraft Folk adults. Woodcraft Folk children had more self-efficacy and they had more experiences in cooperative learning, because their educational program was different from non-members students' program. The authors suggested that educational interventions were designed to improve children's understanding of and positive beliefs about global warming and energy. Also, educational interventions should focus on the style of childrens' learning experience, with an emphasis upon how learning was managed so that active participation and cooperation amongst children was encouraged.

Dimitriou and Christidou's work (2007) explored students' knowledge and understanding of air pollution. Sample of this study included 132 Greek students (7-13 years old) and they completed semi-structured interviews. The results of the study revealed that students defined air pollution regarding different components related to air pollution such as pollution sources and pollutants but they were not able to define air pollution scientifically. Students did not name the air pollutants so they referred to them as smoke.

However, they identified the pollution sources correctly and also they were aware of the negative effects of air pollution on environment. There was no significant development regarding the conceptualisation of the term, air pollution or the sources of air pollutants, between 7-13 years. However, there was a significant development considering pollution impacts between 7-13 years. Younger children had a more concrete understanding while older children had a more abstract one. According to the results, researchers suggested that, from an early age pupils have constructed a preliminary understanding for air pollution, which could serve as a point of departure for a systematic discussion of this issue at school. Also, teaching material should be introduced from the first years of primary school, focusing on the most concrete, perceptible and measurable aspects of the issue, which were either familiar to children from their everyday experience or could be observed through appropriately planned experiments such as growing plants. Progressively, by the end of primary school and through secondary school, more abstract and complex aspects of air pollution should be introduced.

More recently, Boyes, Skamp and Stanisstreet (2008) conducted a study to evaluate secondary students' views about how useful various specific actions might be at reducing global warming, their willingness to undertake the various actions, and the extent to which these two might be linked. A 44-item questionnaire was used to collect data from students (n=500) in years 7 to 10 in three schools in Australia. For some pro-environmental actions, students believed the action to be useful so their willingness to act was greater. Such actions were those that involve minimal inconvenience such as switching off un-used electrical appliances, or those that were becoming well embedded in social practice, such as recycling. For other pro-environmental actions, although they believed the action to be useful, their willingness was less. Actions regarding personal transport; buying smaller cars or using public rather than private transport, and obtaining more electricity from nuclear power stations were in this category. There were disincentives to acting in a pro-environmental manner relating to personal inconvenience, or concern about nuclear power.

The data were also evaluated to determine the strength of the relationships, for each action, between students' professed willingness to act and their belief that an action would be effective. This suggested a measure of the potential effectiveness of education about that action. The results showed that for some actions, this relationship was weak; in such cases, changing belief about the usefulness of the action might not be expected to produce major changes in behaviour. People need to be persuaded to adopt pro-environmental actions for these types of issues such as public transport. For other actions such as recycling, the relationship was stronger, so in these areas environmental education could well be effective, especially if a large proportion of the population were not already willing to undertake that action. The authors concluded that pro-environmental actions might be improved by appropriate education.

Österlind (2005) performed a case study describing the work of three pupils in the upper level of compulsory school. The main purpose of the study was to see how pupils contextualise the theoretical concepts brought up in their work with these issues. Students were learning about the intensified greenhouse effect and the depletion of the ozone layer. Eighth grade students worked in groups of five. Each group decided a problem related to atmosphere, water or soil to work, using the map of concepts and consulting various sources, the students then formulated the questions they wished to investigate, assisted by the teacher in the structuring of the questions. One of the groups selected the greenhouse effect and the other one selected the ozone layer to work. The results show that the students had difficulty in distinguishing between the different meanings attached to individual concepts in their theoretical and practical contexts. They were often not able to identify the meaning relevant to the specific environmental problem that they were working on. Students' difficulties were seen as a problem of differentiation between concepts denoted by the same term as well as between different aspects of the same concept, a view that was then associated with the question of appropriate conditions for conceptual change. According to the results, the author concluded that students' difficulties resulted from poor teaching.

Teachers should prepare well-organized lessons for their students, and they should help their students to improve their investigation methods to find their own relevant contextualisation of the information.

Another line of research focused on college students' and teachers' environmental knowledge (e.g. Boyes & Stanisstreet, 1992; Dove, 1996; Khalid, 2003; Michail, Stamou & Stamou 2007). Earlier, Boyes and Stanisstreet (1992) conducted a study in order to understand first year undergraduate students' perceptions of global warming in England. The results showed that, students had misconceptions about global warming. They thought that lead-free petrol reduced global warming. Also they confused the causes and the consequences of global warming with those of ozone layer depletion. Also girls were less knowledgeable about the mechanism and consequences of global warming. The authors suggested that, local and global environmental problems were explained in detail. The causes and the consequences of those problems were specifically identified. It should also be realized that all environmentally friendly behaviors did not help all environmental problems. In addition, students should prefer formal sources than media, especially television, to get correct information about environmental problems such as global warming, ozone layer depletion.

Kaplowitz and Levine (2005) investigated environmental knowledge level of undergraduate, graduate and professional students of Michigan State University (MSU) and their results were compared with 2000 national sample of Americans adults. The researchers conducted a survey including 12 environmental knowledge questions adopted from National Environmental Education and Training Foundation (NEETF) and Roper Starch Worldwide Survey of adult Americans. Approximately 20.000 MSU students completed the survey. In the survey, the purpose of the 1st question was to test students' evaluation for their own level of knowledge about environmental issues and problems. Remaining 11 questions had 5 choices from which only one was correct, three were distracters and last one was 'I do not know'. The authors concluded that, MSU students were good at questions about household hazardous waste and biodiversity whereas they gave wrong answers to the questions related to the electricity generation and non point source pollution.

When their results were compared with the national sample, majority of them passed the test, while majority of national sample failed. In addition, MSU students were more realistic about self-assessment of their environmental knowledge than national sample. Moreover, the study showed that, there was a difference among colleges of MSU regarding environmental knowledge. Thus, human ecology students obtained the lowest score, while osteopathic medicine, human medicine, agriculture and natural resources, veterinary medicine and natural science students got the highest scores so it can be concluded that, if academic level increased, environmental knowledge would also increase.

The common conclusion of the above studies is that, students across grade level have limited knowledge and plenty of misconceptions about environmental issues and basic ecological concepts. Generally, they are not able to define environmental or ecological concepts scientifically and they have difficulties in making connection between these concepts and their consequences.

Besides studies addressing students' knowledge about environmental concepts, researchers have been interested in the relationship between students' knowledge and attitude toward the environment. In addition, the effects of socio-demographic variables on students' environmental knowledge and attitude are also investigated. In her article, DeChano (2006) investigated the association between environmental knowledge and attitude by using high school students in Chile, England, Switzerland and United States. Approximately 60 students participated from each country. Students completed instrumentations via the Internet. Students were asked demographic questions, 12 questions from the Environmental Knowledge Question developed by NEEFT and the Roper Group (1997), and 8 questions designed by the researcher and the New Ecological Paradigm (NEP) Scale developed by Dunlap, Liere, Merting and Jones (2000). Descriptive statistics, Kruskal-Wallis H method and correlations were used to analyze the results. The results of this study showed that students had limited knowledge about environment, however they had positive attitude toward environment. Moreover, it was reported that, there was no significant relation between environmental knowledge and environmental attitude.

Recently, Said, Yahaya and Ahmadun (2007) conducted a study to investigate environmental comprehension and participation of Malaysian secondary school students. The sample of this study included 306 students who were randomly selected from four different public schools. Self-administered questionnaire included demographic variables, environmental awareness and concern, environmental knowledge, sustainable consumption behaviours, and nature-related activities. Descriptive statistics and correlations were used to analyze data and the results revealed that, environmental education enhanced environmental awareness. However, it was insufficient in developing environmental behavior. Students had difficulty in understanding environmental concepts in a detailed manner and they were not able to define sustainable development. It was suggested to understand the obtacles that prevent behaviour change of the students undertaken in Malaysia so that useful and practical principles for intervention could be identified. Consequently, an integrated approach to effective formal and informal environmental education in Malaysian society, particularly with youth, might be developed.

Kobierska, Tarabuła-Fiertak and Grodzinska-Jurczak (2007), assessed Polish secondary school students' attitudes toward environment, which referred to environmental knowledge and action for the benefit of the environment. For this study, 421 students from 20 gymnasiums and 613 students from 22 general lyceums were selected by using stratified random method. Questionnaires, which contained different set of questions, were specially prepared for gymnasium and lyceum students. Knowledge component was investigated by using quantitative index of environmental knowledge consisting of two indices; environmental knowledge regarding nature, for example national parks, knowledge of names of protected plants and animals and environmental knowledge regarding other issues, such as energy, natural resources and the greenhouse effect and action component was investigated by using factor analysis. The results of this study indicated that, gymnasiums students had higher mean score on both indices of knowledge than lyceums students.

Another important result of this study was to discover students' source of information about environment, both gymnasiums and lyceums students' stated that television, school and journals were the main source for them to obtain information about environment. According to the research, high level of environmental knowledge was not always accompanied by pro-environmental behavior but behavior regarding contact with environment.

In 2007, Travis assessed the effects of a required ecology course on students' environmental attitudes. Travis studied two different groups of eighth grade students; students who did not receive the formal ecology course but had life experiences, and students who would receive the new course and would have a chance to make a connection between their theoretical knowledge and their life experiences. The new ecology course was designed to address Pennsylvania Standards in Environment and Ecology and the purpose of this course was to raise environmentally literate students who became a leader in order to protect and conserve their environment. The Children's Environmental Attitude and Knowledge Scale (CHEAKS), developed by Leeming, Dwyer and Bracken in 1995, and the New Environmental Paradigm, developed by Dunlap and Van Liere in 1978, were incorporated into a single instrument and administered to students as pre and post-test and t-tests were used to analyze the results. According to the both pre and post tests results, newecology course affected students' environmental attitudes positively. Integration of ecology and environmental issues as a component of the science curriculum enhanced students' attitudes toward environment.

In order to foster elementary school students to employ pro-environmental activities, Caretaker Classroom Program were initiated by a major newspaper for the research study of Leeming and Porter (1997). Students who participated in the program were supposed to employ at least eight environmental activities during the academic year. The study was conducted to investigate the difference between students participating the program and non-participants considering environmental attitudes and knowledge. The Children's Environmental Attitude and Knowledge Scale (CHEAKS) was developed to evaluate students' general environmental attitudes and knowledge.

The instrument was applied to all students with pretest and posttest method. The results showed that while the program had positive effect on students' attitude toward environment, it did not affect students' environmental knowledge. Students who were more interested in activities increased their pro-environmental attitudes. Participants of the program showed greater performance in knowledge than non-participants but the effect was not statistically significant. In addition, all students improved their knowledge from pretest to posttest.

In one of the earlier studies, Kuhlemeier, Hans, van den Bergh, Huub, Lagerweij and Nijs (1999) assessed the relationship between environmental knowledge, attitudes and behavior. The author studied more than 9000 students from 206 secondary schools. Four instruments were used for this study; environmental knowledge, environmental attitudes and environmental attitude and willingness to make sacrifices questionnaires, and environmental behavior questionnaire. The environmental knowledge instrument was related to soil, water and air pollution, recycling, energy usage, farming and market gardening, government regulations. The environmental attitude subscale included statements which examine the degree of environmental inclination, environmental concern, environmental indifference and denial of environmental problems. The subscale of willingness to make sacrifices was related to readiness to make an extra effort for the environment, to take extra pain, to make extra sacrifices. Environmental behavior subscale approached the student as an energy user, a consumer or a garbage producer. The results revealed students' knowledge about environmental problems especially in energy usage, pollution, recycling and agricultural activities, and students' environmentally responsible behavior left much to be desired. However, more than half of the students had positive attitude toward the environment. The study also showed a very weak relationship between environmental knowledge and environmental attitudes and behavior. However, it was reported that there was a considerable association between environmental attitude, willingness to make personal sacrifices, and environmentally responsible behavior.

These authors suggested that students carried on caring about the environment, and agreed on the seriousness of the environmental problems although they had limited environmental knowledge. Students' responses toward the environmentally responsible behaviours showed that there was still much to do for improvement.

By exploring the cultural impacts on students' self-reported environmental actions, perceptions, and understandings, Huang and Yore (2003) explored the differences between two culturally distinct groups and also developed models of children's responsible environmental behavior. Data were collected from 278 grade 5 children from Victoria, BC, Canada, and 483 grade 5 children from Kaohsiung, Taiwan. Students completed English and Mandarin version of the same questionnaires. Descriptive statistics, t -tests, and multiple regression analyses were used to evaluate the instruments. The results showed that Canadian and Taiwanese students had more similarities than differences with small to moderate effect sizes. For instance, they both preferred television in order to get environmental information. Similarly, they had not only favorable environmental behavior and environmental attitudes but also more concerned, high emotional disposition toward environmental issues and moderate environmental knowledge. However, Canadian students had more natural activities than Taiwanese students. These childrens' irresponsible behavior toward environment resulted from inconvenience and forgetfulness. The original model of children's responsible environmental behavior did not fully reflect these Canadian and Taiwanese data; therefore, alternative models were designed.

In another study, Worsley and Skrzypiec (1998) investigated Australian high school students' attitudes toward environment with respect to students' regions, gender and socioeconomic status. A sample of this study included 958 senior secondary school students from 32 different schools. Questionnaire of Environmental Concern (QEC) including 40-item was developed by the researchers based on Herrera's Questionnaire of Environmental Beliefs (1992). In order to analyze the results, principal component analysis, ANOVAs and Multiple Regression/Correlation methods were used.

The results indicated that students living not only rural, but also urban regions were concerned, however pessimistic, about environmental concepts. Boys were more optimistic and more supportive of science solutions for environmental problems compared to girls. Moreover, students with lower socio-economic status were more supportive of science solutions for environmental problems than students with high socio-economic status.

Makki, Abd-El-Khalick, and Boujaoude (2003) conducted a study to evaluate Lebanese secondary school students' environmental knowledge, behavioural intentions, affects and commitment to environmentally responsible behaviours with respect to gender. A sample of this study composed 660 tenth and eleven grade students. They completed a two-part questionnaire, the first part of the questionnaire included 34-item and the second part of the questionnaire included 28 Likert-type item. Descriptive statistics, *t*-tests and ANOVA were used to analyze the data. The results revealed that both girls and boys had favourable attitudes toward the environment, but lacked in their environmental knowledge. It was suggested that the Lebanese environmental curriculum was not implemented effectively; pointing out a curriculum should not only provide necessary information, but also create curiosity and interest leading to student involvement and meaningful learning.

Eisler, Eisler and Yoshida (2003) conducted a study to investigate the effects of cultural and gender on attitudes, beliefs, opinions, and perceived risk factors in human ecology; further, on the level of knowledge about nature and the environment, and finally, on behavior affecting the environment. Participants from Japan, Germany, Sweden, and the United States completed a survey including seven parts: image of the sea, image of the mountain, image of the river, sea affairs score, environmental attitudes scale, environmental knowledge scale, and environmental behavior scale. The results showed that there were cultural effects. For instance, the Japanese rated the sea, the mountain, and the river as less pleasant than did the German, Swedish and Americans. Similarly, while the Japanese had the highest scores in environmental knowledge, the Americans had the lowest score.

The German had the lowest score in sea affairs, and both the German and the Swedish identified and assessed their behavior as most protective; however, the Japanese as least protective of the environment. Gender differences were also revealed such as compared with male, female perceived the risk factors as more serious as regards ecological and environmental problems, the global instability caused by economic nationalism, and the increasing gap between rich and poor nations. Also, male were more knowledgeable about environmental issues than female; however they showed lower motivation for ecological thinking and behavior than female.

More recently, Shen and Saijo (2007) explored the effect of socio-demographic characteristics on individual environmental concern in Shanghai, China. They showed that high household income and high education level had positive effect on environmental concern. Also, they concluded that older generations were more concerned about environment than younger generations, and men were more concerned about environment than women. However, they stated that employment status and household size were found not to be relevant to environmental concern.

In her study, Fishman (2005) investigated the effects of urban environmental education program called the Open Spaces as Learning Places program on students' awareness of the local environment and on their knowledge about environmental concept. The purpose of this program was to encourage students in wondering and discovering through exploration of the urban environment's natural and social history. Third and fifth grade students who participated in the program were used as a sample. Fishman used quantitative and qualitative data; knowledge questionnaires (10-item), drawing exercises providing insights into changes in the students' awareness and semi-structured interviews including two open-ended questions. Knowledge test and drawing exercises were applied two times as pre and post-test. Forty-seven students completed both knowledge questionnaires and drawing exercises and their results were analyzed by using paired t-test.

The results of this study showed that, there was a significant positive effect of the program on not only students' awareness of the local environment, but also their knowledge about environmental concepts. In order to evaluate the effect of the students' socio-economic status on improvements in their environmental awareness and knowledge, researcher would like students to write their addresses on their maps. According to the results, there was a correlation between students' socio-economic status and their improvements in environmental awareness, high socio-economic status high improvements in environmental awareness, while there was not a correlation between students' socio-economic status and their improvements in environmental knowledge.

Another research was done by Carrier (2007). The purpose of this study was to investigate the effects of environmental education lessons which compared activities performed in the schoolyard (experimental) with traditional classroom activities involving elementary school boys and girls. The sample of this study was composed of 109 fourth and fifth grade students. There were traditional and experimental groups, each of which included one fourth-grade class and one fifth-grade class from low to middle socio-economic level. During the 14-week environmental education program both traditional and schoolyard activities were selected from environmental education curricular sources, including Project WILD (1986), Activities Integrating Math and Science (AIMS; 1990), and The Schoolyard Wildlife Activity Guide (Cronin-Jones, 1992). The difference between two groups was that schoolyard (experimental) group activities were outdoor activities while traditional group activities were indoor activities. Gender and types of activities were defined as independent variables, knowledge, attitudes, behaviors and comfort levels were defined as dependent variables for this study; therefore MANOVA was used to analyze. The results of the MANOVA indicated that, boys had higher score for all dependent variables in the experimental group than in the traditional group; also boys in the experimental group had higher score on attitude and behavior than girls in the same group because boys were much more active during the learning process than girls.

Studies conducted in Turkey tended to examine elementary and high school students' attitudes toward the environment and environmental knowledge. For instance, Yilmaz, Boone and Andersen (2004) identified elementary school students views on environmental issues covered in the national science curriculum. Yilmaz et al. found that students had favorable attitudes toward population growth and energy conservation. Authors also reported that elementary students were less likely to strongly agree with statements suggesting that environmental protection might be given priority over economic growth, industrialization, and free right to use land. They, however, tended to agree with the importance of environmental education and the need for emphasis on pollution, soil erosion, and prevention of habitat destruction, and were not willing to give environmental protection precedence over economical growth and industrialization although they emphasized the importance of environmental issues. Considering gender and socio-economic variables, the results showed that, the older female students exhibited more support for environmental issues than did male students. Students with high family income, and those students living in urban areas, showed more positive attitudes toward environmental issues than did students with low family income, and those living in suburban areas. The authors concluded that if students had more knowledge about scientific concepts, their concern and positive attitudes toward environmental issues increased as well.

In another study, Tuncer, Ertepinar, Tekkaya and Sungur (2005) assessed the effect of school type and gender on students' environmental attitudes. A total of 1497 sixth, seventh, eighth and tenth grade students participated in the study. Students answered 45-item Likert-type questionnaire including four dimensions; awareness of environmental problems, national environmental problems, solutions to the problems and awareness of individual responsibility. MANOVA was used to determine the effect of school type (private and public) and gender on four dimensions. The results showed that private school students had more awareness about environmental problems, individual responsibility and national environmental problems, and they had more favorable attitudes toward solving the problems.

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In addition, girls had more awareness about environmental problems and individual responsibilities and also had more favorable attitudes.

In a separate study, Alp, Ertepinar, Tekkaya and Yilmaz (2006) assessed 6th, 8th and 10th grade students' environmental knowledge and attitudes; investigated the impacts of the grade level and gender on students' environmental knowledge and attitudes; and to explore how environmentally responsible behavior was associated with environmental knowledge, affects, behavioral intentions, and demographic variables. A sample of this study was composed of 1977 students from 22 randomly selected schools located in urban areas. Data were obtained from the sample by using the Turkish version of Children's Environmental Attitudes and Knowledge Scale (CHEAKS). In order to analyze the results of the instrument, one-way analyses of variance, independent samples t-test, and multiple regression analysis were used. The authors concluded that, a statistically significant effect of grade level was found on environmental knowledge and attitudes. There was not a statistically significant effect of gender on environmental knowledge; however the effect of gender on attitudes toward the environment was statistically significant in favor of girls. Also, environmental knowledge was found to be influential on behaviors not directly, but mediated by behavioral intentions and environmental affects.

In a recent study, Alp, Ertepinar, Tekkaya, and Yilmaz (2008) investigated elementary school students' environmental knowledge and attitudes, the impacts of socio-demographic variables on environmental knowledge and attitudes, and how self-reported environmentally friendly behavior was related to environmental knowledge, behavioral intentions, environmental affects, and locus of control. Children's Environmental Attitudes and Knowledge Scale (CHEAKS) developed and validated by Leeming and Dwyer (1990), and the Locus of Control (LOC) scale, prepared by Rotter (1966) were used to collect data. The instruments were applied on 1140 elementary public school students, 532 sixth graders and 608 eight graders. Descriptive statistics, three-way ANOVA and multiple regression analysis were used to analyze the data. According to the results, students had low level of knowledge, however favorable attitudes toward the environment.

Girls had more positive attitude toward the environment than boys and there was a significant effect of father's education level on students' environmental knowledge. Moreover, behavioral intentions, environmental affects, and locus of control were reported as significant predictors of environmentally friendly behaviors.

Taskin (2008) investigated the effects of school type, gender, parents' education levels, parents' political views, professions, and household income on high school students' environmental attitudes. The sample of this study was composed of 912 students from different school types (public, vocational and private). There were two different questionnaires which were the New Environmental Paradigm (NEP) (12-item) developed by Dunlap and Van Liere, and the General Environmental Attitudes and Perceptions (GAP) (32-item) developed by the researcher. The results of ANOVA and t-tests indicated that school type, gender, parents' education levels, parents' political views, professions, and household income affect students' environmental attitudes. Public school, female, lower middle class students, students with well educated parents in white-collar professions and liberal parents had more pro-environmental attitudes than the others.

Kılınç, Stanisstreet and Boyes (2008) explored Turkish students' ideas about global warming. Year 10 students aged 15-16 from two secondary schools, one in Ankara, the other in Nevsehir, answered a questionnaire developed by Boyes and Stanisstreet (1993). The questionnaire was designed to prob students' ideas about the possible consequences of, causes of, and cures for global warming. The results showed that students had misconceptions about global warming, and they confused the causes and consequences of global warming with those of ozone layer depletion. For example, global warming was associated by many students with skin cancer, a consequence of ozone layer damage in reality. Although students hold scientific understanding of global warming, they had wrong ideas about the mechanism of global warming. The authors suggested that, teachers should enquire not only whether students have understood scientific notions, but also whether they have eliminated misconceptions.

More recently, Teksöz, Tekkaya and Erbaş (2009) conducted a study to explore the regional differences in students' awareness, perception, optimism and responsibility development toward environment. The data used for the study was obtained from the one produced by the Programme for International Student Assessment (PISA) 2006 and composed of the Turkish sample of 4942 fifteen year-old-students attending 160 schools across 78 provinces and 7 geographical regions. The data were statistically analyzed by using frequency distributions and multivariate analysis of variance (MANOVA). Results showed that there was a significant effect of geographical regional differences, even small in magnitude, on students' responsibility towards natural resources and environment.

To be brief, for years, researchers in the field of environmental education have been interested in environmental knowledge, attitude and behavior toward environment and also their relationships between them. Further research has mainly focused on the effects of socio-demographic variables on students' environmental knowledge, environmental attitudes and environmental behaviors. Some other studies however tried to determine effects of intervention on students' environmental knowledge, environmental attitudes and environmental behaviors.

2.2 Research on Environmental Literacy

While environmental education studies have been ongoing, it is accepted that the purpose of environmental education is to raise environmentally literate citizens. Therefore, researchers have become interested in environmental literacy. For instance, In 1999, Willis carried out a study in order to investigate environmental literacy of upper-level high school students. 125 high schools junior and senior science students that had completed at least two years of science education attended this study. Secondary School Environmental Literacy Instrument (SSELI) was used to gain data from the students. SSELI was developed as part of the National Environmental Literacy Assessment Project (1994), and included knowledge, affective, skill and behavior components. The results of the survey were analyzed by descriptive statistics regarding to participants' gender, age, grade level and ethnic grouping.

The study revealed that, students had not only limited knowledge of ecological principles and environmental science but also limited awareness of environmental problems such as water resources management or toxic waste. They had a slightly positive attitude towards environment, moderate levels of perceived knowledge and abilities in using environmental action strategies, and limited participation in environmental responsible behaviors.

Chu, Lee, Ko, Shin, Lee, Mee, Min and Kang (2007) investigated Korean children's environmental literacy, and the factors which affected their environmental literacy. The sample of this study was composed of 969 third grade elementary school students from different part of the country; large cities, medium-sized cities and rural areas. Students completed the Environment Literacy Instrument for Korean Children (ELIKC), which was developed by the researchers and included knowledge, attitude, behavior and skill scales (a total 69 item). In addition, there were 13 items involving demographic variables. Correlation coefficients were calculated in order to study the correlation between scales and MANOVA was conducted to identify the effects of gender, parents' school background and source of information about environment and environmental education experiences before schooling on students' environmental literacy. The results revealed that there was a strong correlation between attitude and behavior while there was a weak correlation between knowledge and behavior. Girls showed better environmental literacy than boys, similarly students whose parents graduated from university displayed higher level of environmental literacy. In addition, source of information affected students' environmental literacy. According to the study, school, books, field trips, television, the Internet and newspaper/magazines were the main sources for students to get information about environment. The results showed that student who obtained information from field trip had better environmental knowledge, skill and attitudes. However, students who used newspaper/magazines or books to get information about environment had better environmental behavior. Moreover, environmental education experiences before schooling had influences on attitude, skill and behavior but not environmental knowledge.

Negev, Sagy, Garb, Salzeberg and Tal (2008) assessed the 6th- and 12th-grade Israeli students' environmental literacy including the dimensions of environmental knowledge, attitudes and behavior, and their associations with demographic and experiential data. In this study, there were 1591 6th-grade students in 39 schools and 1,530 12th-grade students in 38 schools to complete grade-specific surveys. The researchers developed two surveys which were similar in content, but different in grade level for 6th and 12th grade students. The surveys consisted of four sections which were environmental background information and environmental behavior; awareness, attitudes and willingness to act; knowledge and its sources; and open-ended questions. The results revealed that there was no significant correlation between knowledge and behavior. Ethnic and socioeconomic status were moderately related to environmental literacy, whereas the presence of an adult who mediated children's relation to nature was strongly related to environmental attitudes and behavior but weakly related to knowledge. Therefore, the authors concluded that the objectives of environmental education in Israel had not been accomplished.

O'Brein (2007) conducted a study to assess levels of environmental knowledge and attitudes of Iowa State University (ISU) undergraduate and graduate students. It received 2793 completed survey from the university students. A new survey instrument, which was developed specifically for this study, was used to measure students' levels of awareness of knowledge about, and attitudes towards environmental issues, globally and in the Midwestern United States. The instrument included 52 questions divided into four parts: awareness (4-item), knowledge (16-item), attitudes (20-item), and demographics (12-item). The results showed that Iowa State students had moderate level of environmnetal knowledge considering the issues investigated in the study. Their demographic characteristics including age, gender, student' status, college of enrollment, years spent in the Midwest U.S., childhood environment, and outdoor activities practiced during childhood were found to be significantly correlated to their environmental knowledge and attitudes. In addition, their knowledge in most cases was found to be positively correlated to their attitudes as well.

The author stated the need for initiatives to develop the environmental knowledge of not only current school teachers but tomorrow's teachers as well. Institutions of higher education had much room to enhance their efforts in promoting environmental education and disseminating it to all students regardless of their majors of study.

Donovan (2001) evaluated twelfth-grade students' environmental knowledge, attitudes and behaviors. Texas State Envirothon students and East Texas students completed an environmental literacy test. The researcher used one-way ANOVA to compare these two groups and the Spearman's rho correlation to evaluate the relationship between environmental knowledge, attitudes and behavior. Texas State Environthon students and East Texas students were compared to each other and to the nation's adults whose results were obtained from the National Environmental Education and Training Foundation (NEEFT). The results showed that, although Texas students' (including Envirothon) failed the knowledge part of the East Texas Environmental Literacy, Attitudes, and Behavior Study, they scored significantly higher than the nation's adult. However, the nation's adult had higher score on environmentally responsible activities than students. Texas State Environthon students had significantly higher scores on environmental literacy than East Texas students. Moreover, the results indicated that there were positive relationships among environmental knowledge, attitudes and behavior.

More recently, Wright (2008a) conducted a study regarding to evaluate postsecondary students' environmental literacy. Sample of this study included 183 postsecondary, non-science major students. They completed 41-item instrument called Environmental Literacy Instrument (ELI). Knowledge, Beliefs, Opinions, and Self-Perceptions were the research subjects regarding to environmental literacy. For this study, pretest-posttest quasi-experimental control group design was used. Between the surveys experimental group (n=102) participated in a constructivist learning environment (student centered) and the control group (n=81) participated in a traditional lecture based (teacher centered) curriculum.

Constructivist Learning Environment Survey (CLES; Taylor and Fraser, 1991) was used to understand if the constructivist learning environment really occurred in the classroom. Mann-Whitney *U* nonparametric tests were used to alayze the data. The CLES results showed that there were significant differences between the constructivist learning and traditional learning environments. The pre-ELI scores revealed that there were no significant differences between the experimental and control group. The pre-ELI and post-ELI score comparison showed significant differences in each group. When experimental and control group were compared within each other, no significant differences were found. Therefore, regarding the learning environment the students had similar improvement on their environmental literacy after taking an introductory environmental science course.

In a separate study, Wright (2008b) assessed another study to compare effect of Web-Based and In-Class methods to the post secondary students' environmental literacy. Total of 86 non-science major students at a local 2-year community college participated on this study. Two groups were composed as the Web-based group (n = 28) which participated in an online course offered via a Web-CT interface and the in-class group (n = 58) participated in traditional, lecture-based classes. Knowledge, Beliefs, Opinions, and Self-Perceptions were the research subjects regarding to environmental literacy. Environmnetal Literay Instrument (ELI) was completed as pre-test and post test. Mann-Whitney U tests were used to analyze data. Pretest data showed, Web-Based group had significantly higher scores than the In-Class group. However, when compared the pretest posttest results; increase on the In-Class group knowledge was significantly higher than the Web-Based group.

In 2008, Ökesli conducted a study to assess environmental literacy of 6th, 7th and 8th grades primary school students in public schools of Bodrum, Turkey. The sample of this study composed of 848 students. They completed the 49-item Environmental Literacy Questionnaire (ELQ) (Kaplowitz & Levine, 2005). This instrument was related to environmental literacy components; knowledge, attitude, use and concern and frequency distributions of these components were used to analyze.

Results revealed that even if the students had low levels of knowledge about the environment; they showed positive attitudes and high levels of concern toward the environment. In addition, they were aware of the importance of interaction between humans and the environment. Zero order correlation was also used to analyze relationship among the components of environmental literacy. The strongest correlation was found between 'attitude and use' and 'use and concern' variables among the components of the environmental literacy. Furthermore, canonical correlation analysis was used to examine the relationship between the background characteristics of students and the set of environmental literacy variables in the questionnaire. The results showed that students who thought they were knowledgeable about and interested in environmental issues and also gave importance to environmental problems had parents who were also more knowledgeable about and interested in environmental issues, were involved in environmental activities, had a more positive attitude towards environmental issues, a more positive view on environmental uses, service and concern about environmental problems. Moreover, the results of MANOVA showed that female students had more positive attitudes towards environmental issues, more positive views on environmental use and more concern about environmental problems than male students' had, while they had the same level of knowledge on environmental issues.

In her study, İstanbullu (2008) investigated environmental literacy of 6th grade students at a private school in Ankara. In addition, the effects of mothers' educational background and students' background characteristics on environmental literacy dimensions (knowledge, attitude, use and concern) were assessed in the study. There were 681 sixth grades students who responded "Environmental Literacy Questionnaire" (ELQ) to collect data. While zero order correlation was used to investigate the relationship among environmental literacy dimensions; knowledge, attitude, use and concern, MANOVA was used to analyze influences of mothers' educational level on the environmental literacy of the students. Furthermore, canonical correlation was used in order to analyze relationship among environmental background of students. Results of zero order correlations showed that 'knowledge and use' and 'attitude and concern' were positively correlated.

Moreover 'attitude and use' and 'use and concern' were strongly correlated. The results of MANOVA indicated that dimensions of environmental literacy did not differentiate significantly in terms of mothers' educational level. According to the result of canonical correlation, parents' involvement in environmental activities positively related to environmental attitude, use and concern. The author concluded that; environmental literacy was a significant determinant of quality of life and healthy environment in national and international perspectives. Investigating such competency would lead all members of society and governmental bodies as well, to improve strategies to offer sustainable future. Actions should be taken even starting from early ages to all levels of education. In addition, curriculum should be recommended to allocate more quotas for environmental literacy components.

Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepınar and Kaplowitz (2008) conducted a study to investigate the relation between pre-service teachers' environmental knowledge, attitude and concerns, and their interests in environmental problems, involving outdoor activities, parents' interest and involvement in environmental activities. They studied 684 pre-service teachers who attended public university in Turkey. The instrument, which was used for this study, addressed four dimension of pre-service teachers' environmental literacy (Kaplowitz & Levine, 2005) with distinct sets of questions for each component knowledge (11 items), attitudes (7 items), uses (19 items), and concerns (8 items). Pre-service teachers' demographic variables: gender, field of study, class standing; parent's education level and employment status; interest in environmental problems; and view on the importance of environmental problems were also collected. In addition, some questions regarding self-assessment of environmental knowledge, involvement of subjects in outdoor activities, parents' interest in environmental problems and their involvement in environmental activities were also asked pre-service teachers. In order to assess relationships between pre-service teachers' environmental background and literacy, canonical analysis was used. The results indicated that, environmental background of pre-service teachers was positively related to environmental literacy and attitudes along with other uses affected significantly by gender.

Thus, male pre-service teachers had higher score on knowledge dimension; however, female pre-service teachers had higher score on attitude, uses and concerns dimensions.

To sum up, researchers have tended to investigate students' environmental literacy level and its four main components; knowledge, attitude, sensitivity and concerns. In addition, they have been interested in the effects of socio-demographich variables such as gender, age, ethnicity, and educational background on students' environmental literacy. The results have showed that socio-demographic variables have generally affected students' environmental literacy level.

CHAPTER 3

PROBLEMS AND HYPOTHESES

This chapter includes the main problem, sub-problems, and the hypotheses of the study.

3.1 The Main Problem

What is the environmental literacy level of the eighth grade public school students?

3.2 The Sub-Problems

1. What is the environmental knowledge level of eighth grade students?

2. What is the environmental attitudes level of eighth grade students?

3. What is the environmental sensitivity level of eighth grade students?

4. What is the environmental concern level of eighth grade students?

5. Is there a significant effect of gender on environmental literacy of the eighth grade students?

6. Is there a significant effect of mothers' educational level on environmental literacy of the eighth grade students?

7. Is there a significant effect of fathers' educational level on environmental literacy of the eighth grade students?

8. Is there a significant effect of mothers' work status on environmental literacy of the eighth grade students?

9. Is there a significant effect of fathers' work status on environmental literacy of the eighth grade students?

10. Is there a significant effect of source of information about environment on environmental literacy of the eighth grade students?

11. Is there a correlation between students' self-assessment of environmental knowledge and their actual environmental knowledge?

3.3 Hypotheses

1. There is no significant effect of gender on environmental literacy of the eighth grade students.

2. There is no significant effect of mothers' educational level on environmental literacy of the eighth grade students.

3. There is no significant effect of fathers' educational level on environmental literacy of the eighth grade students.

4. There is no significant effect of mothers' work status on environmental literacy of the eighth grade students.

5. There is no significant effect of fathers' work status on environmental literacy of the eighth grade students.

6. There is no significant effect of source of information about environment on environmental literacy of the eighth grade students.

7. There is no correlation between students' self-assessment of environmental knowledge and their actual environmental knowledge.

CHAPTER 4

METHOD

4.1 Population and Sample

Target population of the study was all eighth grade public school students in Yenimahalle district of Ankara. According to the Provincial Directorate of National Education, there were 8,145 eighth grade students in the public schools of Yenimahalle district. Therefore, it was appropriate to define an accessible population since it was not possible to come into contact with this target population. The accessible population was all eighth grade public school students in Çayyolu, which is the part of Yenimahalle district of Ankara. Eight public elementary schools, out of 83, were selected by cluster random sampling. In the selected eight public elementary schools, 437 eighth grade students were volunteers and had permission from their parents to be involved in the study. Table 4.1 presents the number of schools and students in each school.

Table 4.1 Numbers of Schools and Corresponding Students

Number of schools	Number of students	Percent (%)
School 1	79	18.1
School 2	10	2.3
School 3	49	11.2
School 4	24	5.5
School 5	49	11.2
School 6	59	13.5
School 7	112	25.6
School 8	55	12.6
Total	437	100.0

There were 212 (48.5%) girls and 225 (51.5%) boys, the range of ages was from 13 to 15 years with a mean of 13.06 (*SD*=0.24). Moreover, information about the students' mothers' educational level (MEL), fathers' educational level (FEL), mothers' work status (MWS) and fathers' work status (FWS) were obtained for the current study as indication of socio-economic status (see Table 4.2). As is displayed in the table, sixteen percent of mothers graduated from primary school, while 14% graduated from middle school. About 29.5% had attained high school education. In addition, 30.7% of mothers reported to have graduated from university, while 9% had masters' or doctoral degree. While 11.7% of fathers graduated from primary school, 13.7% graduated from middle school. Nearly 24.3% graduated from high school. Of the fathers, 33.9% had university degree while 16.5% had masters' or doctoral degree. There were three illiterate mothers and no illiterate fathers in the sample. In brief, fathers' educational level was higher than mothers' education level. As far as parents' work status is concerned, majority of students reported their mothers (60%) as unemployed, however, majority of fathers (94%) were reported to be employed.

Table 4.2 Demographic Characteristics of Students

	Frequency	*Percent (%)*
Gender		
Girl	212	48.5
Boy	225	51.5
Age		
13	416	94.5
14	24	5.3
15	1	0.2

Table 4.2 (Continued) Demographic Characteristics of Students

	Frequency	Percent (%)
MEL		
Illiterate	3	0.7
Primary school	71	16.0
Middle school	63	14.0
High school	130	29.5
University	134	30.7
Ms	33	7.6
PhD	7	1.6
FEL		
Illiterate	0	0
Primary school	51	11.7
Middle school	61	13.7
High school	108	24.3
University	148	33.9
Ms	59	13.5
PhD	14	3.0
MWS		
Unemployed	263	59.3
Employed	178	40.7
FWS		
Unemployed	25	5.7
Employed	416	94.3

4.2 Variables

In this study there were two different types of variables, which are independent variables and dependent variables.

4.2.1 Independent Variables

Independent variables are presumed to affect or influence other variables. In this study there were four independent variables: gender, mothers' and fathers' educational level, mothers' and fathers' work status and source of information about environment.

4.2.2 Dependent Variables

Dependent variables are presumed to be affected by one or more independent variables. In this study four dimensions of environmental literacy (i.e., knowledge, attitude, sensitivity, and concern) were used as dependent variables.

4.3 Data Collection Instrument

In this study three instruments were used to collect data from students; Demographic Questionnaire, Awareness Questionnaire and Environmental Literacy Test (ELT) (see Appendix C). Table 4.3 shows the description of the instruments.

Table 4.3 Description of the Instruments

Instruments	Number of Items
Demographic Questionnaire	8
Awareness Questionnaire	6
Environmental Test	
Knowledge	20
Attitude	10
Sensitivity	19
Concern	12

4.3.1 Demographic Questionnaire

The Demographic Questionnaire was composed of eight questions, which was designed to provide information about students' gender, age, school, living areas, parents' educational level and parents' work status.

4.3.2 Awareness Questionnaire

The Awareness Questionnaire was composed of six questions, which were designed for the purpose of providing information about both the students' and their parents' general consciousness about environmental issues by asking questions about parents' perceptions about environmental problems; parents' behavior towards environmental protection; interest in environmental problems and view on the importance of environmental problems; self-assessment of environmental knowledge and sources of information about environment

4.3.3 Environmental Literacy Test

The Environmental Literacy Test addressed four dimensions of the students' environmental literacy with distinct sets of questions for each dimension; knowledge, attitude, sensitivity, and concern. Environmental Literacy Test (ELT), which was originated as a part of a university project funded by the Michigan State University (Kaplowitz and Wright, 2001) was later translated and adapted into Turkish by Tuncer, Tekkaya, Sungur, Cakiroglu, Ertepinar and Kaplowitz (2009).

4.3.3.1 Knowledge Dimension

Knowledge dimension included 20 multiple choice questions which assessed students' knowledge about local and global environmental issues and basic ecological concept. Since the knowledge questions of the Environmental Literacy Test (ELT) were originally designed for university students, some of the questions were not suitable for elementary school students. For this reason, only eight questions, out of 11, related to the local and global environmental issues were taken from the Environmental Literacy Test originated from the NEETF/Roper Survey (1998). Ten questions related to local and global environmental issues and basic ecological concepts were taken from the previously adapted instrument (Alp, 2005), which was originally developed by Leeming and Dwyer (1995) for young children. Moreover, 2 questions, about global warming and biological magnification, were taken from Vlaardingerbroek and Taylor's (2007) study.

The final knowledge dimension included 20 questions with five choices, one of them was correct answer, and three of them were distracters. Each knowledge question included an 'I don't know' to help prevent guessing. In computing knowledge score, each correct response received a numeric value of 1 and incorrect responses were coded 0. Therefore, the maximum score of knowledge dimension was 20, the minimum score was 0. The higher score means the higher knowledge about local and global environmental issues and basic ecological concept. The internal consistency of the knowledge dimension of environmental literacy test was found to be 0.68 by using Cronbach alpha coefficient.

4.3.3.2 Attitude toward Environment

The attitude dimension included 10 Likert-type items (5 positive and 5 negative items), which assessed the relationship between humans and the environment. The response options were on five-point scales in which the choices ranged from 1 to 5. Five points were assigned to "strongly agree", 4 to "agree", 3 to "undecided", 2 to "disagree" and 1 to "strongly disagree". The coding of responses were reversed for the negative statements, which meant that 5 points were assigned to "strongly disagree", 4 to "disagree", 3 to "undecided", 2 to "agree" and 1 to "strongly agree". Therefore, the maximum score of attitudes dimension was 50, the minimum score was 10. The higher score refers to the more favorable attitude toward environment. At this point, it is necessary to mention that ten attitude items were taken from the 15-item Revised New Ecological Paradigm Scale (NEP; Dunlap et al., 2000). According to Dunlap, the NEP was consisted of five distinct dimensions; balance of nature, limits to growth, eco-centric, anti-exemptionalism and eco-crisis. For the current study, two items 66 and 68 corresponded to limits to growth, balance of nature (67, 70), eco-centric view (69, 73), anti-exemptionalism (71, 74) and eco-crisis (72, 75). The internal consistency of the attitudes dimension of environmental literacy test was found to be 0.64 by using Cronbach alpha coefficient.

4.3.3.3 Sensitivity toward Environment

The sensitivity dimension, which included 19 Likert-type items, dealt with the students' ideas about the use of environmental services and their responsibilities. Items were scored on a 5 point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Therefore, the maximum score of sensitivity dimension was 95, the minimum score was 19. The higher score means the higher sensitivity toward environment. The internal consistency of the sensitivity dimension of environmental literacy test was found to be 0.75 by using Cronbach alpha coefficient.

4.3.3.4 Concern toward Environmental Problems

The concern dimension, which included 12 items, dealt with students' concern about local and global environmental problems, such as "air pollution" or "global warming". For the concern items with Likert-type response choice sets, 5 points were assigned to "very concerned", 4 to "somewhat concerned", 3 to "undecided", 2 to "a little concerned" and 1 to "not at all concerned". Therefore, the maximum score of concerns dimension was 60, the minimum score was 12. The higher score means the higher concern toward environmental problems. The internal consistency of the concerns dimension of environmental literacy test was found to be 0.80 by using Cronbach alpha coefficient. Table 4.4 represents Cronbach alpha coefficients and number items of present in the Environmental Literacy Test; knowledge, attitude, sensitivity, and concern.

Table 4.4 Cronbach Alpha Coefficients and Number of Items of Dimensions of the ELT

Dimension	Reliability	# of items	Item description	Sample item
Knowledge	0.68	20	Students' knowledge about environmental issues and basic ecological concept.	Which of the following is renewable resource?
Attitude	0.64	10	Relationship between humans and the environment.	Humans were meant to rule over the rest of nature.
Sensitivity	0.75	19	Students' responsibility toward environment.	Laws regarding water quality should be stricter.
Concern	0.80	12	Students' concern about environmental problems.	Energy scarcity.

4.4 Data Collection Procedure

In this research study, the effect of students' gender, parents' educational level, parents' work status, and source of information about environment on students' environmental literacy was examined. Therefore, this study began with the literature review in the aspect of the purpose. Educational Resources Information Center (ERIC), International Dissertations Abstracts, Ebscohost, Science Direct, Internet (Google), thesis, and other studies conducted in Turkey were searched by the help of a keyword list. All the articles and thesis were read. The instruments measuring environmental literacy of students were obtained from these documents. In addition, elementary school science curriculum was investigated to select the most appropriate instruments measuring environmental literacy of the eight grade students. After literature review and preparation of instruments, 8 public elementary schools were selected randomly from Çayyolu, which was a part of Yenimahalle district of Ankara. With the necessary permission from Ethical Committee of Graduate School of Social Sciences at the Middle East Technical University and Ministry of Education, in September 2008, Demographic Questionnaire, Awareness Questionnaire and Environmental Literacy Test were administered to 437 eighth grade students who both were volunteers and had permission from their parents for the study. Completion of the instruments took nearly 40 minutes. Due to the lack of time, teachers were requested to help the researcher during the administration. Teachers were given information about the study and the administration process. Directions were made clear and necessary explanations were done by the researcher or the teachers. Students were told that their score would not affect their science grades, and only the knowledge questions had right and wrong answers. Moreover, students were told that demographic questions were asked to obtain personal information, awareness questions were asked to understand students' and their parents' general consciousness about local and global environmental issues, environmental literacy test were applied to measure their environmental literacy. It was also added that students would not write their names on the instruments, their answers were important for a scientific study and the answers would be kept secret.

In addition, they were notified to read all items carefully and complete all of them. It was also emphasized that students had the right to withdraw from the study if they did not want to complete the instruments. During the administration of the instruments, no specific problems were encountered.

4.5 Data Analysis

Statistical Package for Social Sciences (SPSS) 15 for Windows software program was used for statistical analysis. The data obtained in this study were analyzed in two parts; in the first part, descriptive statistics and in the second part, inferential statistics were used.

4.5.1 Descriptive Statistics

For three instruments, Demographic Questionnaire, Awareness Questionnaire and Environmental Literacy Test; frequency, mean, range, standard deviation, minimum, maximum, skewness, and kurtosis were used as descriptive statistics.

4.5.2 Inferential Statistics

Six separate MANOVAs were conducted to analyze the effect of gender, mothers' and fathers' educational level, mothers' and fathers' work status and source of information about environment on environmental literacy of the eighth grade students. Independent variables for MANOVAs were gender, mothers' and fathers' educational level, mothers' and fathers' work status and source of information about environment, respectively. Dependent variables for all MANOVAs were dimensions of environmental literacy (i.e., knowledge, attitude, sensitivity, and concern). In addition, in order to investigate the correlation between students' self-assessment of environmental knowledge and their actual environmental knowledge, Pearson Correlation Coefficient was calculated.

4.6 Assumptions and Limitations

4.6.1 Assumptions

1. The administration of Demographic Questionnaire, Awareness Questionnaire, and Environmental Literacy Test was done under standard conditions.

2. The items of Demographic Questionnaire, Awareness Questionnaire, and Environmental Literacy Test were answered sincerely by the subjects of the study.

4.6.2 Limitations

1. This study is limited to public schools in Çayyolu.

2. This study is limited to eighth grade students.

3. Knowledge questions might not reveal an accurate result due to their multiple choice format since the students might have chosen the correct answer by guessing, although "I do not know" choice was provided to prevent doing so.

4. The Demographic Questionnaire, Awareness Questionnaire and Attitude, Sensitivity, and Concern dimensions has been evaluated by the use of a self-report measure so the data might not represent the complete objectivity.

5. Knowledge and attitude dimensions of environmental literacy test have low reliability (0.68, 0.64 respectively).

4.7 Threats to Internal Validity of the Study

4.7.1 Subject Characteristics Threat

The selection of participants may result in the individuals or groups differing from one another in unintended ways which are related to the variables to be studied, which is defined as subject characteristics threat (Fraenkel and Wallen, 2006). In order to minimize this threat, characteristics of the participants such as age, gender, socio-economic status should be controlled.

In the current study; all students were eighth grade public school students. In addition, their age, and socio-economic status were nearly similar.

4.7.2 Loss of Subjects (Mortality)

During the study, some individuals may drop out of the study which is known as a mortality threat (Fraenkel and Wallen, 2006). The current study was began and completed with 437 students so mortality could not be a threat to internal validity of the study.

4.7.3 Location

The particular locations in which data are collected may result alternative explanations for any results, which is defined as location threat (Fraenkel and Wallen, 2006). The location could not be threat in the current study since data collection instruments; demographic questionnaire, awareness questionnaire, and environmental literacy test were administrated in classrooms under similar conditions.

4.7.4 Instrumentation

During the study, changes in the instruments cause a threat to internal validity of the study which is an instrument decay threat (Fraenkel and Wallen, 2006). In the current study, instrument decay could not be threat since data collection and scoring were scheduled. Data collectors' characteristics can affect results of the study, which is called as data collector characteristics threat (Fraenkel and Wallen, 2006). In the current study, teachers were requested to help the researcher during the administration so there could be a data collector characteristics threat. Data collector bias threat may occur when a data collector distort results of the study unintentionally (Fraenkel and Wallen, 2006). Data collectors were given information about the study so it was not a threat for the current study.

4.7.5 Testing

When practice on the pretest by itself is responsible for the improvement, testing threat occurs (Fraenkel and Wallen, 2006). However, there could not be a testing threat to internal validity of the current study in the view of the fact that instruments were used only once.

4.7.6 History

History threat takes place if unexpected event affects results of the study (Fraenkel and Wallen, 2006). Unexpected events did not happen during the study so history threat could not be a threat in the current study.

4.7.7 Maturation

Maturation threat can be explained as due to time passing, changes in participants may cause changes in participants' behaviors to study (Fraenkel and Wallen, 2006). In the current study, there were no factors regarding the passing of time which means that there is no maturation threat for the study.

4.7.8 Attitude of Subjects

The attitude of participants toward a study can cause a threat which is called as attitude of subject threat (Fraenkel and Wallen, 2006). Attitude of subject threat could not be a threat for the current study since students thought that the study was a part of their lessons.

4.7.9 Regression

Regression threat may take place whenever change is studied in a group which obtained extremely low or high scores from preintervention (Fraenkel and Wallen, 2006). There was no intervention in the study so regression threat could not occur in the current study. In addition, due to the lack of intervention, there could not be an implementation threat.

4.8 Ethical Issues in the Study

In the current study, elementary school students were participants so consent forms, which provided with information about the purpose of the study, were given both to students and their parents. In consent forms, it was emphasized that students should participate in the study voluntarily. It was also stated that students would not face any physical and psychological harm and they had the right to withdraw from the study if they did not want to complete the instruments, which satisfied the fundamental responsibility of every researcher, protecting participants from harm (Fraenkel and Wallen, 2006). In addition, communication phone number and e-mail address were added in case students or their parents would like to ask any questions about the study, which satisfied another fundamental responsibility, deception (Fraenkel and Wallen, 2006). Moreover, in consent forms it was stated that the answers of students were kept secret and the answers were used for only scientific studies or purposes. During the administration, students did not write their names on the instruments so confidentiality of research data was also guaranteed, which is the last fundamental responsibility, ensuring confidentiality of research (Fraenkel and Wallen, 2006).

CHAPTER 5

RESULT

5.1 Descriptive Statistics

In this part, for the Awareness Questionnaire and the Environmental Literacy Test; frequency, mean, range, standard deviation, minimum, maximum, skewness, and kurtosis were used as descriptive statistics.

5.1.1 Awareness Questionnaire

The Awareness Questionnaire included 6 questions which provided information about both the students' and their parents' general awareness about environmental issues by asking questions about parents' perceptions about environmental problems; parents' behavior towards environmental protection; interest in environmental problems and view on the importance of environmental problems; self-assessment of environmental knowledge and sources of information about environment (See Table 5.1). First two questions were related to students' opinions about their parents' perceptions about environmental problems and their parents' behavior towards environmental protection. As presented in the table, one fourth of girls and nearly one fifth of boys indicated that their parents were concerned about environmental problems a lot, however; almost half of girls (49%) and more than half of boys (55%) stated that their parents were concerned about environmental problems, a fair amount. In addition, nearly equal number of girls (14%) and boys (10%) indicated that their parents were concerned about environmental problems, only a little. Moreover, nearly one third of girls (32%) and less than one fourth of boys (22%) thought that their parents were very active in environmental protection activities, while slightly more than half of girls (53%) and 60% of boys stated that their parents were little active in environmental protection activities. Also, only less than ten percent of girls and boys thought that their parents were not active at all.

Table 5.1 Percentage of Response Awareness Questionnaire with Respect to Gender

Item Number	Frequency (%)		
	Girl	*Boy*	*Total*
Parents' perceptions about environmental problems			
A lot	27.4	18.2	22.7
A fair amount	48.6	55.1	51.9
A little	13.7	10.2	11.9
Nothing	0.9	2.7	1.8
Don't know	9.4	13.8	11.7
Students' idea about their parents' behavior towards environmental protection			
Very active	32.1	22.2	27.0
Little active	53.3	60.0	56.8
Not active at all	5.2	4.4	4.8
Don't know	9.4	13.3	11.4
Students' interest in environmental problems			
A lot	34.4	24.0	29.1
A fair amount	55.7	65.8	60.9
A little	9.4	8.0	8.7
Nothing	0.5	2.2	1.4
Students' view on the importance of environmental problems			
Most important problem	64.2	53.3	58.6
Important problem	34.4	40.9	37.8
Not a important problem	0.9	3.1	2.1
Not a problem	0.5	2.7	1.6

Table 5.1 (Continued) Percentage of Response Awareness Questionnaire with Respect to Gender

Item Number	Frequency (%)		
	Girl	Boy	Total
Students' self-assessment of environmental knowledge			
A lot	13.7	11.6	12.6
A fair amount	66.0	63.1	64.5
A little	17.0	21.3	19.2
Nothing	2.4	4.0	3.2
Don't know	0.9	0.0	0.5

Furthermore, slightly more than one third of girls and nearly one fourth of boys thought that they were interested in environmental problems, a lot; however more than half of girls and boys stated that they were interested in environmental problems, a fair amount. Similarly, more than half of girls and boys reported the environment to be one of the two or three most important problems currently being faced, while nearly one third of girls less than half of boys indicated that the environment to be an important problem, but there are other more important problems. Moreover, majority of girls and boys indicated that they had "a fair amount" of environmental knowledge while nearly equal number of girls and boys stated that they had "a little" amount of environmental knowledge. Finally, when asked to the participants that where they got the information about environment, less than half of girls and boys answered as watching television. In addition, less than one third of girls and less than one fourth of boys answered this question as reading newspaper, magazines or books. The amount of girls who answered this question as the Internet was half of the boys that gave the same answer. However, almost equal number of girls (10%) and boys (9%) identified school as a major source of environmental knowledge. Moreover, less than five percent of girls and boys reported to get the information about environment from their families or friends.

As presented in Table 5.2, only a few numbers of girls and boys participated in Non-governmental organizations (NGO's) event to be informed about environment.

Table 5.2 Frequency of Response Source of Information about Environment with Respect to Gender

Source of information about environment	Frequency (%)		
	Girl	*Boy*	*Total*
Newspaper, magazines and books	30.2	24.4	27.2
Internet	10.8	19.1	15.1
Television	43.9	40.0	41.9
Non-governmental organization's event	0.9	1.3	1.1
School	9.9	8.9	9.4
Family	2.8	3.1	3.0
Friends	1.5	3.1	2.3

To brief, results of awareness questionnaire showed that girls and their parents' were more aware of environmental problems and were more active in environmental protection activities than boys and their parents. Moreover, more girls than boys thought environment as one of the most important problems. Similarly, in terms of self-assessment of environmental knowledge, girls stated that they were more knowledgeable about environment. Concerning source of information about environment, majority of the students stated that television was the main source followed by newspaper which meant that media was the major source of environmental information for students.

5.1.2 Environmental Literacy Test

The Environmental Literacy Test addressed four dimensions of the students' environmental literacy with distinct sets of questions for each dimension; knowledge, attitude, sensitivity and concern.

Table 5.3 presents mean scores, standard deviations, maximum scores and minimum scores of environmental literacy dimensions with respect to gender.

Table 5.3 Mean of Environmental Literacy Dimensions with Respect to Gender

	Knowledge			*Attitude*			*Sensitivity*			*Concern*		
	Girl	*Boy*	*Total*	*Girl*	*Boy*	*Total*	*Girl*	*Boy*	*Total*	*Girl*	*Boy*	*Total*
M	9.55	9.08	9.31	38.06	38.24	38.16	74.52	74.92	74.72	51.63	49.74	50.66
SD	3.28	3.48	3.39	5.08	6.19	5.67	7.87	9.39	8.68	6.37	6.89	6.70

As presented in the table, for the knowledge dimension, girls had higher score than boys with a mean of 9.55 questions answered correctly, while boys answered an average of 9.08 questions correctly. In other words, it can be said that girls were slightly more knowledgeable about environmental issues than boys. Similarly, compared with boys (M = 49.74), girls were slightly more concerned about local and global environmental problems (M = 51.63). However, girls and boys had nearly equal favorable attitude toward environment (M = 38.06, M = 38.24 respectively) and also were almost equally sensitive toward environment (M = 74.52, M = 74.92 respectively). In this following section, results of frequency analyses will be presented for each literacy dimension.

5.1.2.1 Knowledge Dimension

The knowledge dimension included 20 multiple choice questions which assessed students' knowledge about local and global environmental issues and basic ecological concepts. The higher score means the higher knowledge about local and global environmental issues and basic ecological concepts. Table 5.4 presents information about frequency distributions of correct responses on environmental knowledge test with respect to gender. The knowledge dimension results were presented in two parts; environmental issues and ecological concepts.

Totally, there were fifteen questions related to local and global environmental issues in knowledge dimension. Considering local environmental issues, knowledge dimension included three questions. The first question was about the biggest contributor of carbon monoxide (air pollution) in Turkey. Less than one fifth of girls and boys selected the correct answer that "motor vehicles" were the biggest contributor of carbon monoxide. Nearly equal number of girls (76%) and boys (73%) selected the wrong answer "factories and businesses". Less than ten percent of girls and boys chose "I don't know" choice. Another question was related to electricity generation in Turkey. Nearly seventy percent of girls and boys selected the wrong answer, which was that most of electricity in Turkey was generated by "hydroelectric power plants". The last question related to local environmental issues was about the name of the primary federal agency that works to protect the environment. More than half of girls (59%) and nearly half of boys (48%) correctly identified "the Ministry of Environment and Forestry" as the primary governmental agency for environmental protection in Turkey, while more than one third of girls and less than one third of boys selected the wrong answer, which was "Turkish Foundation for Combating Erosion, Reforestation and the Protection of Natural Habitats (TEMA)", less than five percent of girls and boys selected "I don't know" choice.

Students' knowledge on global environmental issues, on the other hand, was assessed by twelve questions. The first question was related to burning coal for energy. The great majority of girls (88%) and boys (80%) stated that burning coal for energy was a problem because "it released pollutants into air". While a few amount of girls and boys selected the wrong answer; burning coal for energy was a problem because "it reduced the amount of ozone in the stratosphere", nearly ten percent of girls and boys selected "I don't know" option. The second question assessed the students' knowledge about global warming. The great majority of girls (78%) and boys (80%) selected correct answer that "melting of polar ice" explains the rising of sea levels due to global warming.

While, a few amount of girls and boys stated that, "expansion of water as it warmed" explains the rising of sea levels due to the global warming, nearly five percent of girls and boys preferred "I don't know" option. For the question concerning acid rain, while more than one third of girls (35%) and boys (40%) recognized that "sulphur dioxide" contributes to the acid rain formation, nearly equal number of girls and boys believed that "nitrogen" contributes to the acid rain formation. Less than one third of girls and one fourth of boys, however, selected "I don't know" alternative. The other question was about decomposition of materials. Nearly equal number of girls (44%) and boys (45%) selected the correct answer; "aluminum" took longest to decompose. Around half of the girls (51%) and boys (48%) gave the wrong answer that "tin" took longest to decompose. However, less than ten percent of girls (7%) and more than ten percent of boys (11%) selected "I don't know" choice. Next question assessed the causes of the increase in the amount of carbon dioxide, methane and water vapor in the atmosphere. Less than one fifth of girls (18%) and boys (13%) correctly identified that increase in the amount of carbon dioxide, methane and water vapor in the atmosphere causes "greenhouse effect and temperature rise". Nearly equal number of girls (34%) and boys (30%) wrongly believed that it causes "depletion of ozone and temperature rise". Less than one fourth of girls and boys indicated that they had no idea about the question. Another question was related to the main reason for recycling. The majority of girls (61%) and boys (59%) were aware that the main reason for recycling was to "decrease the amount of waste", while one fourth of girls and boys thought that saving trees is the main reason. Only a few girls and boys preferred "I don't know" alternative for this question. Another question about recycling was the material unable to be recycled and reused. The great majority of girls (73%) and boys (71%) selected the correct answer that "diapers" cannot be recycled and reused again. Nearly equal number of girls (14%) and boys (15%) selected the wrong answer which was "plastic bottles". However, only a few amount of girls and boys selected "I don't know" choice. The next question was related to recognition of renewable resources. More than half of girls (59%) and boys (56%) knew that "trees" were renewable resources.

While more than ten percent of girls selected the wrong answer, "oil", nearly one fifth of boys selected another wrong answer, "iron ore". Nearly equal number of girls (17%) and boys (14%) reported that they had no idea about the question. The other question was related to knowledge about materials considered hazardous waste. More than half of girls (59%) and boys (57%) identified "batteries" as household hazardous waste, while less than twenty percent of girls and boys selected the wrong answer, "plastic packaging". In addition, less than five percent of girls and boys selected "I don't know" choice. In another question, slightly more than half of girls (51%) and less than half of boys (44%) correctly identified that "overpopulation" had the greatest impact on the earth's environment. Equal number of girls (24%) and boys (24%) selected the wrong answer that "natural disastrous" had the greatest impact on the earth's environment, around 10 percent of girls and boys selected "I don't know" option. The next question was about protection provided by ozone in Upper Atmosphere. Less than half of girls (44%) and slightly more than half of boys (52%) knew that the ozone layer served as a protective layer from "harmful cancer-causing sunlight". Less than one fifth of girls and more than ten percent of boys thought that ozone layer protects us from "global warming", while equal number of girls (16%) and boys (16%) selected "I don't know" choice. The last question about global environmental issues was related to disposal of nuclear waste in the world. One fourth of girls and less than one fifth of boys selected the correct answer that the common method for storing nuclear waste throughout the world was "storing and monitoring". However, slightly more than one fifth of girls and boys selected the wrong answer, "the common method for storing nuclear waste was to use it as nuclear fuel". Nearly equal number of girls (39%) and boys (42%) selected "I don't know" option.

Regarding ecological concepts, however, there were five questions in knowledge dimension. The first ecological concept question was related to the definition of ecology. While more than half of girls (61%) and boys (52%) correctly defined "ecology", one fourth of girls and more than one fifth of boys identified relationship between organisms and their environments as "biology".

Nearly equal number of girls and boys selected "I don't know" choice. The second question was about building a dam on a river. More than half of girls (57%) and boys (63%) correctly answered the question which of the following is the most harmful effect of building a dam on a river as "damages the river's natural ecosystem". The most popular wrong answer of this question was that "dams increased water pollution". However, nearly equal number of girls (18%) and boys (15%) selected "I don't know" alternative. The next question was related to the harmful effect of phosphates in sea water. More than half of girls and slightly more than one third of boys selected the correct answer that phosphates were harmful in sea water because they "suffocated fish by increasing algae". Most common wrong answer was that, "phosphates stopped reproduction in fish", followed by "phosphates caused cancer in fish". Less than one third of girls (29%) and slightly more than one third of boys (35%) selected "I don't know" choice. Another question was about the explanation of biological magnification. Relatively low number of girls (8%) and boys (10%) explained biological magnification, correctly. While nearly one fifth of girls identified biological magnification as "the metal killed the plants quickly and did not enter the bodies of herbivores or carnivores as it was returned to the soil", more than ten percent of boys identified biological magnification as "the metal occurred in approximately equal concentrations in the bodies of the plants and the local herbivores and carnivores". In addition, more than half of girls (58%) and boys (60%) preferred "I don't know" alternative. The last question related to the ecological concepts was the extinction of animal species. More than half of girls (60%) and boys (58%) gave the correct answer that the most common reason why an animal species become extinct was "their habitats were being destroyed by humans" While, almost equal number of girls (17%) and boys (19%) selected the wrong answer that "animals became extinct because of too much hunting", less than ten percent of girls and boys selected "I don't know" choice.

To sum up, the results of environmental issues and ecological concepts showed that although students correctly answered less than half of local environmental questions, girls were slightly more knowledgeable about local environmental issues (M = 0.91), global environmental issues (M = 6.24) and ecological concepts (M = 2.41) than boys (M = 0.85, M = 6.06 and SM = 2.17 respectively). Thus, it can be concluded that compared with boys, girls were more knowledgeable about not only local and global environmental issues, but also ecological concepts.

Table 5.4 Frequency Distributions of Correct Responses Environmental Knowledge Statements

# of Items	Items	Girl	Boy	Correct response %
15	Definition of ecology	60.8	52.0	56.3
16	The biggest contributor of carbon monoxide (air pollution) in Turkey	16.0	18.2	17.2
17	The result of burning coal for energy	88.2	80.4	84.2
18	The cause of the rising of sea levels	77.8	80.0	78.9
19	The most responsible for creating acid rain	34.9	40.4	37.8
21	The longest decomposed material in nature	33.5	34.7	34.1
22	The harmful effect of phosphate in sea water	54.2	33.8	43.7
23	The causes of the increase in the amount of carbon dioxide, methane and water vapor in the atmosphere	17.9	13.3	15.6
24	The main reason of the recycle	60.8	59.1	60.0
25	The material unable to be recycled and reused	73.1	70.7	71.9

Table 5.4 (Continued) Frequency Distributions of Correct Responses Environmental Knowledge Statements

# of Items	Items	Girl	Boy	Correct response %
26	How most electricity in Turkey is generated	16.0	9.1	17.6
27	Explanation of biological magnification	8.0	10.2	9.2
28	Recognition of renewable resources	58.5	55.6	57.0
29	Knowledge about materials considered hazardous waste	59.4	57.3	58.4
30	The most common reason for extinction of animal species	60.4	58.2	59.3
31	The greatest impact of thing on the earth's environment	50.5	43.6	46.9
32	Protection provided by ozone in Upper Atmosphere	44.3	52.4	48.5
33	Disposal of nuclear waste in the world	24.5	18.2	21.3
34	Name of the primary federal agency that works to protect the environment	58.5	48.0	53.1

5.1.2.2 Attitude toward Environment

The attitude dimension included 10 items which assess the relationship between humans and the environment. The higher score refers to the more favorable attitude toward environment. Table 5.5 and Table 5.6 present mean scores and standard deviations of each item in attitude dimension and frequency distribution of responses attitude dimension with respect to gender, respectively.

Table 5.5 Item Mean Environmental Attitude Dimension with Respect to Gender

# of Items	Items	Girl		Boy		Total	
		M	SD	M	SD	M	SD
66	We are approaching the limit of the number of people the earth can support.	3.89	1.05	4.06	1.11	3.98	1.08
67	When humans interfere with nature it often produces disastrous consequences.	3.77	1.16	3.91	1.12	3.84	1.14
68	The earth has plenty of natural resources if we just learn how to develop them. *	3.96	1.17	3.81	1.28	3.88	1.23
69	Plants and animals have as much right as humans to exist.	3.89	0.77	4.43	0.85	4.51	0.82
70	The balance of nature is strong enough to cope with the impacts of modern industrial nations. *	3.42	1.13	3.70	1.22	3.56	1.18
71	Despite our special abilities humans are still subjects to the laws of nature.	3.90	1.21	3.88	1.14	3.89	1.17
72	The so-called 'ecological crisis' facing humankind has been greatly exaggerated. *	2.77	1.37	3.09	1.48	2.94	1.43
73	Humans were meant to rule over the rest of nature. *	2.89	1.49	3.14	1.49	3.02	1.50
74	Humans will eventually learn enough about how nature works to be able to control it. *	4.33	0.90	3.96	1.06	4.14	1.00

Table 5.5 (Continued) Item Mean Environmental Attitude Dimension with Respect to Gender

# of Items	Items	Girl		Boy		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
75	If things continue on their present course, we will soon experience a major ecological catastrophe.	4.54	0.80	4.27	1.15	4.40	1.00

* Response category inverted

As presented in Table 5.5, boys had higher mean score than girls for six items of attitude dimension, while girls had higher mean score of four items of attitude dimension. However, as presented in table 5.3, boys and girls had nearly equal positive attitude toward environment (*M* = 38.24, *M* = 38. 06 respectively).

Table 5.6 Frequency Distributions of Attitude Dimension with Respect to Gender

Items	Strongly Agree			Agree			Undecided			Disagree			Strongly Disagree		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
We are approaching the limit of the number of people the earth can support.	35.8	47.1	41.6	27.4	25.3	26.3	29.7	18.7	24.0	3.8	4.4	4.1	3.3	4.4	3.9
When humans interfere with nature it often produces disastrous consequences.	34.0	38.2	36.2	28.8	29.8	29.3	22.6	20.4	21.5	9.9	7.6	8.7	4.7	4.0	4.3
The earth has plenty of natural resources if we just learn how to develop them. *	5.7	8.4	7.1	7.5	8.4	8.0	13.2	16.4	14.9	32.1	27.1	29.5	41.5	39.6	40.5
Plants and animals have as much right as humans to exist.	73.6	61.3	67.3	16.5	25.8	21.3	7.5	8.0	7.8	1.4	4.4	3.0	0.9	0.4	0.7
The balance of nature is strong enough to cope with the impacts of modern industrial nations. *	6.1	6.2	6.2	13.7	11.6	12.6	32.1	21.8	26.8	28.8	27.1	27.9	19.3	33.3	26.5
Despite our special abilities humans are still subjects to the laws of nature.	41.0	38.2	39.6	27.4	28.4	27.9	18.9	21.3	20.1	5.7	7.6	6.6	7.1	4.4	5.7
The so-called 'ecological crisis' facing humankind has been greatly exaggerated. *	21.7	20.0	20.8	25.9	20.4	23.1	21.7	14.2	17.8	14.6	21.3	18.1	16.0	24.0	20.1

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Table 5.6 (Continued) Frequency Distributions of Attitude Dimension with Respect to Gender

Items	Strongly Agree			Agree			Undecided			Disagree			Strongly Disagree		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
Humans were meant to rule over the rest of nature. *	28.3	19.6	23.8	12.3	17.8	15.1	21.7	20.4	21.1	17.9	13.8	15.8	19.8	28.4	24.3
Humans will eventually learn enough about how nature works to be able to control it.*	1.9	3.6	2.7	1.9	5.8	3.9	12.3	20.0	16.2	29.2	32.9	31.1	54.7	37.8	46.0
If things continue on their present course, we will soon experience a major ecological catastrophe.	68.9	60.4	64.5	19.3	22.7	21.1	9.4	6.7	8.0	1.4	4.0	2.7	0.9	6.2	3.7

67   *** Response category inverted**

Table 5.6 showed the frequency distributions of attitude dimension of environmental literacy test. As mentioned previously, attitude items were taken from the 15-item Revised New Ecological Paradigm Scale (NEP) and consisted of five distinct dimensions; balance of nature, limits to growth, eco-centric, anti-exemptionalism and eco-crisis. When "strongly agree" and "agree" choices were evaluated together; the item upon which great majority of the girls (90%) and boys (87%) agreed was "plants and animals right to exist" which reflects eco-centric view. Nearly equal number of girls (41%) and boys (37%) agreed on the item related to "humans were meant to rule over the rest of nature", which is the second item about eco-centric ecological worldview. The eco-crisis item, which was related to the "ecological catastrophe", received relatively high agreement from both girls (88%) and boys (83%). Nearly half of girls and less than half of boys agreed that "the so-called 'ecological crisis' facing humankind has been greatly exaggerated" which is the second item about eco-crisis. Almost equal number of girls (68%) and boys (67%) agreed on the one related to "despite our special abilities humans are still subjects to the laws of nature", which reflects anti-exemptionalism view. The second anti-exemptianolsim item, "in order to control nature, humans should learn about how it works", received the lowest agreement responses from both girls (4%) and boys (9%), followed by limits to growth item related to "the amount of natural resources in the earth" which had the lowest agreement responses. The balance of nature item, "the balance of nature is strong enough to cope with the impacts of modern industrial nations", received the highest undecided response by both girls (32%) and boys (22%).

5.1.2.3 Sensitivity toward Environment

The sensitivity dimension, which included 19 items, dealt with the students' ideas about use of environmental services and their responsibilities. The maximum score of sensitivity dimension was 95, the minimum score was 19. The higher score means the higher sensitivity toward environment.

Table 5.7 and 5.8 present item mean scores and standard deviations and frequency distribution of responses sensitivity dimension with respect to gender, respectively.

Table 5.7 Item Mean Environmental Sensitivity Dimension with Respect to Gender

# of Items	Items	Girl		Boy		Total	
		M	SD	M	SD	M	SD
47	Special areas should be set aside for endangered species.	4.58	0.65	4.48	0.87	4.53	0.77
48	Laws regarding water quality should be stricter.	4.50	0.75	4.28	0.94	4.39	0.86
49	Wild animals that provide meat for people are the most important species to protect.	3.70	1.13	3.83	1.08	3.77	1.11
50	Poisonous snakes and insects that pose a threat to people should be killed.	2.53	1.51	2.88	1.52	2.71	1.53
51	Landowners should be allowed to drain wetlands for agricultural or industrial uses.	3.49	1.24	3.70	1.27	3.60	1.26
52	It is important that everyone be aware of environmental problems.	4.70	0.60	4.47	0.92	4.58	0.79
53	Individuals should be allowed to use private land as they see fit.	2.76	1.30	3.14	1.47	2.96	1.40
54	I feel personally responsible for helping to solve environmental problems.	4.32	0.89	4.16	0.97	4.24	0.93
55	Government should regulate the use of private land to protect wildlife habitat.	4.17	0.96	4.24	0.94	4.21	0.95
56	People should be held responsible for any damages they cause to the environment.	4.50	0.82	4.30	1.02	4.40	0.94
57	All plants and animals play an important role in the environment.	4.60	0.80	4.45	0.90	4.52	0.85

Table 5.7 (Continued) Item Mean Environmental Sensitivity Dimension with Respect to Gender

# of Items	Items	Girl		Boy		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
58	Technological changes often do as much harm to the environment as they do well for the environment.	4.33	0.84	4.19	0.98	4.26	0.92
59	Government should pass laws to make recycling mandatory.	4.25	0.96	4.18	1.03	4.22	1.00
60	Air pollution laws are already strict enough.	2.73	1.31	3.05	1.44	2.90	1.39
61	Science and technology will be very important in solving our environmental problems.	3.94	1.06	4.01	1.09	3.98	1.07
62	Cultural changes will be very important in solving environmental problems.	3.66	1.16	3.78	1.17	3.72	1.16
63	Changes in people's values will help solve environmental problems.	3.98	0.94	3.91	1.00	3.95	0.98
64	Collective action (i.e. movements) is central to solving environmental problems.	3.80	1.11	3.86	1.15	3.83	1.13
65	Lifestyle changes (i.e., consumption) will help solve environmental problems.	3.97	1.10	4.01	1.06	3.99	1.08

As presented in Table 5.5, boys had higher mean score than girls for ten items, while girls had higher score than boys for nine items of sensitivity dimension. Therefore, girls and boys were almost equally sensitive toward environment (*M* = 74.52 and *M* = 74.92 respectively).

Table 5.8 Frequency Distributions of Sensitivity Dimension with Respect to Gender

Items	Strongly Agree			Agree			Undecided			Disagree			Strongly Disagree		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
Special areas should be set aside for endangered species.	66.5	64.0	65.2	25.5	25.8	25.6	7.5	6.2	6.9	0.5	1.8	1.1	0.0	2.2	1.1
Laws regarding water quality should be stricter.	62.7	51.1	56.8	25.9	34.7	30.4	9.9	8.4	9.2	0.9	3.1	2.1	0.5	2.7	1.6
Wild animals that provide meat for people are the most important species to protect.	27.4	34.2	30.9	34.4	28.4	31.4	25.0	27.1	26.1	7.1	6.7	6.9	6.1	3.6	4.8
Poisonous snakes and insects that pose a threat to people should be killed.	17.5	20.4	19.0	12.3	20.9	16.7	13.2	12.9	13.0	20.3	17.8	19.0	36.8	28.0	32.3
Landowners should be allowed to drain wetlands for agricultural or industrial uses.	25.5	33.8	29.7	27.4	30.2	28.8	26.9	17.3	22.0	10.8	9.8	10.3	9.4	8.9	9.2
It is important that everyone be aware of environmental problems.	75.5	66.2	70.7	20.3	22.2	21.3	3.3	5.8	4.6	0.5	3.6	2.1	0.5	2.2	1.4
Individuals should be allowed to use private land as they see fit.	12.7	25.8	19.5	17.5	19.6	18.5	22.2	16.4	19.2	28.8	19.1	23.8	18.9	19.1	19.0

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Table 5.8 (Continued) Frequency Distributions of Sensitivity Dimension with Respect to Gender

Items	Strongly Agree			Agree			Undecided			Disagree			Strongly Disagree		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
I feel personally responsible for helping to solve environmental problems.	52.8	48.0	50.3	31.1	27.6	29.3	12.7	18.2	15.6	1.4	5.3	3.4	1.9	0.9	1.4
Government should regulate the use of private land to protect wildlife habitat.	48.1	50.2	49.2	27.8	30.2	29.1	18.9	15.1	16.9	3.8	2.2	3.0	1.4	2.2	1.8
People should be held responsible for any damages they cause to the environment.	65.1	57.3	61.1	25.0	25.8	25.4	7.1	9.8	8.5	0.9	3.6	2.3	1.9	3.6	2.7
All plants and animals play an important role in the environment.	74.1	63.1	68.4	17.0	25.8	21.5	5.7	6.2	5.9	1.9	2.7	2.3	1.4	2.2	1.8
Technological changes often do as much harm to the environment as they do well for the environment.	50.0	47.6	48.7	39.2	32.4	35.7	6.6	13.8	10.3	2.8	3.6	3.2	1.4	2.7	2.1
Government should pass laws to make recycling mandatory.	53.3	48.9	51.0	26.4	31.6	29.1	14.2	10.7	12.4	4.7	6.2	5.5	1.4	2.7	2.1
Air pollution laws are already strict enough.	11.3	23.1	17.4	18.4	17.3	17.8	25.5	20.4	22.9	21.7	20.0	20.8	23.1	19.1	21.1

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Table 5.8 (Continued) Frequency Distributions of Sensitivity Dimension with Respect to Gender

Items	Strongly Agree			Agree			Undecided			Disagree			Strongly Disagree		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
Science and technology will be very important in solving our environmental problems.	35.4	41.8	38.7	36.8	32.0	34.3	17.9	16.0	16.9	6.1	6.2	6.2	3.8	4.0	3.9
Cultural changes will be very important in solving environmental problems.	29.2	36.0	32.7	27.4	24.4	25.9	29.2	25.3	27.2	8.0	9.8	8.9	6.1	4.4	5.3
Changes in people's values will help solve environmental problems.	34.9	31.6	33.2	35.8	40.0	38.0	22.6	19.1	20.8	5.7	6.7	6.2	0.9	2.7	1.8
Collective action (i.e. movements) is central to solving environmental problems.	33.5	38.2	35.9	29.2	27.6	28.4	24.5	19.1	21.7	9.0	12.0	10.5	3.8	3.1	3.4
Lifestyle changes (i.e., consumption) will help solve environmental problems.	39.2	40.4	39.8	33.5	33.3	33.4	17.5	16.0	16.7	5.2	7.1	6.2	4.7	3.1	3.9

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Considering students' sensitivity toward environment with respect to gender, when "strongly agree" and "agree" choices were evaluated together; the highest agreement for girls and boys were obtained for the items; "it is important that everyone be aware of environmental problems" followed by "special areas should be set aside for endangered species" (92%, 90%) and "all plants and animals play an important role in the environment" (91%, 90). While the highest agreement item was related to the awareness of environmental problems, the least agreement item was about laws of air pollution. In addition, girls (29%) were mostly undecided about the item "cultural changes will be very important in solving environmental problems"; while boys (27%) were mostly undecided about the other item "wild animals that provide meat for people are the most important species to protect". The item which was "air pollution laws are already strict enough" received the lowest agreement responses by both girls and boys (30%, 40% respectively); followed by "poisonous snakes and insects that pose a threat to people should be killed" (30%, 41%) and "individuals should be allowed to use private land as they see fit" (30%, 45%). To be brief, students were generally aware of their responsibilities about environment (see also Table 5.3).

5.1.2.4 Concern toward Environmental PFroblems

In the concern part, students were requested to share their level of concern about the environmental problems. The maximum score of concern dimension was 60, the minimum score was 12. The higher score means the higher concern toward environmental problems. Mean scores and standard deviations of each item and frequency distributions were given in Table 5.9 and Table 5.10 respectively.

Table 5.9 Item Mean of Environmental Concern Dimension with Respect to Gender

# of Items	Items	Girl		Boy		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
35	Air pollution.	4.49	0.71	4.41	0.83	4.45	0.77
36	Noise pollution.	3.46	1.24	3.29	1.33	3.37	1.29
37	Automobile emissions.	3.90	1.17	3.74	1.21	3.81	1.19
38	Industrial pollution.	4.13	1.07	4.02	1.11	4.08	1.09
39	Hazardous wastes.	4.62	0.74	4.40	0.98	4.51	0.88
40	Water shortage.	4.81	0.65	4.63	0.80	4.71	0.74
41	Deforestation.	4.66	0.77	4.54	0.86	4.60	0.82
42	Loss of biodiversity	4.11	1.01	3.92	1.12	4.01	1.07
43	Energy shortage.	4.16	0.96	4.10	1.04	4.13	1.00
44	Ozone depletion.	4.57	0.87	4.41	0.95	4.49	0.91
45	Global warming.	4.79	0.60	4.61	0.78	4.70	0.70
46	Over-hunting.	3.93	1.15	3.67	1.29	3.80	1.23

As indicated in Table 5.9, girls had higher mean scores than boys for each item of concern dimension of environmental literacy. Therefore it can be concluded that, compared to boys (*M* = 49.74); girls (*M* = 51.63) were more concerned about local and global environmental problems (see also Table 5.3). A clear picture about environmental concern with respect to gender (girls and boys) can be seen from the figure 5.1.
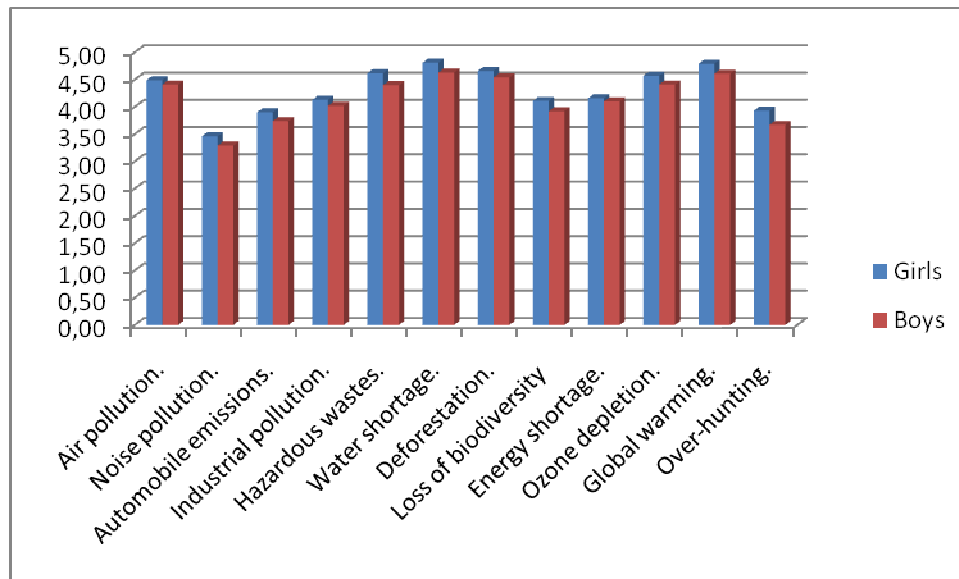
Figure 5.1 Item Mean of Environmental Concern Dimension

Table 5.10 Frequency Distributions of Concern Dimension with Respect to Gender

Items	Very Concerned			Somewhat Concerned			Unsure			A Little Concerned			Not at all Concerned		
	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total	Girl	Boy	Total
Air pollution.	58.5	56.9	57.7	34.4	32.9	33.6	5.2	6.2	5.7	1.4	2.7	2.1	0.5	1.3	0.9
Noise pollution.	19.3	18.7	19.0	42.9	35.6	39.1	12.3	16.4	14.4	15.6	14.7	15.1	9.9	14.7	12.4
Automobile emissions.	40.6	33.8	37.1	26.4	28.0	27.2	20.3	23.6	22.0	7.5	7.6	7.6	5.2	7.1	6.2
Industrial pollution.	49.5	43.1	46.2	25.5	30.7	28.1	17.5	16,4	16.9	3.8	4.9	4.3	3.8	4.9	4.3
Hazardous wastes.	73.1	63.1	68.0	19.8	23.1	21.5	4.2	6.7	5.5	1.9	4.4	3.2	0.9	2.7	1.8
Water shortage.	88.2	76.9	82.4	8.5	12.9	10.8	0.5	8.0	4.3	1.4	0.4	0.9	1.4	1.8	1.6
Deforestation.	78.3	70.7	74.4	14.6	19.1	16.9	2.4	4.4	3.4	4.2	4.9	4.6	0.5	0.9	0.7
Loss of biodiversity	43.9	37.8	40.7	33.5	32.9	33.2	15.1	18.2	16.7	4.7	6.2	5.5	2.8	4.9	3.9
Energy shortage.	45.3	45.3	45.3	32.5	30.7	31.6	16.5	14.7	15.6	3.8	7.1	5.5	1.9	2.2	2.1
Ozone depletion.	75.0	63.6	69.1	13.7	22.2	18.1	5.7	8.4	7.1	4.7	3.6	4.1	0.9	2.2	1.6
Global warming.	85.8	73.8	79.6	9.9	17.8	14.0	2.8	6.2	4.6	0.5	0.4	0.5	0.9	1.8	1.4
Over-hunting.	39.2	32.0	35.5	33.5	33.8	33.6	13.2	12.9	13.0	9.4	12.0	10.8	4.7	9.3	7.1

As Table 5.10 illustrated, both girls and boys appeared to be "very concerned" about many environmental problems. The highest concern for girls and boys were obtained for the items; water shortage followed by global warming and deforestation. Moreover, about 75% of girls and 63% of boys reported that ozone depletion and hazardous wastes were serious concerns for them. In addition, air pollution was a serious concern for both more than half of girls and boys. Nearly one third of girls and boys appeared to be "somewhat concerned" about items; industrial pollution, loss of biodiversity, energy shortage and over-hunting. While girls (20%) and boys (24%) were mostly undecided about whether automobile emissions is a problem or not, noise pollution was not a serious concern for both girls and boys. These findings indicated that the problems students were mostly concerned about related to the problems they faced the most in their environment, such as water shortage, global warming or deforestation.

Overall, descriptive results of the environmental literacy test pointed out that, girls had higher mean score on knowledge and concern dimensions of environmental literacy, while girls and boys had nearly equal scores on attitude and sensitivity dimensions (see Table 5.3).

5.2 Inferential Statistics

In this part, results of six separate MANOVAs, conducted to analyze the effect of gender, mothers' and fathers' educational level, mothers' and fathers' work status and source of information about environment on environmental literacy of the eighth grade students were reported. In addition, in order to investigate correlation between students' self-assessment of environmental knowledge and their actual environmental knowledge, Pearson Correlation Coefficient was calculated.

5.2.1 Assumptions of Multivariate Analysis of Variance (MANOVA)

Before conducting MANOVAs, assumptions were checked. MANOVA has six assumptions, namely, sample size, normality, outliers, linearity, multicollinearity and singularity, and homogeneity of variance-covariance matrices. Sample size, normality, outliers and multicollinearity and singularity assumptions should be checked only once, however, linearity and homogeneity of variance-covariance matrices assumptions should be checked for each MANOVA separately (Pallant, 2001).

1. Sample size

In the current study, there were more cases in each cell than the number of dependent variables; therefore the sample size (N = 437) was suitable to conduct for six MANOVAs.

2. Normality

Univariate and multivariate normalities were checked for each MANOVA. Skewness, kurtosis, and histograms were examined to check univariate normalities. As presented in Table 5.11, skewness and kurtosis values were in acceptable range being between -2 and +2 for all the dependent variables indicating univariate normality. In addition, histograms for all the dependent variables indicated that the scores appeared to be normally distributed. In order to check multivariate normality Mahalanobis distances was calculated as 41.05. This value was compared with critical value given in the Chi-square table (Pallant, 2001). For four dependent variables, the critical value was found as 18.47, since 41.05 exceeded the critical value, it was considered an outlier.

Table 5.11 Skewness and Kurtosis Values of the Dependent Variables

	Knowledge	*Attitude*	*Sensitivity*	*Concern*
Skewness	0.107	0.113	-0.118	-1.033
Kurtosis	-0.177	-0.380	0.341	0.902

3. Outliers

In order to find out multivariate outliers, a further analysis was conducted. There were three students who had scores that exceeded the critical value and were found to be influential (Pallant, 2001). These students' Mahalanobis scores were 41.05, 26.86 and 19.22, respectively. In order to assume that there were no substantial multivariate outliers and proceeded to check other assumptions, these three students should be removed from the data file. Therefore, the sample size of the study decreased to 434 (212 girls and 222 boys) which was still suitable to conduct six MANOVAs.

4. Linearity

In order to check linearity assumption scatterplots were generated for each pair of dependent variables and these scatterplots showed that there was no violation of the linearity assumption for the each MANOVA. (Scatterplots were illustrated in Appendix D.)

5. Multicollinearity and singularity

In order to check multicollinearity and singularity assumption, correlation coefficients between dependent variables were calculated. As indicated in Table 5.12, Pearson correlation coefficients between four dependent variables ranged from -0.079 to 0.649, smaller than 0.8, so it can be concluded that dependent variables were moderately correlated.

Table 5.12 Pearson Correlations between Students Environmental Knowledge, Attitude, Sensitivity and Concern

	Attitude	*Sensitivity*	*Concern*
Knowledge	-0.079	0.017	0.271
Attitude		0.649	0.323
Sensitivity			0.507

6. Homogeneity of variance-covariance matrices

The result of the Box's M Test of Equality of Covariance Matrices revealed that, all the Box's M significant values were larger than 0.001 so there were no violation of the assumption of homogeneity of variance-covariance matrices for all the MANOVAs ($p = 0.031$ for the first MANOVA, $p = 0.069$ for the second MANOVA, $p = 0.135$ for the third MANOVA, $p = 0.032$ for the fourth MANOVA, $p = 0.184$ for the fifth MANOVA and $p = 0.150$ for the sixth MANOVA).

Having met the assumptions of four MANOVAs, analyses were conducted, respectively.

5.2.2 Hypothesis 1: There is no statistically significant effect of gender on eighth grade students' environmental literacy; knowledge, attitude, sensitivity and concern.

One-Way MANOVA was conducted to investigate the effect of gender on eighth grade students' environmental literacy. The results showed that there was a statistically significant multivariate effect of gender with respect to collective dependent variables (Wilks' $\Lambda = 0.973$, $F = (3, 429) = 3.01$, $p = 0.018$). The multivariate η^2 value of 0.027 indicated that 2.7% of multivariate variance of the dependent variables was associated with the gender. Hence, there was a statistically significant difference between girls and boys in terms of their environmental literacy. In order to investigate whether girls and boys differed on all of the dependent variables or not, Between-Subjects Effects test should be considered. Therefore, Bonferroni adjustment should be applied in order to control Type I error. The original alpha level of 0.05 was divided the number of dependent variables, (i.e. four), and obtained a new alpha level of 0.0125. If the significant values of four dependent variables were less than 0.0125, the results were defined as significant. The follow-up analyses for pair wise comparisons showed that the mean scores on concern dimension of the questionnaire were significantly different with respect to gender ($F = 7.961$ $p < 0.0125$) in favor of girls ($M = 51.63$, $SD = 6.37$ for girls; $M = 49.84$, $SD = 6.82$ for boy).

No statistically significant gender effect was found for the knowledge, attitude and sensitivity dimensions. This result implies that girls endorsed environmental concern more than did boys (Table 5.14)

Table 5.13 Follow-Up Pairwise Comparisons

Source	Dependent Variables	df	F	Sig. (p)	Partial Eta Squared
	Knowledge	1	1.761	0.185	0.004
Gender	Attitude	1	0.398	0.529	0.001
	Sensitivity	1	0.040	0.841	0.000
	Concern	1	7.961	0.005	0.018

In order to evaluate effect size in gender on concern, Partial Eta Squared results should be considered. The value in this case was 0.018, which was considered a small effect (Cohen 1988, pp.284-287).

5.2.3 Hypothesis 2: There is no significant effect of mothers' educational level on eighth grade students' environmental literacy.

One-Way MANOVA was conducted to investigate the effect of mothers' educational level on eighth grade students' environmental literacy. The results showed that there was a statistically significant multivariate effect of mothers' educational level with respect to collective dependent variables (Wilks' Λ = 0.773, F = (20, 1411) = 5.70, p = 0.000) (See Table 5.14). The multivariate η^2 value of 0.062 indicated that 6.2% of multivariate variance of the dependent variables was associated with the mothers' educational level.

Table 5.14 Multivariate Tests with respect to Mothers' Education Level

Source	Wilks' Lambda	F	df	Sig. (p)
Mothers' Educational Level (MEL)	0.773	5.70	20.000	0.000

In order to investigate whether mothers' educational level differed on all of the dependent variables or not, Between-Subjects Effects test should be considered. Therefore, Bonferroni adjustment should be applied which meant that original alpha level of 0.01 was divided the number of dependent variables, (i.e. four), and obtained a new alpha level of 0.0025. If the significant values of four dependent variables were less than 0.0025, the results were defined as significant. Original alpha level set 0.01 because, when alpha level was 0.05 there was violated the assumption of equality of variance for some dependent variables. The post-hoc analyses showed that the mean scores on knowledge dimension of the questionnaire were significantly different with respect to mothers' educational level; ($F = 22.117$, $p < 0.0025$). Students, who had more educated mothers, had also higher score on environmental knowledge. Students whose mothers had graduate degree had higher mean scores on environmental knowledge ($M = 11.83$), compared with students whose mothers had high school, middle school and primary school degree ($M = 9.10$, $M = 7.93$ and $M = 7.06$ respectively). Similarly, students having university degree mothers were more knowledgeable about environment ($M = 10.69$) than students having high school, middle school and primary school degree mothers ($M = 9.10$, $M = 7.93$ and $M = 7.06$ respectively). There was also statistically significant difference between students whose mothers graduated from high school ($M = 9.10$) and students whose mothers graduated from primary school ($M = 7.06$.). There was not a statistically significant difference between students having graduate degree mothers and university degree mothers with respect to students' environmental knowledge levels. Similarly, there was not a statistically significant difference between students whose mothers had high school degree and middle school degree. Table 5.15 shows detailed information about post hoc test.

Table 5.15 Post Hoc Test

Dependent Variable	(I) MELB	(J) MELB	Mean Difference (I-J)	Std. Error	Sig.	99 % Confidence Interval	
						Lower Bound	Upper Bound
Knowledge	Illeterate	Primary	-1.0571	1.78553	.997	-8.0415	5.9272
		Middle	-1.9333	1.79164	.948	-8.9416	5.0749
		High School	-3.1016	1.76883	.689	-10.0206	3.8175
		University	-4.6917	1.76807	.220	-11.6078	2.2243
		Graduate	-5.8250	1.81284	.069	-12.9162	1.2662
	Primary	Illeterate	1.0571	1.78553	.997	-5.9272	8.0415
		Middle	-.8762	.53280	.745	-2.9603	1.2079
		High School	-2.0444*	.45019	.001	-3.8054	-.2834
		University	-3.6346*	.44719	.000	-5.3838	-1.8854
		Graduate	-4.7679*	.60025	.000	-7.1158	-2.4199
	Middle	Illeterate	1.9333	1.79164	.948	-5.0749	8.9416
		Primary	.8762	.53280	.745	-1.2079	2.9603
		High School	-1.1682	.47382	.301	-3.0216	.6852
		University	-2.7584*	.47097	.000	-4.6007	-.9161
		Graduate	-3.8917*	.61817	.000	-6.3097	-1.4736

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Table 5.15 (Continued) Post Hoc Test

Dependent Variable	(I) MELB	(J) MELB	Mean Difference (I-J)	Std. Error	Sig.	99 % Confidence Interval	
						Lower Bound	Upper Bound
Knowledge	High School	Illeterate	3.1016	1.76883	.689	-3.8175	10.0206
		Primary	2.0444*	.45019	.001	.2834	3.8054
		Middle	1.1682	.47382	.301	-.6852	3.0216
		University	-1.5902*	.37498	.003	-3.0569	-.1234
		Graduate	-2.7234*	.54857	.000	-4.8693	-.5776
	University	Illeterate	4.6917	1.76807	.220	-2.2243	11.6078
		Primary	3.6346*	.44719	.000	1.8854	5.3838
		Middle	2.7584*	.47097	.000	.9161	4.6007
		High School	1.5902*	.37498	.003	.1234	3.0569
		Graduate	-1.1333	.54611	.507	-3.2695	1.0029
	Graduate	Illeterate	5.8250	1.81284	.069	-1.2662	12.9162
		Primary	4.7679*	.60025	.000	2.4199	7.1158
		Middle	3.8917*	.61817	.000	1.4736	6.3097
		High School	2.7234*	.54857	.000	.5776	4.8693
		University	1.1333	.54611	.507	-1.0029	3.2695

5.2.4 Hypothesis 3: There is no significant effect of fathers' educational level on environmental literacy of the eighth grade students.

One-Way MANOVA was conducted to investigate the effect of fathers' educational level on eighth grade students' environmental literacy.

The results showed that there was a statistically significant multivariate effect of fathers' educational level with respect to collective dependent variables (Wilks' Λ = 0.752, F = (16, 1302) = 7.963, p = 0.000) (See Table5.16). The multivariate η^2 value of 0.069 indicated that 6.9% of multivariate variance of the dependent variables was associated with the fathers' educational level.

Table 5.16 Multivariate Tests regarding Fathers' Educational Level

Source	Wilks' Lambda	F	df	Sig. (p)
Fathers' Educational Level (FEL)	0.752	7.963	16.000	0.000

In order to investigate whether fathers' educational level differed on all of the dependent variables or not, Between-Subjects Effects test should be considered. Therefore, Bonferroni adjustment should be applied which meant that original alpha level of 0.01 was divided the number of dependent variables, (i.e. four), and obtained a new alpha level of 0.0025. If the significant values of four dependent variables were less than 0.0025, the results were defined as significant. Original alpha level set 0.01 because, when alpha level was 0.05 there was violated the assumption of equality of variance for some dependent variables. The post-hoc analyses showed that the mean scores on knowledge dimension of the questionnaire were significantly different with respect to fathers' educational level; (F = 30.030 p < 0.0025). Students who had more educated fathers had also higher score on environmental knowledge. Students whose fathers had graduate degree had higher mean scores on environmental knowledge (M = 11.49), compared with students whose fathers had high school, middle school and primary school degree (M = 8.51, M = 7.08 and M = 7.39 respectively).

Similarly, students having university degree fathers were more knowledgeable about environment (M = 10.45) than students having high school, middle school and primary school degree fathers (M = 8.51, M = 7.08 and M = 7.39 respectively). There was not a statistically significant difference between students having graduate degree fathers and university degree fathers with respect to students' environmental knowledge levels. Similarly, there was not a statistically significant difference between students whose fathers had high school degree and students whose fathers had secondary or primary school degree. Table 5.17 shows detailed information about post hoc test.

Table 5.17 Post Hoc Test

Dependent Variable	(I) FELB	(J) FELB	Mean Difference (I-J)	Std. Error	Sig.	99 % Confidence Interval	
						Lower Bound	Upper Bound
	Primary	Middle	.3088	.57123	.990	-1.7863	2.4040
		High School	-1.1221	.51191	.310	-2.9997	.7554
		University	-3.0530	.48784	.000	-4.8424	-1.2637
		Graduate	-4.0940	.54892	.000	-6.1073	-2.0806
	Middle	Primary	-.3088	.57123	.990	-2.4040	1.7863
		High School	-1.4310	.48538	.071	-3.2112	.3493
		University	-3.3619	.45993	.000	-5.0488	-1.6750
		Graduate	-4.4028	.52427	.000	-6.3257	-2.4799
	High School	Primary	1.1221	.51191	.310	-.7554	2.9997
		Middle	1.4310	.48538	.071	-.3493	3.2112
		University	-1.9309	.38377	.000	-3.3385	-.5233
		Graduate	-2.9718	.45892	.000	-4.6550	-1.2886

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Table 5.17 (Continued) Post Hoc Test

Dependent Variable	(I) FELB	(J) FELB	Mean Difference (I-J)	Std. Error	Sig.	99 % Confidence Interval	
						Lower Bound	Upper Bound
Knowledge	University	Primary	3.0530	.48784	.000	1.2637	4.8424
		Middle	3.3619	.45993	.000	1.6750	5.0488
		High School	1.9309	.38377	.000	.5233	3.3385
		Graduate	-1.0409	.43191	.216	-2.6251	.5432
	Graduate	Primary	4.0940	.54892	.000	2.0806	6.1073
		Middle	4.4028	.52427	.000	2.4799	6.3257
		High School	2.9718	.45892	.000	1.2886	4.6550
		University	1.0409	.43191	.216	-.5432	2.6251

5.2.5 Hypothesis 4: There is no significant effect of mothers' work status on environmental literacy of the eighth grade students.

One-Way MANOVA was conducted to investigate the effect of mothers' work status on eighth grade students' environmental literacy.

The results showed that there was a statistically significant multivariate effect of mothers' work status with respect to collective dependent variables (Wilks' Λ = 0.931, F = (4, 429) = 7.954, p = 0.000) (See Table5.18). The multivariate η^2 value of 0.069 indicated that 6.9% of multivariate variance of the dependent variables was associated with the mothers' work status.

In order to investigate whether mothers' work status differed on all of the dependent variables or not, Between-Subjects Effects test should be considered. Therefore, Bonferroni adjustment should be applied which meant that original alpha level of 0.01 was divided the number of dependent variables, (i.e. four), and obtained a new alpha level of 0.0025. If the significant values of four dependent variables were less than 0.0025, the results were defined as significant. Original alpha level set 0.01 because, when alpha level was 0.05 there was violated the assumption of equality of variance for some dependent variables. The follow-up analyses for pair wise comparisons showed that the mean scores on knowledge dimension of the questionnaire were significantly different with respect to mothers' work status (F = 31.321 p < 0.0025) in favor of working mothers (M = 10.39, SD = 0.247 for employed mothers; M = 8.60, SD = 0.203 for unemployed mathers). No statistically significant mothers' work status effect was found for the knowledge, attitude and sensitivity dimensions.

Table 5.18 Multivariate Test concerning Mothers' Work Status

Source	*Wilks' Lambda*	*F*	*df*	*Sig. (p)*
Mothers' Work Status (MWS)	0.931	7.954	4.000	0.000

5.2.6   Hypothesis 5: There is no significant effect of fathers' work status on environmental literacy of the eighth grade students.

One-Way MANOVA was conducted to investigate effect of fathers'work status on eighth grade students' environmental literacy (i.e. knowledge, attitude, sensitivity and concern). As illustrated in Table 5.19, there was not a statistically significant effect of fathers' work status on students' environmental literacy (Wilks' $\Lambda = 0.997$, $F(4,429) = 0.326$, $p = 0.861$).

Table 5.19 Multivariate Test about Fathers' Work Status

Source	Wilks' Lambda	F	df	Sig. (p)
Fathers' Work Status (FWS)	0.997	0.326	4.000	0.861

5.2.7   Hypothesis 6: There is no significant effect of source of information about environment on environmental literacy of the eighth grade students.

One-Way MANOVA, which was the first last one, was conducted to investigate effect of source of information about environment on environmental literacy of the eighth grade students. Four dependent variables were used; knowledge, attitude, sensitivity, and concern. The independent variable was source of information about environment (newspaper, magazines and book, Internet, television, Non-governmental organization's event, school, family and friends). As shown in Table 5.20, there was not a statistically significant difference in source of information about environment on students' environmental literacy (Wilks' $\Lambda = 0.956$, $F = 1.663$, $p = 0.086$).

Table 5.20 Multivariate Tests regarding Source of Information about Environment

Source	Wilks' Lambda	F	df	Sig. (p)
Source of Information about Environment	0.956	1.663	12.000	0.086

5.2.8   Hypothesis 7: There is no correlation between students' self-assessment of environmental knowledge and their actual environmental knowledge.

Students were asked how much they thought that they knew about environmental issues and problems and the results of this question was compared with students' actual environmental knowledge by the help of the Pearson Correlation Coefficient, in order to find how students correctly evaluate themselves, which refers to how aware students are of their environmental literacy level regarding knowledge components. The results indicated a small significance and positive correlation between actual knowledge and self-reported knowledge ($r = 0.154$; $p = 0.000$). This means that students who thought they knew a lot about environmental problems tended to perform better than those who believed they knew practically nothing about the environmental problems.

5.3 Summary of Results

The results of the current study can be summarized as follows:

1. Descriptive results of the environmental literacy test showed that, girls had higher mean score on knowledge and concern dimensions of environmental literacy, while girls and boys had nearly equal scores on attitude and sensitivity dimensions.

2. Inferential results of the environmental literacy test revealed that, there was no statistically significant gender effect on students' environmental knowledge, attitudes and sensitivity. However, girls endorsed environmental concern more than did boys.

3. One-way MANOVA results showed that, there was a statistically significant effect of mothers' educational level on students' environmental knowledge.

4. Similarly, one-way MANOVA results indicated that, there was a statistically significant effect of fathers' educational level on students' environmental knowledge.

5. One-way MANOVA results showed that, there was a statistically significant effect of mothers' work status on students' environmental knowledge.

6. Similarly, one-way MANOVA results indicated that there was not a statistically significant effect of fathers' work status on students' environmental literacy.

7. One-way MANOVA results revealed that, there was not a statistically significant difference in source of information about environment on students' environmental literacy.

8. Pearson Correlation Coefficient results indicated that, there was a small significance and positive correlation between actual knowledge and self-reported knowledge, which referred to students who thought they knew a lot about environmental problems tended to perform better than those who believed they knew practically nothing about the environmental problems.

CHAPTER 6

CONCLUSIONS, DISCUSSION AND IMPLICATIONS

This chapter includes discussion of the results, implications of the study and recommendations for further research.

6.1 Discussion of the Results

The main purpose of this study was to investigate eighth grade students' environmental literacy. The effects of gender, parents' educational level, parents' work status, and source of information about environmental knowledge on students' environmental literacy and correlation between students' actual knowledge and their self-assessment of environmental knowledge were also examined.

In general, students who participated in the current study had low to moderate levels of environmental knowledge. However they showed positive attitudes toward the environment as well as having high degrees of concern about environmental problems. They also had higher sensitivity toward environment and they perceived environmental problems as one of the most important problems of their lives. Descriptive results of the environmental literacy test pointed out that, girls had higher mean score on knowledge and concern dimensions of environmental literacy, while girls and boys had nearly equal scores on attitude and sensitivity dimensions. The results of environmental issues and ecological concepts show that although students correctly answered less than half of local environmental questions, girls were slightly more knowledgeable about local environmental issues ($M = 1.79$), global environmental issues ($M = 5.35$) and ecological concepts ($M = 2.41$) than boys ($M = 1.66$, $M = 5.25$ and $M = 2.17$ respectively). Students were more successful in answering the questions related to their daily life experiences, such as global warming, recycle, renewable sources and animal extinction. However, they had difficulty in answering the questions which evaluated their probable misconceptions.

For example, around 30 percent of students thought that, the increase in the amount of carbon dioxide, methane and water vapor in the atmosphere caused depletion of ozone and temperature rise, which indicated that they had misconceptions about ozone layer depletion and global warming. They seemed to confuse these two concepts. Prior studies also stated that students across countries confused greenhouse effect with ozone layer depletion (Boyes & Stanisstreet, 1993, 1994; Boyes et al., 1999; Francis et al., 1993; Koulaidis&Christidou, 1999). Also, half of the students thought that, "tin" took longest to decompose in the nature. They conflated tin and aluminum, which might arise due to use of daily life language in scientific context. Surprisingly, majority of the students thought that, "factories and businesses" were the main source of carbon monoxide, which caused air pollution, although they are exposed to air pollution due to the motor vehicles in their daily life. Many students, however, selected "I don't know" option on questions related to harmful effect of phosphates in sea water, disposal of nuclear waste in the world, and biological magnification. Since we have not nuclear power plant in Turkey yet, it was reasonable to assume that they did not know much about disposal of nuclear waste. Although biological magnification and euthrophication were the most popular concepts all over the world including Turkey, these concepts were not covered in revised curriculum in detail. Therefore, students had limited knowledge and awareness about these concepts. This limited environmental knowledge, however, did not seem to prevent paricipants from concerning about environmental problems and issues. Students were mostly concerned about problems they faced the most in their environment such as water shortage, global warming or deforestation. In recent years, students living in Ankara have experienced water shortage very closely. Also they feel the effect of global warming in their life. In addition, deforestation was another important issue since most of the trees around district were cut in order to construct building and roads. Current study also statistically revealed the significant gender effect on students' concern toward environmental issues and problems. The literature suggests two main theories, which are socialization-based theories and structural theories so as to explain gender difference in environmental variables.

According to socialization-based theory, females tend to assume 'caregiver' roles more than males, which in turn make them more able to understand their locality and the world. As a result, females can feel compassion for the ecological environment. The fact that women affiliate themselves with nature is not considered to be resulted from biological differences but socialization, because of cultural and social-structural forces. According to structural theories, what frames the viewpoint of women and men on the environment is the gendered segmentation of the economy and workplace. It is claimed that despite women's knowledge and acceptance of the purposes of economic growth, they have a stronger predisposition to question the results of that growth than men. That is because women not only act as caregivers in the household and do most of the work but they also play an active role in the workforce. This role is in direct contrast to men's historical "breadwinner" role (Weaver, 2002; p. 83). In order to explain the findings of the current study, we need to consider the propositions of both theories. Taking socialization-based theory into consideration, different socialization of males and females can be claimed as being the reason for the gender difference in environmental attitudes and responsibility favoring females. Females are socialized to be more altruistic, cooperative, nurturing, and interdependent while males are socialized to be more independent and competitive (Zelezny, Chua, & Aldrich, 2000). Therefore, females who are expected to take care of the home and children prone to exhibit more helping behaviors including pro-environmental behaviors. Indeed, based on the structural theories, females' pro-environmental behaviors are likely to arise from beliefs about detrimental effects of environmental problems for self (egocentric), others (altruistic), and biosphere (eco-centric) (Tikka, Kuitunen & Tynys, 2000; Stern, Dietz & Kalof, 1993). Stern et al., (1993) reported that females had a tendency to assume that environmental quality results in personal well being, social welfare, and the health of the biosphere. Bord and O'Connor (1997) proposed the reason for gender differences in environmental surveys as the differences in perceived vulnerability to risk from the environment, rather than the differences in ecological sensibility.

In most of the studies, authors found that females are more concerned with "risk-related environmental issues" such as, chemical and radioactive wastes, nuclear power, food preservatives and irradiated food. They concluded that females' concern level was greater than males when the risk to health and personal well being was related to environmental issues. In their cross-cultural study, Eisler et al. (2003) found that females, compared to males, regard the risk factors related to ecological and environmental problems, the global instability caused by economic nationalism, and the growing gap between rich and poor nations as more serious. Furthermore, females were more worried about global instability caused by economic nationalism and the growing gap between rich and poor nations than males did. Eisler et al. also stated that it was the female students who had a tendency to find out new ways to help solve the environmental and ecological problems, emphasized how the environmental quality of human life was of great significance and who were more responsible than males towards the protection of nature and the environment. While males seemed to be more knowledgeable about environment, females seemed to be more motivated for ecological thinking and behavior, as well as being more conscious about what environmental damage can cause. In her five-country comparison on what determines environmental attitudes, Weaver (2002) found that gender was positively related to Human Actions Have Environmental Consequences in West Germany, and to Environmental Problems Have Human Consequences in the United States, with females more likely than males to support the respective concerns. In Chu et al.'s study (2007), girls had better environmental literacy and were more responsible towards the environment, compared to boys. Tikka et al. (2000) found that girls had more positive attitudes and high sense of responsibility toward the environment than boys did. It was stated that boys were more prone to focus on matering nature and benefit from natural resources, while girls express a more emotional attitude to nature. According to the authors, that behavior could be a way of taking care of their offspring, because traditionally girls have taken the responsibility for looking after the home and children.

Van Liere and Dunlap (1978), Worsley and Skrzypiec, (1998), Eagles and Demare, (1999) and Tikka et al., (2000) also found thsat girls were more concerned about environment. In Huang and Yore's study (2003) with fifth grade Canadian and Taiwanese students, girls were found to be more concerned about environmental issues compared to boys. However, no statistically significant gender differences were reported regarding environmental knowledge. Quite the contrary, an earlier study by McDonalds and Hara (1994) reported girls to be less concerned with environmental issues than boys, and gender to be a weak predictor of environmental concern considering college students. There have been other studies which were inconsistent with the current study regarging, knowledge, attitude, and sensitivity dimensions. Working with high school students, Gambro and Switzky (1999) reported gender as an influential factor regarding the development of environmental knowledge. They stated that male students' tendency to be more knowledgeable in terms of environmental issues was significant, although the number of science classes taken by male and female students did not differ. In addition, Zimmerman (1996), and O'Brein (2007) showed that, boys had higher mean score on environmental knowledge than girls. Yılmaz et al. (2004), Tuncer *et al*. (2005), Alp, Ertepınar, Tekkaya and Yılmaz (2006), Chu et al. (2007), and O'Brein (2007) showed that, girls had higher mean score on environmental attitude than boys. Similarly, girls were more sensitive toward environment than boys as indicated in Yılmaz et al. (2004), Alp et al. (2006), Chu et al. (2007).

The current study also showed that, there was a statistically significant effect of parents' educational level and mothers' work status on students' environmental knowledge. Parents' educational level and working status regarded as an important indicator of socio-economic status therefore it can be concluded that students having high socio-economic status are more knowledgeable about environment. Specifically, present study revealed that, students who had more educated parents had higher score on environmental knowledge. As explained by Makki et al. (2003), more educated parents might provide their children with rich scientific and environmental resources.

Another reason for this situation might be that, more educated parents might have more knowledge about environmental concepts, they might share their knowledge with their children, they might discuss local and global environmental problems, and also they might be a model for their children to get involved in activities related to the environment. These results were consistent with the prior studies (e.g. Alp et al., 2008; Carlisle, 2007; Chu et al. 2007; Makki et al. 2003). For example, Carlisle (2007) indicated that parents' educational level had a positive effect on students' environmental knowledge, as well as, pro-environmental attitudes. She claimed that students having more educated parents had a chance to discuss environmental issues with their parents and as a result they would keep information considering these issues. Chu et al.'s study (2007) indicated that students tended to have higher environmental literacy level if they had parents with a university degree. While educational background of mothers was reported to be effective on students' knowledge, educational background of fathers' was reported to be effective on students' attitude and knowledge. They explained these results as students spend more time together with their parents playing, reading and studying at home. Makki et al. (2003) showed fathers' and mothers' educational level affected students' environmental knowledge. Students having fathers with a Master's degree were more knowledgeable about environment compared to students having fathers with a less than high school degree. Similarly, students whose mothers had university degrees had more environmental knowledge compared to students whose mothers had less than high school degrees. Similar to our finding, Makki et al.'s study failed to show significant effect of parents' educational level on students' environmental attitude. Alp et al.'s study (2008), however, revealed that there was a significant effect of fathers' educational level on students' environmental knowledge.

Another finding of the current study is that, there was a statistically significant effect of mothers' work status on only knowledge component of environmental literacy, in favor of working mother. This means that students who had working mothers had more knowledge about environmental concepts. The reason might be that, working mothers compared to working fathers might have more time to spend with their children. Therefore, they might have a chance to hold a controversy with their children on environmental issues; or to involve environmental activities with their children. However, there was not a statistically significant effect of fathers' work status on none of the components of environmental literacy. In their study, Holdsworth and Boldero (1996) emphasized the controversial nature of environmental questions including different values and stated that a capacity not only to specify and analyze values, but also to distinguish fact from value is needed. Many jobs require the use of value and judgement, and sensitivity to value, which also attract people because of having certain liberal and humanitarian values. In addition, women have major responsibility to raise children (Baxter, 1993; Bittman & Lovejoy, 1993 cited in Holdsworth and Boldero). Inevitably, they are more concerned about the purity of water, air, and soil than men due to its obvious-effect on children. Since compared to fathers, working mothers are more involved in values and the preservation of the species; they might be expected to be more environmentally concerned. Kobierska et al. (2007) showed that there was a significant effect of parents' work status on students' environmental knowledge regarding nature. They stated that, students' environmental knowledge based on both their social status and their parents. Therefore, the current study was consistent with this study regarding mothers' work status; however it was inconsistent with this study considering fathers' work status

Another finding of the current study is that, there was not a statistically significant effect of source of information about environment on students' environmental literacy. The mass media, however, was reported to be the leading source of environmental knowledge for the eighth graders. Specifically, majority of the students depended on mainly television, newspapers and Internet (42%, 28% and 15% respectively) to obtain their environmental knowledge. Less than ten percent of the students reported to get their environmental information from their schools. Less prominent were the friends and involvement in NGOs events. These results supported the growing influence of media on environmental education. This study was consistent with many other studies (e.g. Coyle, 2005; Huang & Yore, 2003; Michail et al., 2007; O'Brein, 2007). For instance, Huang and Yore (2003) stated that television was major source of environmental information of Canadian and Taiwanese children. Likewise, Coyle (2005) and O'Brein (2007) concluded that television and newspapers were the leading sources of environmental information. However, Carlisle (2007) indicated that television watching was negatively associated with environmental knowledge, in other words, the more one watched television the less he/she was being exposed to and able to select for retention, environmentally-related information. She mentioned that, students who spend more time watching television spend less time doing homework, reading and conserving with their parents about environmental issues. Therefore, students who were academically and intellectually motivated by educated parents and watched less television would have higher environmental knowledge. Chu et al.'s study (2007) indicated significant effect of source of information on Korean students' environmental literacy (i.e. knowledge, attitude, skill, and behavior). Korean students reported school as a main source of information followed by field trips, television, Internet, and newspaper/magazines. Young children obtaining information from field trip found to have better environmental knowledge, skill and attitude. Similarly, children getting information from newspaper/magazines or books reported to have better environmental behavior. However, children obtaining environmental information from school found to have least environmental knowledge and behavior.

Authors found these results were reasonable due to the fact that environmental education taught in schools generally depended on "indirect experience" such as textbooks. Studying with Greek teachers, Michail et al. (2007) reported mass media such as newspapers, news magazines, and television as main source of information. However, Greek teachers rarely obtain information from radio, the Internet, specialized magazines, seminars, and NGO's events. They mentioned about three theories related to these results; cultivation theory, agenda setting, and uses and gratifications theory. According to the cultivation theory, if people spend more time in watching television, their conceptions of social reality would reflect what they see on television. Similarly, according to the agenda setting theory, people give more importance to the topics which are mostly discussed and considered in media. However, uses and gratification theory imply that, individuals' use of media based on whether or not media meet their requirements.

6.2 Implication of the Study

The results of study provide educators, teachers, curriculum developers, textbook authors and parents with suggestions that contribute to the improvement of the quality of environmental education in Turkey. Participants of the study found to have low to moderate environmental knowledge. Since, their knowledge about environment was limited and they had some misconceptions especially about global warming and ozone layer depletion; curriculum developers and teachers should pay more attention to the teaching of these concepts, as well as others. In order to improve students' environmental knowledge, topics related to environment might be infused not only the unit on ecology but also other units present in the science curriculum as much as possible. Moreover, the number of activities and projects about environment and ecology should be increased. Teachers should give opportunities to their students to express their knowledge about these concepts in order to identify and eliminate their misconceptions.

One of the important outcomes of the study is that, although revised curriculum included environmental issues, ecological concepts and STSE objectives, only ten percent of the students identified school as the main source of environmental information. This finding is crucial in terms of current state of the environmental education in elementary level. Besides, considering the interdisciplinary nature of environment, such concepts might also be integrated into other disciplines other than science. The present study indicated a statistically significant effect of gender on students' environmental concern, in favors girls, which points out the probable gender bias on environmental concern. In order to prevent gender inequity, educators should focus on how they engage boys' concern to environmental problems. The current study also has implication for parents. Mothers' and fathers' educational level and mothers' work status found to be effective on students' environmental knowledge level. Students who have educated parents and working mothers have high level of knowledge about environment. Therefore, special interest should be given to students, who had low educated parents and unemployed mothers.

6.3 Recommendations for Further Research

This study is limited to eighth grade students attending public schools in Çayyolu which is the part of Yenimahalle district of Ankara. For the further research, sample, school type and district size can be increased in order to generalize the results of the present study. A cross age study can be conducted to evaluate the effects of age/grade level on students' environmental literacy. In addition, it can be studied with two groups of eighth grade students, one of them from suburban area, the other one from urban area in order to see the effects of socio-demographic variables on students' environmental literacy level. In this study, students answered some other questions related to their parents' perceptions about environmental problems; their parents' behavior towards environmental protection; their interest in environmental problems and their view on the importance of environmental problems, so it can be investigated the effects of these variables, as well as other variables which were not covered in the study, on students' environmental literacy level.

The present study did not collect information about parents' occupation which may affect students' environmental literacy level. Further studies, thus, may specify parents' occupation. The instruments can be included open-ended questions to evaluate students' actual knowledge because multiple choice formats may give a chance for students to choose the correct answer by guessing. Similar studies should also be replicated with pre-school, classroom, and science teachers, as well as pre-service teachers since, teachers play a crucial role in developing students' knowledge, attitudes, sensitivity, and concern. That the teachers have adequate knowledge, positive attitude, high level of sensitivity and concern is a key factor to become good role models for their students.

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APPENDIX A

PERMISSION OBTAINED FROM MINISTRY OF EDUCATION

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : Strateji Geliştirme
SAYI   : B B.08.4.MEM.4.06.00.04-312/ 95771
KONU   : Tuğçe VARIŞLI

14.10.2008.

VALİLİK MAKAMINA

İLGİ   : a) M.E.B. Bağlı Okul ve Kurumlarda Yapılacak Araştırma ve Araştırma Desteğine
               Yönelik İzin ve Uygulama Yönergesi.
          b) Orta Doğu Teknik Üniversitesi'nin 20.08.2008 gün ve 6273 sayılı yazısı.

Orta Doğu Teknik Üniversitesi İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı yüksek lisans öğrencilerinden Tuğçe VARIŞLI'nın "Sekizinci Sınıf Öğrencilerinin Çevre Okuryazarlığının Değerlendirilmesinde Sosyodemografik Değişkenliklerin Rolü" konulu tez çalışması kapsamında anket uygulama isteği İlgi (a) yönerge doğrultusunda Müdürlüğümüz Değerlendirme Komisyonu tarafından incelenmiş olup, ekli listede belirtilen okullarda gönüllülük esasına dayalı olarak (Çevre Okuryazarlığı Anketi Anket 4 sayfadan oluşan) uygulama isteği Müdürlüğümüzce uygun görülmüştür.

Makamlarınızca da uygun görüldüğü takdirde Olurlarınıza arz ederim.

Murat Bey PALTA
Milli Eğitim Müdürü

O L U R
10.10.2008

Nurullah Naci KALKANCI
Vali a.
Vali Yardımcısı

Ekler:
1-Anket (11 sayfa)
2-Okul Listesi (1 sayfa)

115

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü
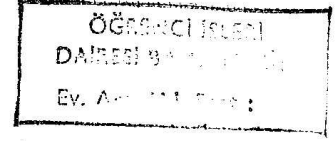
BÖLÜM   : Strateji Geliştirme
SAYI   : B B.08.4.MEM.4.06.00.04-312/ 97407
KONU   : Tuğçe VARIŞLI

17.10.2008

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Öğrenci İşleri Dairesi Başkanlığı)

İLGİ   : a)Orta Doğu Teknik Üniversitesi'nin   20.08..2008 tarih ve 011323 sayılı yazısı,
          b) 14.10.2008 tarih ve 95721 sayılı Valilik Onayı.

Orta Doğu Teknik Üniversitesi İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı yüksek lisans öğrencilerinden Tuğçe VARIŞLI'nın "Sekizinci Sınıf Öğrencilerinin Çevre Okuryazarlığının Değerlendirilmesinde Sosyodemografik Değişkenliklerin Rolü" konulu tez çalışmalarının, İlimiz okullarında uygulama isteği ilgi (b) Valilik Onayı ile uygun görülmüş olup,

Mühürlü   anket   örneği (Çevre Okuryazarlığı Anketi 4 sayfadan oluşan)   ve uygulanacak okul listesi yazımız ekinde gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın   bitiminde   iki   örneğinin (CD/Disket) Müdürlüğümüz Strateji Geliştirme Bölümüne gönderilmesi hususunda bilgilerinizi ve gereğini rica ederim.

Kâmil AYDOĞAN
Vali a.
Milli Eğitim Müdürü

EK: 1-Anket (11 sayfa)
      2-Valilik Onayı (1 sayfa)
      3-Okul Listesi (1 sayfa)

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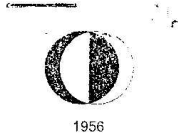
ırta Doğu Teknik Üniversitesi
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SOSYAL BİLİMLER ENSTİTÜSÜ MÜDÜRLÜĞÜ'NE

İLGİ: 21.7.2008 tarih ve B.30.2.ODT.0.E1.00.00/400-1048-8015 sayılı yazınız.

İlgi yazınız T.C. Ankara Valiliği Milli Eğitim Müdürlüğü'ne iletilmiş olup, alınan yazı ve ekleri ilgisi nedeni ile ilişikte sunulmuştur.

Gereğini bilgilerinize arz ederim.

Saygılarımla.

Nesrin ÜNSAL
Öğrenci İşleri
Dairesi Başkanı

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TURKISH VERSION OF ENVIRONMENTAL LITERACY TEST

Çevre Okuryazarlığı Anketi 2008

Bu anketin amacı Yenimahalle ilçesi ilköğretim okulu sekizinci sınıf öğrencilerinin çevre ile ilgili tutum, bilgi ve ilgilerini değerlendirmektir. Anketin tamamlanması yaklaşık 15 - 20 dakikanızı alacaktır. Bu çalışmaya katkılarınız **gönüllü** olmanıza bağlı olup, çalışmanın sonuçlandırılabilmesi açısından çok değerlidir. Bu anketten elde edilecek verilerin değerlendirilmesi aşamasında, ankette yer alan kişisel bilgiler kesinlikle **gizli** tutulacaktır.

Bu çalışma ile ilgili sorularınız için Tuğçe Varışlı'yı 0505 938 17 36 nolu telefondan arayabilirsiniz.

Lütfen her soru için bir seçenek işaretleyiniz.

Yardımlarınız ve katkılarınız için teşekkür ederiz.

Kişisel Bilgiler:

1. Cinsiyetiniz nedir?

    a. Kız

    b. Erkek

2. Hangi yılda doğdunuz? **19 _ _**

3. Okulunuzun adı: ……………………………………………………

4. Ankara'da nasıl bir çevrede yaşıyorsunuz?

    a. Şehir merkezinde çok katlı bir apartmanda.

    b. Şehir merkezinde bahçeli bir evde.

    c. Şehirden uzak site içinde bir apartmanda.

    d. Şehirden uzak site içinde bahçeli bir evde.

5. Anne ve babanızın çevre problemlerine ilgisi konusunda ne düşünüyorsunuz?

    a. Çok ilgili

    b. Yeteri kadar

    c. Az ilgili

    d. İlgisiz

    e. Kararsızım

6. Anne ve babanız çevre korumacı davranışlar konusunda ne kadar aktiftir?

        a. Çok aktif

        b. Biraz aktif

        c. Aktif değil

        d. Kararsızım

7. Anne ve babanızın eğitim seviyesi hangi düzeydedir?

7.Anneniz		8.Babanız	
	İlkokul		İlkokul
	Ortaokul		Ortaokul
	Lise		Lise
	Üniversite		Üniversite
	Yüksek Lisans		Yüksek Lisans
	Doktora		Doktora

9. Anneniz çalışıyor mu?

        a. Hayır

        b. Evet (Lütfen belirtiniz).................................

10. Babanız çalışıyor mu?

        a. Hayır

        b. Evet (Lütfen belirtiniz).................................

11. Çevre sorunları ile ne kadar ilgilisiniz?

        a. Çok fazla

        b. Biraz

        c. Çok az

        d. Hiç

12. Aşağıdakilerden hangisi sizin görüşünüze en yakındır?

   a. Çevre günümüzde insanların karşı karşıya olduğu en önemli 2 ya da 3 problemden biridir.

   b. Çevre önemli bir problemdir, ama daha önemli başka problemler de vardır.

   c. Çevre önemli bir problem değildir.

   d. Çevre bir problem değildir.

13. Çevre konuları ve problemleri ile ilgili, genel olarak, ne kadar **bilginiz** olduğunu düşünüyorsunuz?

   a. Çok

   b. Yeteri kadar

   c. Biraz

   d. Fikrim yok

   e. Bilmiyorum

14. Çevre ile ilgili bilgileri **en çok** nereden ediniyorsunuz?

   a. Gazete, dergi ve kitapları okuyarak

   b. İnternet sitelerini ziyaret ederek

   c. Televizyon programlarını izleyerek

   d. Çevre ile ilgili yürütülen gönüllü çalışmalara katılarak

   e. Okuldan

   f. Ailemden

   g. Arkadaşlarımdan

   h. Diğer (Lütfen belirtiniz) …………………………………………………

15. Canlıların birbirleri ve fiziksel çevreleri ile arasındaki ilişkileri inceleyen bilim dalı aşağıdakilerden hangisidir?

   a. Zooloji.

   b. Biyoloji.

   c. Ekoloji.

   d. Botanik

   e. Bilmiyorum

16. Karbon monoksit Türkiye'de hava kirliliği yaratan önemli bir kirleticidir. Aşağıdakilerden hangisi en önemli karbon monoksit kaynağıdır?

 a. Fabrikalar ve işyerleri.

 b. İnsanların nefes alıp vermesi.

 c. Motorlu araçlar.

 d. Ağaçlar

 e. Bilmiyorum

17. Enerji elde etmek için kömür yakılması neden bir çevre sorunudur?

 a. Hava kirliliğine neden olan maddeleri yayar.

 b. Asit yağmurlarını azaltır.

 c. Stratosferdeki ozon miktarını düşürür.

 d. Su yataklarının kirlenmesine neden olur.

 e. Bilmiyorum

18. Aşağıdakilerden hangisi küresel ısınma nedeniyle deniz seviyesinin yükselmesini en iyi açıklar?

 a. Yağış miktsrının artması

 b. Suyun ısındığı için genişlemesi

 c. Buzulların erimesi

 d. Nehirlerde taşkınların artması

 e. Bilmiyorum

19. Aşağıdakilerden hangisi asit yağmurlarının başlıca nedenlerindendir?

 a. Kükürtdioksit

 b. Karbondioksit

 c. Ozon

 d. Azot

 e. Bilmiyorum

20. Nehirlerin üzerine baraj yapılmasının en zararlı etkisi aşağıdakilerden hangisi olabilir?

    a. Barajlar nehirdeki çamuru arttırır.

    b. Barajlar su kirliliğini arttırır.

    c. Barajlar nehrin taşmasına neden olur.

    d. Barajlar nehrin doğal ekosistemine zarar verir.

    e. Bilmiyorum

21. Sulara karışan fosfatlı kimyasal maddeler aşağıdakilerden hangisine neden olur?

    a. Balıklarda kansere neden olur.

    b. Balıklarda üremeyi durdurur.

    c. Suyu bulanıklaştırır.

    d. Alglerin sayısını arttırarak balıkların ölmesine neden olur.

    e. Bilmiyorum

22. Atmosferde karbondioksit, metan gibi gazların ve su buharı miktarının artması aşağıdaki olayların hangisi ya da hangilerine sebep olur?

        I. Ozon tabakasının delinmesi

        II. Sera etkisi

        III. Sıcaklığın artması

    a. Yalnız I

    b. II ve III

    c. I ve II

    d. I ve III

    e. Bilmiyorum

23. Geri dönüşümün başlıca nedeni aşağıdakilerden hangisidir?

    a. Daha dayanıklı plastik maddeler üretebilmek.

    b. Ormanları korumak.

    c. Atık miktarını azaltmak.

    d. Hava kirliliğini azaltmak.

    e. Bilmiyorum

24. Geri dönüşümü **sağlanamayan** ve tekrar **kullanılamayan** madde aşağıdakilerden hangisidir?

    a. Çocuk bezleri.

    b. Gazeteler.

    c. Aluminyum kaplar.

    d. Plastik şişeler.

    e. Bilmiyorum

25. Aşağıdakilerden hangisi doğada en zor kaybolur?

    a. Teneke

    b. Pamuk

    c. Odun

    d. Alüminyum

    e. Bilmiyorum

26. Türkiye'de elektrik üretimi büyük ölçüde nasıl gerçekleştirilmektedir?

    a. Petrol, kömür ve odun yakılarak

    b. Nükleer santraller ile

    c. Güneş enerjisi ile

    d. Hidroelektrik santraller ile

    e. Bilmiyorum

27. Aşağıdakilerden hangisi yenilenebilir bir kaynaktır?

a. Petrol

b. Demir Madeni

c. Ağaçlar

d. Kömür

e. Bilmiyorum

28. Ozon, atmosferin üst katmanlarında koruyucu bir tabaka oluşturur. Ozon bizi aşağıdakilerden hangisinden korur?

a. Asit yağmurlarından

b. Küresel ısınmadan

c. Sıcaklıktaki ani değişimlerden

d. Zararlı, kansere neden olan güneş ışığından

e. Bilmiyorum

29. Aşağıdakilerden hangisi zararlı atık olarak adlandırılabilir?

a. Plastik ambalajlar

b. Cam şişeler

c. Piller

d. Bozulmuş yiyecekler

e. Bilmiyorum

30. Hayvan türlerinin nesillerinin tükenmesinin en yaygın sebebi nedir?

a. Pestisitlerin (tarım ilaçlarının) kullanılması.

b. Yaşam alanlarının insanlar tarafından yok edilmesi.

c. Avcılığın artması.

d. İklim değişiklikleri

e. Bilmiyorum

31. Aşağıdakilerden hangisi çevre için uzun zaman diliminde en zararlı etkendir?

    a. Nüfus fazlalığı.

    b. Doğal afetler.

    c. Vahşi hayvanlar.

    d. Erozyon

    e. Bilmiyorum.

32. Aşağıdakilerden hangisi civa gibi ağır bir metalin bitkiler tarafından alınarak besin zincirine girmesi sonucu olacakları açıklar?

    a. Metal bitkiyi hemen öldürür ve toprağa geri döner bu nedenle otçul ve etçillere geçemez.

    b. Metal konsantrasyonu bitkilerde, otçullarda ve etçillerde hemen hemen eşit olur.

    c. Metal konsantrasyonu bitkilerde az, otçullarda fazla, etçillerde ise en fazla olur.

    d. Metal konsantrasyonu bitkilerde en fazla, otçullarda az, etçillerde ise en az olur.

    e. Bilmiyorum.

33. Bilim adamları nükleer atıkların depolanması ile ilgili çalışmalarında henüz sonuca ulaşamamışlardır. Şu anda dünyada yaygın olan nükleer atıklar nasıl depolanmaktadır?

    a. Nükleer yakıt olarak kullanılmaktadır.

    b. Başka ülkelere satılmaktadır.

    c. Çöp depolama alanlarında depo edilmektedir.

    d. Depolanmakta ve kontrol altında tutulmaktadır.

    e. Bilmiyorum

34. Türkiye'de çevreyi korumaya yönelik kararlar alan **resmi** kurumun adı nedir?

    a. Çevre ve Orman Bakanlığı.

    b. TEMA.

    c. Tabiatı Koruma Vakfı

    d. Türkiye Çevre Eğitim Vakfı

    e. Bilmiyorum

35. Aşağıdaki tümceler insan ve çevre ilişkisini yansıtmaktadır. Lütfen düşüncelerinizi her tümce için verilen seçeneklerden birini işaretleyerek belirtiniz.

		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
a.	Dünyanın insan yaşamını destekleme kapasitesini doldurmak üzereyiz.					
b.	İnsanların doğaya müdahale etmesi genellikle felaketle sonuçlanır.					
c.	Dünyada herkese yetecek miktarda doğal kaynak vardır, sorun bu kaynaklardan nasıl yararlanacağımızı öğrenmektir.					
d.	Bitki ve hayvanlar da insanlar kadar var olma hakkına sahiptir.					
e.	Doğanın dengesi, modern endüstrileşmiş toplumların etkileri ile rekabet edebilecek güçtedir.					
f.	Bizi diğer canlılardan üstün kılan özel yeteneklerimize rağmen, hala doğa yasaları ile mücadele ediyoruz.					
g.	İnsanların karşı karşıya kaldıkları 'Ekolojik kriz' olarak adlandırılan olaylar fazlasıyla abartılmaktadır.					
h.	İnsan olmak doğanın geri kalan bölümüne hükmetmektir.					
i.	İnsanlar doğayı kontrol edebilmek için doğayı anlamaları gerektiğini sonunda öğrenecekler					
j.	Eğer her şey bugünkü gibi devam ederse, yakında büyük bir ekolojik facia ile karşılaşacağız					

36. Lütfen aşağıda verilen her tümce için verilen seçeneklerden birini işaretleyiniz.

		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
a.	Soyu tükenmekte olan türler için özel alanlar ayrılmalıdır.					
b.	Su kalitesi ile ilgili yasalar daha yaptırımcı olmalıdır.					
c.	İnsanların et ihtiyaçlarının karşılandığı vahşi hayvanlar korunması gereken en önemli türlerdir.					
d.	Zehirli yılanlar ve böcekler insanlar için tehdit oluşturdukları için öldürülmelidirler.					
e.	Toprak sahiplerine sulak alanlarını tarımsal ve endüstriyel amaçlar için kullanmalarına izin verilmelidir.					
f.	Herkesin çevre sorunlarının farkında olması çok önemlidir.					
g.	Şahıslar sahip oldukları arazileri istedikleri şekilde kullanmakta serbest olmalıdır.					
h.	Çevre sorunlarının çözümlenmesinde kişisel sorumluluklarım olduğunu düşünüyorum.					
i.	Hükümet, vahşi hayatın korunması amacı ile özel mülkiyet alanlarının kullanımını denetlemelidir.					
j.	İnsanlar çevreye verdikleri her türlü zarardan sorumlu tutulmalıdır.					
k.	Bitki ve hayvanların tümü çevrede önemli bir role sahiptir.					
l.	Teknolojik değişimlerin çevre için yararı olduğu kadar zararı da vardır.					
m.	Hükümet geri dönüşümün zorunlu olması yönünde yasalar hazırlamalı ve uygulamalıdır.					
n.	Hava kirliliği ile ilgili yasalar yeteri kadar serttir.					
o.	Çevre problemlerinin çözümünde bilim ve teknoloji çok önemlidir.					
p.	Çevre problemlerinin çözümünde kültürel farklılıklar çok önemlidir.					
r.	İnsanların değer yargılarının değişmesi, çevre problemlerinin çözümlenmesine yardımcı olacaktır					
s.	Toplu eylemler çevre problemlerinin çözümünde önemli bir yer tutar.					
t.	Yaşam alışkanlıklarındaki değişimler (tüketim gibi) çevre problemlerinin çözümlenmesinde önemli rol oynayacaktır.					

37. Aşağıda verilen çevre problemlerini ciddi bir endişe konusu olarak görüyor musunuz? Lütfen her madde için verilen seçeneklerden birini işaretleyiniz.

		Hiç endişe duymuyorum	Çok az endişe duyuyorum	Kararsızım	Biraz endişe duyuyorum	Çok endişe duyuyorum
a.	Hava kirliliği.					
b.	Ses kirliliği.					
c.	Otomobil emisyonları.					
d.	Endüstriyel kirlilik.					
e.	Zararlı atıklar.					
f.	Su kıtlığı.					
g.	Ormanların yok olması.					
h.	Biyolojik çeşitliliğin azalması					
ı.	Enerji kıtlığı.					
j.	Ozon tabakasının delinmesi.					
k.	Küresel ısınma.					
l.	Aşırı avlanma.					

Katkılarınız için teşekkür ederiz!

Bizimle paylaşmak istediğimiz bir düşünceniz varsa, lütfen aşağıdaki boşluğu kullanınız.

APPENDIX C

ENVIRONMENTAL LITERACY TEST

1) Are you…(Mark ⊗ one)
   1) Girl
   2) Boy

2) In what year were you born? **19……**

3) What is your school name? **…………………………..**

4) In what type area are you living?
   1) In a apartment in city center
   2) In a house in city center
   3) In a apartment in a sub-urban area
   4) In a house in a sub-urban area

5) What do you think about your parents' perception about environmental problems?
   1) A lot
   2) A fair amount
   3) A little
   4) Nothing
   5) Don't know

6) What do you think about your parents' behavior towards environmental protection activities?
   1) Very active
   2) Little active
   3) Not active at all
   4) Don't know

Your parents' educational level

7) Mother	8) Father
1) Illiterate	Illiterate
2) Primary school	Primary school
3) Middle school	Middle school
4) High school	High school
5) University	University
6) Ms Degree	Ms Degree
7) PhD	PhD

9) Mother's work status
    1) No
    2) Yes ………….

10) Father's work status
    1) No
    2) Yes ………….

11) How concerned are you personally about environmental problems?
    1) A lot
    2) A fair amount
    3) A little
    4) Nothing

12) Which <u>one</u> of the following comes closest to your view?
    1) The environment is one of the 2 or 3 most important problems that people currently face
    2) The environment is an important problem, but there are other more important problems.
    3) The environment is not an important problem.
    4) The environment is not a problem.

13) In general, how much do you feel you know about environmental issues and problems?
    1) A lot
    2) A fair amount
    3) A little
    4) Nothing
    5) Don't know

14) Where do you get the information about environment
1) Newspapers, magazines and books
2) Internet
3) Television
4) Non-governmental organization's event
5) School
6) Family
7) Friends

15) Which one of the following describes the scientific study of the relationship between organisms and their environments?
1) Zoology
2) Biology
3) Ecology
4) Botany
5) Don't know

16) Carbon monoxide is a major contributor to air pollution in Turkey. Which of the following is the biggest source of carbon monoxide?
1) Factories and businesses
2) People breathing
3) Motor vehicles
4) Trees
5) Don't know

17) Why burning coal for energy is an environmental problem?
1) Releases pollutants into the air
2) Decreases needed acid rain
3) Reduces the amount of ozone in the stratosphere
4) Pollutes the water in aquifers
5) Don't know

18) Which of the following best explains the rising of sea levels due to global warming?
1) Increased rainfall
2) Expansion of water as it warms
3) Melting of polar ice
4) Increased flooding of rivers
5) Don't know

19) Which of the most responsible for creating acid rain?
1) Sulfur dioxide
2) Carbon monoxide
3) Ozone
4) Nitrogen
5) Don't know

20) Which of the following is the most harmful effect of building a dam on a river?

      1) Makes the river muddy
      2) Increases level of pollution on the water
      3) Causes the river to flood
      4) Damages the river's natural ecosystem
      5) Don't know

21) Which of the following materials usually takes longest to decompose?

      1) Tin
      2) Cotton
      3) Wood
      4) Aluminum
      5) Don't know

22) Why phosphates are harmful in sea water?

      1) Cause cancer in fish
      2) Stop reproduction in fish
      3) Make the water cloudy
      4) Suffocate fish by increasing algae
      5) Don't know

23) What are the results of the increase in the amount of carbon dioxide, methane and water vapor in the atmosphere?

      I. Depletion of ozone layer
      II. Greenhouse effect
      III. Temperature rise

      1) I
      2) II and III
      3) I and II
      4) I and III
      5) Don't know

24)   Primarily, why do we recycle?

      1) To aid the production of more durable plastic products
      2) To save trees
      3) To reduce the amount of waste going into landfills
      4) To reduce air pollution
      5) Don't know

25) Which of the following item cannot be recycled and reused again?

      1) Diapers
      2) Newspaper
      3) Aluminum cans
      4) Plastic bottles
      5) Don't know

26) How is most of the electricity in Turkey generated?
1) Burning oil, coal and wood
2) Nuclear power
3) Solar energy
4) Hydroelectric power plants
5) Don't know

27) Which of the following describes what eventually happens when a heavy metal such as mercury enters food chains by being absorbed by plants?

1) The metal will kill the plants quickly and not enter the bodies of herbivores or carnivores as it will be returned to the soil.
2) The metal will occur in approximately equal concentrations in the bodies of the plants and the local herbivores and carnivores.
3) The metal will occur in low concentrations in the plants, higher concentrations in local herbivores, and even higher concentrations in local carnivores.
4) The metal will occur in high concentrations in the plants, lower concentrations in local herbivores, and even lower concentrations in local carnivores.
5) Don't know

28) Which of the following is renewable resource?
1) Oil
2) Iron ore
3) Trees
4) Coal
5) Don't know

29) Which of the following household wastes is considered a hazardous waste?
1) Plastic Packaging
2) Glass
3) Batteries
4) Spoiled Food
5) Don't Know

30) What is the most common reason that an animal species become extinct?
1) Pesticides are killing them
2) Their habitats are being destroyed by humans
3) There is too much hunting
4) There are climate changes that affect them
5) Don't know

31) Which of the following has the greatest impact on the earth's environment?
    1) Overpopulation
    2) Natural disastrous
    3) Wild animals
    4) Erosion
    5) Don't know

32) Ozone forms a protective layer in the earth's upper atmosphere. What does ozone protect us from?
    1) Acid rain
    2) Global warming
    3) Sudden changes in temperature
    4) Harmful, cancer-causing sunlight
    5) Don't Know

33) Scientists have not determined the best solution for disposing of nuclear waste. In the world what do we do with it now?
    1) Use it as nuclear fuel
    2) Sell it to other countries
    3) Dump it in landfills
    4) Store and monitor the waste
    5) Don't Know

34) What is the name of the primary federal agency that works to protect the environment?
    1) The Ministry of Environment and Forestry
    2) Turkish Foundation for Combating Erosion, Reforestation and the Protection of Natural Habitats (TEMA)
    3) Turkish Nature Conservation Foundation
    4) Turkish Foundation for Environmental Education
    5) Don't Know

Concern Statements

In general, how concerned are you about the following sources of environmental problems? For each item, please indicate whether you are: 1= Not at all concerned, 2= A little concerned, 3= Unsure, 4=Somewhat concerned 5= Very concerned.

		Not at all concerned	A little concerned	Unsure	Somewhat concerned	Very concerned
35	Air pollution.					
36	Noise pollution.					
37	Automobile emissions.					
38	Industrial pollution.					
39	Hazardous wastes.					
40	Water scarcity.					
41	Deforestation					
42	Loss of biodiversity					
43	Energy scarcity.					
44	Ozone Depletion					
45	Global warming					
46	Over-hunting					

Sensitivity Statements

For each of the following statements, please indicate if you: 1= Strongly Disagree 2 = Disagree, 3 = Unsure, 4 = Agree or 5 = Strongly Agree

		Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
47	Special areas should be set aside for endangered species.					
48	Laws regarding water quality should be stricter.					
49	Wild animals that provide meat for people are the most important species to protect.					
50	Poisonous snakes and insects that pose a threat to people should be killed.					
51	Landowners should be allowed to drain wetlands for agricultural or industrial uses.					
52	It is important that everyone be aware of environmental problems.					
53	Individuals should be allowed to use private land as they see fit.					
54	I feel personally responsible for helping to solve environmental problems.					
55	Government should regulate the use of private land to protect wildlife habitat.					
56	People should be held responsible for any damages they cause to the environment.					
57	All plants and animals play an important role in the environment.					
58	Technological changes often do as much harm to the environment as they do well for the environment.					
59	Government should pass laws to make recycling mandatory.					
60	Air pollution laws are already strict enough.					

61	Science and technology will be very important in solving our environmental problems.					
62	Cultural changes will be very important in solving environmental problems.					
63	Changes in people's values will help solve environmental problems.					
64	Collective action (i.e. movements) is central to solving environmental problems.					
65	Lifestyle changes (i.e., consumption) will help solve environmental problems.					

Attitude Statements

For each of the following statements, please indicate if you: 1= Strongly Disagree 2 = Disagree, 3 = Unsure, 4 = Agree or 5 = Strongly Agree

		Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
66	We are approaching the limit of the number of people the earth can support.					
67	When humans interfere with nature it often produces disastrous consequences.					
68	The earth has plenty of natural resources if we just learn how to develop them. *					
69	Plants and animals have as much right as humans to exist.					
70	The balance of nature is strong enough to cope with the impacts of modern industrial nations. *					
71	Despite our special abilities humans are still subjects to the laws of nature.					
72	The so-called 'ecological crisis' facing humankind has been greatly exaggerated. *					
73	Humans were meant to rule over the rest of nature. *					
74	Humans will eventually learn enough about how nature works to be able to control it. *					
75	If things continue on their present course, we will soon experience a major ecological catastrophe.					

* Response category inverted

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APPENDIX D

LINEARITY ASSUMPTION SCATTERPLOTS

Gender: Girl

Gender: Boy

MELB: Illiterate

MELB: Primary school

MELB: Middle school

MELB: High school

MELB: University

MELB: Graduate

FELB
University

FELB: Graduate

MWS: Unemployed

FWS Unemployed

knowledgetotal   attitudetotal   sensitivitytotal   concernstotal

FWS: Employed

News14: Media

News14: School

News14: Colleagues

News14: NGO's event